The University of Auckland

School of Chemical Sciences

# HEALTH
# AND
# SAFETY GUIDELINES

2021

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THE UNIVERSITY OF AUCKLAND
Te Whare Wānanga o Tāmaki Makaurau
NEW ZEALAND

SCIENCE
SCHOOL OF CHEMICAL SCIENCES

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# Contents

# School of Chemical Sciences Safety Rules – Summary

- **In the case of serious accidents DIAL 1-111 and if time permits also communicate the problem to UniSafe (Security). Emergency calls dial 966 (internal phone) Routine calls on ext. 85000.**

- Students and staff must wear protective eyewear and appropriate lab coats in laboratories and workshops at all times. Appropriate full-cover footwear must be worn in all laboratories and workshops.

- Personal music equipment (iPods, MP3 players, etc.) with headphones are not to be used in laboratories or whilst moving/transporting chemicals and equipment around the building. They may be used in computer and reading rooms.

- Smoking in the building is prohibited.

- Eating and drinking in laboratories is prohibited. Eating and drinking in the reading/computer rooms located between the research laboratories is allowed.

- Work with hazardous or toxic materials must not be undertaken without proper precautions. If any doubt exists, consult your supervisor.

- No un-authorised preparations of any substances are to be attempted.

- All accidents must be reported to School Management using the appropriate forms. This is particularly important when the circumstances leading to the accident are likely to recur. Acquaint yourself with the first aid equipment provided.

- Undergraduate students, except 4th year B.Tech and BSc (Hons) students are not permitted to work in laboratories outside their scheduled laboratory hours.

- At no time of the day or night are students or staff allowed to carry out research laboratory work unless a second person is within audible distance **and** a named person on the Laboratory manager or nominated person-in-charge list is present in or near the laboratory.

- Before each experiment or procedure is undertaken a "Take Five" assessment must be completed.

- Before leaving an experiment overnight (or unattended) a yellow "unattended/overnight experiment permission form" must be completed.

- Staff and students (including BSc (Hons) and 4th year BTech students) must have a signed "Access to University Facilities Individual Approval" from the HOS to carry out an experimental work in the laboratories outside Normal Operating Hours and may only use laboratories in which they have been given specific authority to work. Supervisors and Laboratory Managers are required to examine the proposed work and assure themselves that rules concerning safety are met.

- Corridor doors and windows must be kept closed outside normal working hours.

- Only authorised persons are permitted to service or remove protection covers to electrical equipment including cord sets and extension cables.

- Child visitors to the School must remain under adult supervision at ALL times, and are strictly forbidden from laboratories and workshops.

# 1.0 Introduction

Everyone has a moral responsibility to work in such a way as to ensure the safety of staff, students and visitors. The University is responsible for providing safe working conditions and for seeing that all students and staff are given adequate instruction and safety equipment to enable them to do their work safely. These responsibilities for safety are formalised into a number of legal requirements such as the Hazardous Substances and New Organisms Act (2001), Health and Safety in Employment Act (1992) and the Education Amendment Act (1990). These Acts describe the legal obligations imposed on the University – many of these obligations will automatically be satisfied if the moral principles in the above opening sentence are followed.

## 1.1 Disclaimer

The information in this manual is intended for all students and staff and particularly researchers working in the School of Chemical Sciences. Personal safety depends on each individual acting responsibly. Much has been done to minimise hazards in the School but the co-operation of staff and students in keeping the laboratories safe and tidy is vital. Please read this manual carefully. **The information presented here is not intended to be a complete guide on safety matters and any omission is not an excuse for unsafe practices.** In all cases the individual supervisor is ultimately responsible for safe work practices and must insist upon the use of such proper procedures to eliminate unnecessary hazards.

# 2.0 Safety – General Information

## 2.1 Getting Started

Before new students, staff or visitors to the School are allowed to commence research work, the "Getting Started" package, available from the School reception must be completed.

## 2.2 Awareness in Research

Before starting work in any area the following should be known:

- Where are the main exit routes
- Where are the nearest telephones, first aid boxes and fire alarms
- Where are the safety showers
- Who is responsible for the area
- What other work is being performed nearby and does it interfere with your work

The health and safety aspects of all research work must be discussed with the research supervisor. Supervisors have the responsibility for emphasising any special hazards that the research might involve and describing precautions that should be taken. Such information is typically provided on MSDS hazard data sheets – it is the supervisor's responsibility to provide such information to the research worker. The research supervisor also has the responsibility of ensuring that the research does not produce a dangerous environment within the laboratory. Recognising the nature of research, it would be prudent for all research workers to consider:

- Could the experiment be performed more safely?
- What action should be taken if the experiment develops in an unplanned way e.g. breakage, spillage, overheating etc.
- Are the materials necessary or are less dangerous substitutes available?

- Will there be any disposal or decontamination problems on completion?
- Are the other personnel working in the laboratory aware of the potential hazards associated with these experiments?

## 2.3 Take Five Safety Assessment

Before each experiment or procedure is undertaken a "Take Five" assessment must be completed. This is done by using the Take Five stick-in forms which are available from the Stores Technician. This assessment is designed to ensure that researchers have thought about the safety aspects of a particular procedure **even if they have completed the experiment or procedure many times before**. The assessment sheets need to be completed, signed and stuck into the lab book BEFORE the experiment is started.

### Take Five Safety Assessment Sheet

| **Take 5 Safety Assessment**<br>For the following experiment/procedure: | **Tick** |
|---|---|
| **I am authorized** to carry out this procedure and I am aware of any known hazards and safety guidelines<br>(Do you have the appropriate literature, MSDS's and has the procedure discussed with your supervisor? If after-hours, is it authorized and will there be support people around?) | |
| **I am not authorized** to carry out this procedure unless this safety assessment has been given due consideration and has been countersigned by the Lab manager or PiC below. | |
| I am using the appropriate chemicals and the procedure is clearly labelled. If the procedure is using particularly hazardous chemicals I have informed others about the safety implications. | |
| I am using the appropriate equipment (including personal protection) and the facilities are in good order. | |
| I have completed an experimental data table if the procedure is being carried out for the first time and if I have conducted this experiment before, I have thought about any changes to the procedure that may affect safety? (larger scale, new equipment, new location) | |
| I know where the safety equipment is located, how to use it and who to contact if my experiment becomes dangerous or causes an accident. | |
| Researchers signature: Date: | |
| Lab manager/PiC signature if required: | |

## 2.4 Unattended/Overnight Experiments

Before leaving an experiment overnight (or unattended) a yellow "unattended/overnight experiment permission form" must be completed. The form MUST be signed by both the experimenter **and** the supervisor. If the supervisor is unavailable, a "designated person-in-charge" may sign the forms. The researchers permitted to sign the forms must be of at least senior PhD or postdoctoral status and should be indicated on the laboratory managers list.

<table>
<tr><td colspan="7">UNIVERSITY OF AUCKLAND, DEPARTMENT OF CHEMISTRY<br>UNATTENDED/OVERNIGHT EXPERIMENT PERMISSION FORM<br>Reaction Scheme including Reagents, Solvents and Scale (µg, mg, g)<br><br>SPECIFIC HAZARDS AND EMERGENCY PROCEDURES:</td></tr>
<tr><td colspan="3">Name:</td><td>Lab Book Ref:</td><td colspan="2">Fumehood/Bench No.</td><td>Date:</td></tr>
<tr><td>IN USE</td><td>Electricity</td><td>Nitrogen</td><td>Water</td><td>Heating</td><td colspan="2">Other relevant information</td></tr>
<tr><td>TICK OR FILL</td><td></td><td></td><td></td><td>Temp:</td><td colspan="2"></td></tr>
<tr><td colspan="5">Has a Take 5 Assessment been completed? NO YES<br>Has the experimental setup been checked? NO YES</td><td colspan="2">EXPERIMENT DURATION<br>(date and time)<br>Start:<br>Finish:</td></tr>
<tr><td colspan="5">Contact Telephone No. (Experimenter)</td><td colspan="2">Supervisor/delegated person-in-charge:</td></tr>
<tr><td colspan="5">Contact Telephone No. (Supervisor)</td><td colspan="2">Sign: Date:</td></tr>
</table>

## 2.5 Accidents and injuries

Accidents may be minimised if forethought and care are exercised. Access to laboratories is conditional on the availability of assistance to deal with hazards, accidents or sudden illness. Never work alone in any laboratory where there are potential hazards.

The School has a number of trained First-Aiders who are available for assistance after an injury. Current lists of First Aid certificate holding members of staff and students are located near all First Aid cabinets, near lifts and at fire call points. If none are available, contact UniSafe (Security) on Ext. 85000.

In the case of **serious** injury or illness DIAL 1-111 and request an ambulance.
**If it is related to a chemical provide a hard copy of the MSDS to accompany the victim**
Basic first aid tips refer to http://www.stjohn.org.nz/tips/

**First Aid Boxes** – Two First Aid Boxes are located on each floor of the School of Chemical Sciences buildings. These are clearly identified by a standard First Aid sign. The cabinets contain a selection of material for dealing with minor injuries. The contents of these cabinets are replenished regularly but it is naturally in your best interests to report any shortages to the **School First Aid Officer Katrina Graaf** (Ext. 87513).

**Reporting accidents and incidents** – Report all accidents including minor cuts and grazes. University of Auckland Accident/Incident Report and Accident/Incident Investigation form must both be completed and handed to School Management staff as soon as possible after the incident. These forms are required as part of our measures to reduce accidents in the workplace. The information contained on the forms will also be used to improve the School's safety practices.
Also refer to accident and injury

## 2.6 Access to Building and Working After-Hours Guidelines

Access to all University of Auckland building is controlled by "The University of Auckland Policy on Access to University Facilities." This document outlines the type of activities that can take place in the University at all times of the day and what approvals are required to undertake work outside normal hours.

In the School of Chemical Sciences, **Normal Working Hours are from 8am to 6pm Monday to Friday**, excluding statutory/public holidays and university closure days. During this time work classified from Low to High risk can be undertaken, after the required safety assessments have been undertaken. **At all other times work is considered After Hours and rules govern what activities, based on their level of risk, can be done during these times.** The University of Auckland has a no access total closure time between 12am and 6am on every day and access to any facility during these times requires an explicit one-off approval from the School of Chemical Sciences HOS. See below for Risk definitions.

**On weekdays** (Monday to Friday) between 6am-8am and then from 10pm-12am work classified from Low to High risk can be undertaken, after the required safety assessments have been undertaken. From 10pm-12am only Low risk activities can be undertaken.

**On weekends** (Saturday, Sunday) **and public holidays** between 8am-10pm work classified from Low to High risk can be undertaken, after the required safety assessments have been undertaken. From 6am-8am and 10pm-12am only Low risk activities can be undertaken.

This can be summarised as:

| Monday to Friday (excluding statutory/public holidays and university closure days) | | | | | |
|---|---|---|---|---|---|
| Low Risk Only | Low to High Risk | Low to Extreme Risk | Low to High Risk | Low Risk Only | University closed |
| 6am-8am | 8am-9am | 9am-5pm | 5pm-10pm | 10pm-12am | 12am-6am |
| | | | | | |
| **Saturday, Sunday and public holidays** | | | | | |
| Low Risk Only | Low to High Risk | | | Low Risk Only | University closed |
| 6am-8am | 8am-10pm | | | 10pm-12am | 12am-6am |

The main doors of the School of Chemical Sciences are open from 8.00 am to 6:30 pm Monday to Friday. To gain access to the building outside those hours, a swipe card must be used (for ingress **and** egress). Swipe cards are issued by the University, and for people wanting to access SCS buildings, are subject to attending a SCS Safety seminar, and signing the appropriate documents.

**Swipe cards must not be used to admit un-authorised personnel to the building.**

At no time of the day or night are students or staff allowed to carry out research laboratory work unless a second person is within audible distance **and** a named person on the Laboratory manager or nominated person-in-charge list is present in or near the laboratory. Work carried out when a person is alone in a room must be restricted to Normal Working hours, with operations restricted to those with which the individual is familiar and that are **not hazardous**.

On leaving the laboratory in which they have been working, staff and students are responsible for ensuring that all equipment and services are in a safe condition. This means for example, turning off electricity and water that they have used.

The practice of staff and students bringing young children into the School, especially in the evening or at weekends, is potentially dangerous and undesirable. Children must remain under adult supervision at all times. Laboratories and workshops are strictly out-of-bounds to children.

**Risk Assessment and After-Hours Access**

The following tables are reproduced from The University of Auckland Policy on Access to University Facilities and state the level of risk associated with different activities within the university. Almost all work in the School of Chemical Sciences can be considered High Risk due to the proximity of hazardous chemicals and the nature of machinery and equipment used. What work that can be undertaken after hours is determined by the risk associated with that task. Students should consult with their supervisors what the risk level of each experiment is and determine whether conducting such an experiment after hours is possible or acceptable. Remember that no work at all can be conducted outside Normal Working Hours unless a signed approval form from the HOS has been issued. Persons who are found to be undertaking inappropriate procedures or experiments after hours or who are present in the No Access period (12am-6am) without official approval can have their after-hours access removed.

| Risk Level | Suggested type of approval | Notes |
|---|---|---|
| Low | • work in an office environment,<br>• using a computer outside a laboratory,<br>• readings or observations from **low risk** experiments<br>• Use of instruments such as NMR, IR, UV<br>• work in seminar rooms, study areas, libraries, and information commons facilities,<br>• studio work not involving hazardous substances, hazardous machinery, high work requiring use of lifting devices, ladders, scaffolding or "wet lab" work,<br>• interview / survey work with communities except high risk groups, | Members should arrange a contact to advise safe return.<br>It is advisable to have arrangements to ensure safety if working at night, such as parking near office or security escort to vehicle.<br>What may in substance be Low risk work, when undertaken in a laboratory may be deemed as a moderate or high hazard due to the surrounding hazards.<br>Access for children, even accompanying Members, shall be deemed a "moderate" hazard. |
| Moderate | • working or dealing with at risk persons or for example in clinical situations,<br>• undertaking low risk work in a moderate risk laboratory,<br>• working in a remote area. | Some moderate risk activities require appropriate supervision e.g. Members undertaking work with hazardous substances, radiation, or operating workshop machines or where Working Alone. If a hazard cannot be safely handled by a Member on their own, conditions must apply. |
| High | • Working with, or near, toxic or corrosive substances and/or infectious agents where there is a risk of exposure to the substance, taking into account the volume used.<br>• Operating apparatus capable of inflicting serious injury.<br>• Using apparatus that could result in explosion, implosion, or the release of high energy fragments or significant amounts of toxic or environmentally damaging hazardous material. Eg. vacuum lines, rotary evaporators, solvent stills<br>• Working with exposed energized electrical or electronic systems with nominal voltages exceeding 50 V AC or 120 V ripple-free DC. NOTE: These limits are for dry, indoor conditions and a more conservative approach should be taken in other conditions.<br>• Working with radio nuclides requiring a high level laboratory in accordance with National Radiation Laboratory Code of safe practice for the use of unsealed radioactive materials, NRL C1.<br>• Working with micro-organisms of Risk Group 3 and higher, or which require the use of containment level 3 facility or higher | Due to the chemical nature of work conducted in the School of Chemical Sciences almost all work conducted in a laboratory is considered high risk.<br><br>Members shall not undertake work or be granted access where the risk is identified as high without an Approval which is subject to conditions including supervision and hazard assessment.<br>Every effort shall be made to reduce the level of risk. |
| Extreme | No after-hours approval. Every effort shall be made to reduce the level of risk | No staff or student shall undertake extreme risk activities. |

## 2.7 Security

**UniSafe (University Security)** – The prime function of Unisafe is to provide a safe and secure environment for University students and staff as well as the protection of university assets. Security is located at 24 Symonds St and provides a 24 hours a day, 7 days a week control room staffed by operators. In an EMERGENCY dial 966. For routine issues, dial 85000.

**Identification Cards** – All staff and students are issued with a University Identification Card which must be carried at all times, and presented, if required, to Unisafe (University Security) staff on demand. Lost or stolen cards should be reported immediately to the ID card center on ext. 87885.

**Security of Building** – Under normal circumstances, doors to laboratories, offices etc should be locked whenever possible and when not in use. If staff leave an office, even for a short period of time, it is recommended that the door be locked. Many thefts that occur are on the spur of the moment where an office door is left open. Research workers should securely lock away equipment likely to be attractive to thieves and not in immediate use, and it is advisable not to leave purses and wallets out on desks or benches. All incidences of theft or vandalism or strangers snooping around rooms in the School should be reported to Unisafe (Security) immediately on 966 or ext. 85000.

If you are concerned about your personal safety at any time, contact Unisafe (Security) on ext. 85000. Also refer to Personal Security

## 2.8 Equipment Maintenance

All electrical equipment must be kept in a clean usable condition and **not left unused for long periods in fume hoods.** Regular inspection of electrical equipment is required by law. This is undertaken annually by registered electrical service technicians. If you find any equipment to be faulty or requiring electrical servicing, immediately unplug and label the equipment as faulty and notify the floor technician.

## 2.9 Glassblowing

Requests for glassblowing assistance should be made to Alistair Mead or Michael Wadsworth (Ext. 87508, Bldg 312 Rm 172 ) and should be accompanied by a requisition, and a diagram of the desired piece of apparatus, complete with all necessary measurements. Glassware provided for repair or modification **must** be clean, dry and **free of flammable vapours.** Work on sealed ampoules requires the authorisation of an academic staff member

## 2.10 Breakdowns in Services

Breakdowns in general services should be reported to School Management, or in an after-hours emergency directly to Unisafe (Ext. 85000).

## 2.11 Use of Specialist Equipment

Students who need to use some of the special equipment that the School possesses, for example, spectrophotometers or chromatographs, should first enquire of their supervisor as to the necessary procedure. He / she will refer the student to the staff member who is responsible for the instrument. **This equipment is expensive. In no case should a student begin to use an instrument without a clear understanding of the operating procedure.**

## 2.12 Health and Safety Information

Documents detailing hazards identified in the School of Chemical Sciences and methods for the control of such hazards (Safe Methods of Use documents) are available from the Health and Safety pages of the SCS web site.

Links to Material Safety Data Sheets (MSDS) are available through the Health and Safety pages of the SCS web site. The information contained on the MSDS's will help you assess the hazards associated with a particular chemical and how best to store, use and dispose of it. Copies of MSDS forms relating to chemicals used in individual laboratories need not be stored in those laboratories, however it is important that the data sheets be readily available, especially in an after–hours emergency situation.

## 2.13 Procedure When Research Work Has Been Completed.

Once bench work has been completed, students must ensure that:

- all chemical wastes have been disposed of correctly
- chemicals, glassware and accessories have been returned to their correct location
- the work area and equipment is left in a safe and tidy condition
- any borrowed items are returned
- the supervisor's approval is obtained before departure (failure to do so may result in withholding of results).

## 2.14 Computer Safety Guidelines (OOS).

Occupational Overuse Syndrome (OOS) may be caused by many factors but the most common are:

**Poor ergonomics** – Work stations (chair, desk, and monitor) should be comfortably set up as per the Code of Practice for the use of Visual Display Units published by the Occupational Safety & Health Service of the Department of Labour. UoA Human Resources can provide access to Kairos Computer Safety Toolkit Software.

**Lack of task variety –** Task variety is essential to prevent static postures for prolonged periods. Where this is impractical it is imperative that micropauses be used every 10 minutes or so and that there be a 10 minute break from computer work every hour. Rest and meal breaks must be taken.

**Excessive workloads –** Excessive workloads do not allow time for muscles to recover. Prolonged computer usage should be considered in the same manner as are hours or work for airline pilots and truck drivers.

**Stress** – Stress from whatever its source tends to tense the body and make it more susceptible to OOS type complaints.

Such factors can be overcome by:

1. All staff who use a University computer as a significant part of their work should adopt safe work practices which includes injury prevention exercises.
2. All staff who use a computer should attend a OOS workshop run by HR POD
3. Staff are to be instructed and encouraged to report any aches, pains or discomfort. Work stations and workloads are to be investigated and appropriate action taken.
4. Supervisors and managers must monitor their employees‟ workloads and provide as much task variety as possible. They must insist that micropauses and breaks be taken.
5. Break reminder software should be installed on computers where necessary.

Also refer to Use of Computers

# 3.0 Emergencies

## 3.1 Fire

Fire is one of the greatest potential hazards in our buildings and every effort should be made to avoid the possibility of starting a fire. Examples of hazards include; water baths running dry; self-igniting chemical mixtures; electrical equipment in poor condition; and lack of precautions when handling flammable solvents. Reduce the hazard of fire by minimising the quantities of flammable reagents held. Be aware of the methods of dealing with fires involving the reagents you use.

Some parts of the building are protected by an Automatic Sprinkler Fire Alarm System. If fire broke out it would activate the ceiling sprinkler head above the fire, releasing a continuous spray of water, and it would also activate the fire alarm and automatically notify the Fire Brigade.

If a serious fire is discovered:

- Immediately evacuate the room
- Make sure that no one is in immediate danger
- Activate the fire alarm if there is one close at hand
- Dial 1-111, ask for the Fire Service and report details as below:
    - The location and nature of the fire
    - Any special hazards of which you may be aware e.g. proximity of gas cylinders, possible radiation hazards or chemicals
    - Any casualties
- Telephone Unisafe (University security) on 966 or ext. 85000 and repeat the information given to the Fire Service.

**Fire Alarm**. When you hear the fire alarm (a warbling siren) you **MUST** leave the building **IMMEDIATELY** using the main stairs in the center of the building or alternatively, the stairs towards the western end of the building may also be used. NOTE that the ladders at the end of the floor do not allow exit from the building, and so they should not be used.

Upon hearing the alarm, laboratory workers should:

- Shut down services to equipment unless advised otherwise by the laboratory supervisor.
- Close the windows.
- Leave the room and close the door.
- Leave the building under the direction of the floor warden, using the main stairs in the center of the building, or the secondary stairwell at the western end of the building.

While exiting the building, **DO NOT USE LIFTS.** The lifts automatically go to the ground floor in an alarm situation.

Do not attempt to gather personal possessions or official records.

If a person is unable to leave the building by stairs, leave them with someone near the main lifts (SMOKE STOP LOBBY) and inform the building warden or fire brigade immediately at the Symonds Street entrance to the Chemistry Building. ASSEMBLY POINTS are located at:

- CONCOURSE by the Recreation center
- On Symonds Street footpath (primary)

Only re–enter the building when the "all–clear" has been given by the Fire Service.

Note that at least one practice emergency evacuation is carried out per University semester. Treat all

alarms seriously. As part of these drills, the ability of laboratory staff to respond to chemical emergencies will be tested. As previously explained the ability of our staff to provide information to Emergency Services is not only a statutory requirement, but it has also proved to be crucial to swift resolution of the incident.

The testing of response of laboratory staff will be simple. Two laboratories in each building will be selected at random 5 minutes prior to the evacuation drill. The Laboratory Manager or the Person in Charge of the selected laboratories will be expected to report to the Building Warden when the building is evacuated.

Lives may depend on knowing what to do in a real emergency.
Also refer to Emergency Evacuation Procedures

**Fire Fighting**

Prompt action will often prevent a small fire in a laboratory from becoming a major disaster by smothering the flames with a wet towel or even a notebook, and the use of the correct type of portable fire extinguisher. You should know the positions of sand buckets, fire extinguishers, fire hoses and the nearest fire alarm.

The following types of fire extinguishers are installed throughout the buildings.

- **Dry Powder**; Red with white band, A very fine powder, specially treated to render it free flowing. It is non-conducting, non-poisonous and non-corrosive and is effective on most types of simple fires involving oils, spirits, fats, etc. To use, remove pin or break seal, and squeeze handle.

- **$CO_2$ Gas**; Red with black band, Useful for small fires involving most flammable liquids, electrical apparatus, delicate instruments, and most chemicals. Certain light metals will however, continue to burn. To use, remove pin or break seal, squeeze handle

- **Water Hose Reels**; 2 per floor of the School. These are only suitable for building fires – they must NEVER be used on chemicals, electrical apparatus or inflammable liquids. To use, turn nozzle control water flow.

**Used extinguishers** – When an extinguisher has been used, within 12 hours or as soon as practicable notify the School Technical Manager who will arrange to have it recharged. A used extinguisher should be laid on its side on the floor – do **not** put it back on the wall mount.

## 3.2 Gas Leak.

University of Auckland policy response to a gas leak is to raise the alarm to other building occupants by NOT using the fire alarm, but rather to spread the alarm verbally amongst people in the building. Extinguish any naked flames, telephone Fire Services, notify floor wardens and evacuate the building.

## 3.3 Civil Emergencies.

**Earthquakes** – In the event of a strong earthquake take immediate cover under any solid structure such as table, bench or doorway. Leave the building as soon as possible, using the same route as for fire evacuation.

**Volcanic Eruption** – listen to a radio for instructions, obey the requests of Civil Defence personnel, do not go sightseeing and keep indoors and close all windows and doors.

Also refer to Civil Defense Policy

# 4.0 Hazard Guidelines

## 4.1 Chemical Safety Guidelines

### 4.1.1 Safe Use of Chemicals

Where chemicals, including liquids, gasses and solids are procured (through whatever means), imported or manufactured on site, it is the responsibility of the person in charge of the project or laboratory, for the safe use of these materials. This safe use includes the storage, transportation, handling/use, and their ultimate disposal.

Information on the hazards, storage and disposal of chemicals can be obtained from Materials Safety Data Sheets (MSDS) available on the University Library database web page (Gold FXX). Note that access to Gold FXX requires students to have logged through Net Account FIRST. The University requires that MSDS sheets be readily available to research workers and that they be consulted when necessary.

Very few chemicals are completely harmless – treat all chemicals as potentially harmful. Note hazard warnings displayed on labels and read any literature supplied by the manufacturer. Handling of volatile or highly toxic chemicals (especially in situations likely to produce aerosols or fine powders) must be carried out in a fume hood. Wear appropriate protective clothing including gloves and safety glasses when working with toxic or corrosive chemicals. Note that some organic chemicals can penetrate rubber and/or plastic gloves. Before leaving the laboratory for more general areas, hands should be washed and the laboratory coat, along with other safety equipment, removed.

Winchesters of flammable solvents should not be left on benches. Fill small bottles (e.g. 500ml) for everyday use, and immediately return Winchesters to their normal storage, preferably in a flammable solvent storage cabinet (where available). When flammable solvents are being used, every effort must be made to eliminate all sources of ignition e.g. naked flames, hotplates, electric switching contacts, electric motors, and static electricity sources. For obvious reasons, flammable liquids must never be heated with a naked flame.

Before commencing work, workers should familiarise themselves with the toxic properties of, and antidotes for, the compounds with which they are working. Special permission is required for work involving hazardous chemicals (e.g. cyanides). Antidotes and emergency procedures must be immediately available and fellow workers in the close vicinity should have been informed of the appropriate action to take in case of an accident.

Also refer to gloves for chemicals and glove information

### 4.1.2 Common Sense and Good Housekeeping

Common sense and good housekeeping care will go a long way to producing an accident–free laboratory.

All chemicals must be clearly labelled with the name of the chemical, and information on any particular hazard associated with the chemical (eg. corrosive, flammable). The chemical container should be clean and fitted with an appropriate seal, and should be stored in an appropriate place immediately after use. Quantities in use at any one time should be kept to a minimum. Bottles of any chemicals, especially liquids, should not be kept in direct sunlight since very sharp increases in temperatures can result.

### 4.1.3 Storage of Hazardous Substances in the Laboratory

In order to provide a safe working environment, it is imperative that minimum stock levels of chemicals are to be maintained in laboratories. **Chemicals must be stored according to their UN classification.** For help with this classification, see the School and Faculty of Science health and safety website pages. Incompatible chemicals must not be stored together e.g. flammable solvents should not be

stored with strong oxidising agents, in either dangerous goods stores or laboratories. Where possible, chemicals in laboratories are to be stored in cupboards and cabinets rather than open shelving. Chemicals are to be stored at or below shoulder height to avoid accidental spillage or splashes to eyes and, if on shelves in laboratories, above floor level to avoid accidental contact by cleaning staff. Any cupboards, cabinets and shelves used to store chemicals must be secure from toppling and not overloaded. Chemical bottles should be opened carefully after normal storage, as in some instances pressure build-up can occur. Fresh stocks and waste chemical material must never be stored together.

Winchesters of flammable liquids must always be stored in flameproof cabinets, If needed, small quantities of flammable liquids can be stored in a refrigerator – but the refrigerator must be spark proofed. All domestic type refrigerators and deep freezers not modified to make them spark proof are to be clearly marked "Unsuitable for Flammable Solvents". Chemicals stored in a refrigerator must be stored in such a way such that opening of the refrigerator cannot result in the chemical bottle falling out of the fridge on to the floor.

#### 4.1.3.1 Use and Storage of 1st Generation Peptide Coupling Reagents (carbodiimide based reagents such as: DCC, EDC.HCl, DIC)

It is the aim of this Guideline to make people aware of the possibility of hypersensitivity reactions from exposure to peptide coupling reagents, and the debilitating effect of these reactions on some people.

These reagents are to be treated as potentially hypersensitivity causative, and that exposure to them is kept to an absolute minimum.

Such reagents are to be used in fume hoods at all times, and if it is not possible to have a balance in a fume hood, a single balance must be dedicated for weighing out these reagents in a given laboratory.

Appropriate gloves must be worn at all times and scrupulous cleanliness observed around the balance and other work areas.

These reagents should be stored in closed containers in a separate cupboard that is clearly labelled as to the nature and hazards of the contents.

If a separate cupboard is not available, then the reagents must be stored in a secondary, clearly labelled container within the cupboard.

- HSNO Code of Practice
- Safe Methods of Use
- UN Classification of chemicals
- HSNO Classification of chemicals

### 4.1.4 Transportation

Winchester carriers should be used when winchesters have to be transported any distance – never carry winchesters by the neck. Ideally, chemicals should only be transported to different levels of the building via the Bldg 302 Goods Lift. If the Goods Lift is not available, use only one of the other two Bldg 302 western lifts, and transport your chemicals in a closed-in trolley. Special care must be taken when chemicals are being transported any appreciable distance on campus to avoid accidental dropping, toppling, spillage, or contact with people. Ensure containers are securely sealed, and that appropriate secondary containment is used to contain spills. Use appropriate moving equipment and choose routes clear of obstacles and large numbers of people.

**External Transportation of Chemicals**

- Chemicals required at Grafton, Newmarket or Waiheke campus'should be delivered directly to site to avoid secondary transport
- Transport of chemicals is regulated by the Land Transport Rule: Dangerous Goods 1999 (Revised in 2005).
- Failure to observe these regulations will entail prosecution Fines which start at >$2,000 for the individual, and >$10,000 for the University
- Public transport, including the inter-campus bus CANNOT be used to transport any chemical or dangerous good, no matter how small

For off-site transportation of hazardous materials use CHEMCOURIERS – enquire from Stores staff.

### 4.1.4.1 Correct Use of Goods Lift and Passenger Lifts

Under no circumstance should any lift be used in an evacuation of the building. Use the closest stairwell.

Chemicals should be transported between levels of our buildings via the Goods Lift (Lift number 3 at the western side of Bldg 302)
If the Goods Lift is unavailable, chemicals may only be transported via passenger lifts 1 and 2, in the western lift bank of Bldg 302.

**Important note:** Chemicals must only be transported in the lifts using the enclosed blue cabinet trolleys which have been provided to research groups. Chemicals must travel in secondary containment in the lower enclosed compartment of the trolley.

**With chemicals well protected in secondary containment, lab coats and gloves are not to be worn in the lifts**

**Cryogenic material and gas cylinders on trolleys must always travel unaccompanied in the lifts.**
** Evaporation of cryogen from the Dewar will displace air from the lift leading to rapid asphyxiation and death. Evaporation from boxes of dry ice or a leaking gas cylinder may also lead to low oxygen levels in an enclosed space.

Cryogenic material and gas cylinders should always travel in the Goods Lift using the **Hazardous Goods** facility. This facility locks out potential passengers from entering the lift until the cryogens have been retrieved at their destination. Technicians and Stores staff have keys for this facility.

**Only** if the Goods Lift is unavailable, may cryogens or gas cylinders be transported in lifts 1 or 2 of the western bank lifts of Bldg 302, and the following precautions must be strictly adhered to:

Before sending the Cryogens or gas cylinders unaccompanied, ensure:
- Clear signage is placed on the Dewar or other hazardous goods warning other lift users not to enter the lift while these products are in the car.
- The yellow barrier chain with the warning sign (found in the Goods Lift with spares in the PPE cabinet on the loading dock) must be used to physically block entry to the car.
- Another appropriate person is waiting to meet the lift at its destination.

**Passenger Lift**
Lab coats and gloves are not to be worn in passenger lifts. If you are on your way to the Stores, and will be working with chemicals on site, please utilize a lab coat available in the Stores.

If a Passenger Lift is out of order please check the number in the lift and report it to reception.

### 4.1.5 Fume hoods

Fume hoods are designed to contain and extract fumes and aerosols. One of the main design features of these fume hoods is the face or entry velocity across the open sash. For general laboratory fume hoods a face velocity of at least 0.5m/s is recommended while for highly toxic materials face velocities of up to 1m/s are required. The efficiency of every fume hoods must be checked periodically. As some of the fume hoods currently in use in research laboratories in the School lack any audible alarms to indicate loss of air flow it is imperative that these fume hoods be fitted with a "tell–tail". In its simplest form, this can be a flexible plastic strip or strip of tissue paper attached to the bottom of the sash that can act as an indicator of extraction efficiency. Fume hoods should be cleared of potentially dangerous compounds before any experiment is started. Experiments that evolve noxious, toxic or flammable vapours and gases should be undertaken in a fume hoods that is suitable for the purpose.

Please update the mini white board on each fume hood with the name and contact details (i.e. phone number) of the student(s) and the initials of the lab manager/ supervisor(s). If it becomes necessary (such as in the scenario above) to discuss the contents of the fume hood the users can easily be identified. In general (rather than the described emergency situation) the lab manager/ supervisor (not the student) would be approached in the first instance.

#### 4.1.5.1 Use of Blast Shields

In some circumstances it is required to use additional protection in addition to performing experiments in a fume hood. These instances may include the use of potentially explosive reactants, experiments left under high vacuum for long periods of time or when using untested equipment under vacuum for the first time. These reactions are considered Extreme risk and need to be started during Normal Operating Hours (see above for details). For more information about the use of blast shields and for lists of chemicals when blast shield use in mandatory please see: SMOU Blast Shields

### 4.1.6 Disposal of Waste Chemicals.

Each individual user carries the responsibility for checking on the properties and disposal methods for materials used. If in doubt, consult with your supervisor. When you are about to leave the School or complete a project, consult your supervisor about safe disposal of any hazardous chemicals that you may have remaining in your laboratory.

In this School all wastes are transported to the store where they will be removed by external contractors. Chemical waste submitted to the disposal area **must** be appropriately labelled with:

- Your name
- Contact details
- The contents (in as much detail as possible)
- UN hazard class (easily obtained from the bright red signs displayed at the disposal area)

To make this waste submission as easy as possible, there are labels available from stores that should be filled out and fixed to the waste container. An enlarged copy of the label is shown below.

| HAZARDOUS WASTE DISPOSAL<br>attach form clearly on waste container |
|---|
| **NAME** |
| **CONTACT DETAILS** (E-mail, Phone No., Lab number) |
| **CONTENTS**<br>(include full chemical names, mass, hazards etc) |
| **UN HAZARD CLASS** |

## Waste Solvents

Before considering disposal of laboratory solvent waste, all practical avenues of solvent recycling should be considered.

Small amounts of water miscible solvents such as ethanol, methanol and acetone may be poured down the sink while running plenty of water down the drain. Larger amounts of these solvents must be disposed of via the waste solvent bottles – not the sink.

Water immiscible solvents, such as hexanes, diethyl ether, dichloromethane, etc. must **never** be poured down the sink. They must be collected in labelled waste solvent bottles, which are available from the store. **Chlorinated solvents must be kept separate from other waste solvents**. Separate bottles are available from stores for chlorinated and non-chlorinated solvents. When the bottle is full it should be capped and returned to the chemical store. Solvent residue bottles should have secondary containment, in case of rupture of the bottle due to corrosion, pressure etc.

Waste solvents bottles are only to be used for solvents and must not be used to dispose of large amount of other chemicals. Small amounts of reaction residues washed from glassware is acceptable in the waste solvent. Bulk chemicals must not be simply placed in waste solvent for disposal, see the safety officer or store person for information on larger disposals.

## Aqueous Wastes

In general only pH neutral, non-toxic aqueous waste can be disposed of down the drains, the following methods may be used to aid disposal of some aqueous materials.

## Acids and Bases.

Mineral acids and bases may be neutralized and the resulting salt solutions flushed down the drain, **provided that the material is not hazardous for reasons other than its acidity or basicity.** Use the following steps:

Prepare a dilute aqueous solution of the acid or base to be destroyed in a beaker or wide-mouth flask. Always add acid or base to an excess of water. You should never add the water to the acid or base, because the heat generated may be enough to boil the water, and expel the substance violently from the container.

Then prepare a dilute solution of sodium hydroxide if you wish to neutralize an acid, or hydrochloric acid if you are neutralizing a base.

Because neutralisation can generate a lot of heat if you are neutralising a large amount of acid or base you should cool the solution of the strong acid or base before continuing. Then using pH paper (or pH meter) to monitor the pH slowly add the solution of sodium hydroxide or hydrochloric acid until

solution is between pH 6.6-7.4.

You may then dispose neutralized solution down the drain with lots of running water.

**Inorganic Compounds**

Inorganic Compounds may be dissolved in water and flushed down the drain with much cold water, **provided they do not contain any heavy metals or toxic anions, and are not powerful oxidizers or water reactive**. Thus, lithium, sodium, potassium, magnesium, and calcium salts may be disposed of in this way, but arsenic, barium, copper, tin, lead, silver, iron, cobalt, nickel, chromium, zinc, manganese, and mercury salts may not be. Solutions with toxic anions, cyanide for example, should not be disposed of down the drain unless they have been properly treated. Insoluble materials of whatever type should not be flushed down the drain. If you are unsure if a particular solution or inorganic salt can be disposed of down the drain then ask your supervisor.

**Other Wastes – Solids and Oil**

All waste solids should be placed in sealable containers and transported to stores for disposal. Waste silica should always be handled and transferred between containers in a fume hood due to the risk of inhalation of the dust.

Waste oil from thermostats, rotary pumps, etc. must not be placed in solvent residues but stored in separate oil containers pending disposal.

**Other Wastes – Sharps**

Sharp waste such as needles MUST be disposed of in the dedicated yellow bins that are available from stores. Sharps must not be mixed in with solvent waste, solid waste or placed in any general waste bins. The ONLY exception to this rule is broken glass, which may be placed in the dedicated broken glass waste bins.

It is unacceptable to submit sharp material to stores in anything other than the yellow bins. Unlabelled sharps present a real risk of injury to personnel dealing with the waste.

### 4.1.7 Spillages

In the event of a **significant (> 10 L) organic solvent** spill,

- **contain** the spill (e.g. set spilled vessel in the upright position),
- immediately **evacuate** the area and inform a member of Staff.
- if no Staff member is immediately available, trigger the fire alarm, Dial 1-111 and ask for the Fire Brigade.

The appropriate MSDS form for the spilled chemical must be provided to Fire Service workers. Do not attempt to clean up the spill without appropriate protective equipment. Emergency escape masks held in each laboratory are NOT to be used to help contain a spill – such masks are only to be used to aid in emergency egress from the lab.

**Spill sizes up to 5 litres** can be dealt with using the small spill kits stored in laboratories. As an alternative, spills can be dealt with by adding sand to the spill. In either case, the procedure for the controlled disposal of the chemically contaminated sand or absorbent material is:

1. Wrap the used spill media securely in plastic bag such that escape of volatiles is kept an absolute minimum.

2. Notify the School Safety Officer and storeperson.
3. Deliver to Stores, who will arrange for University chemical waste disposal contractor to pick up. It is absolutely crucial that the storeperson is notified of the delivery as in Step 2.

Spillages of water or chemicals onto benches or floors must be cleaned up immediately. Acid and alkali solutions should be neutralised before cleaning up. Mercury is particularly toxic and should be sucked up with a capillary connected to a water pump and the area then treated with a wash of calcium hydroxide and flowers of sulphur mixed to a thin paste with water.

Any chemicals spilled or splashed on to any part of the body must be washed off immediately with Diphoterine® and or/ running water. Emergency showers are located in or just outside laboratories. Medical advice (Student Health, Ext. 87681) should be obtained after the following emergency action has been taken (**See section 4.7.3**).
Provide a hard copy of the MSDS to accompany the victim

Poisons Centre (Dunedin) 0800 764-766 (0800 POISON)

Basic first aid tips refer to http://www.stjohn.org.nz/tips/

*Chemicals in the eye*
Wash thoroughly with Diphoterine® and/or running water for 30 minutes

*Acid or Alkali on other part of body*
Wash thoroughly with Diphoterine® and/or running water for 30 minutes

*Acids swallowed*
Quickly wash out mouth with water; give plenty of water to drink to wash throat then milk of magnesia at intervals. *Do not give emetics.*

*Alkalis swallowed*
Quickly wash out mouth with water; plenty of water to drink to wash throat then give 1 % solution of acetic acid. *Do not give emetics.*

*Poisons if in mouth but not swallowed*
Spit out and rinse the mouth repeatedly with water.

Remember that many poisons can be absorbed through the lungs or skin: for example, hydrogen sulphide (lungs) or aniline (skin) can both prove fatal in sufficient quantities.

Also refer to section 6 of HSNO Code of Practice

## 4.2 Compressed Gas Cylinder Safety Guidelines.

DO NOT ATTEMPT TO USE A GAS CYLINDER UNTIL INSTRUCTED IN THEIR USE

All users of gas cylinders must know and understand the properties of a gas before using it (flammability, toxicity and chemical activity) and must establish plans to deal with any emergency situation that might arise during use. Note that gas cylinders can be heavy and persons who are small or feel uncomfortable handling cylinders should seek assistance.

Users of carbon monoxide (CO) should be especially aware of the colourless, odourless and toxic nature of the gas. Cylinders of CO must always be stored in an actively vented area, and the gas can only be used in a fume hood that is working satisfactorily. Additionally, no worker can use CO on their own (at least one other worker must be present in the room) and the gas is not to be used after hours.

The School of Chemical Sciences has a limited supply of CO gas detectors – they MUST be used when operating a cylinder of CO.

Users of compressed gas must ensure that they are familiar with the procedures recommended by the various suppliers and that the correct regulators and valves are used in the proper manner. Always check the official stamping on the cylinder or its label to determine the contents of the cylinder. The valve outlets for combustible gases are screwed left-hand and those for non-combustible are screwed right-hand to avoid the dangers that could arise by the interchange of cylinders during use. Never open a cylinder with unknown contents and contact the School of Chemical Sciences Safety Officer who will deal with the cylinder.

All gas cylinders must be secured in a cylinder floor stand or securely chained or strapped in an upright position to a bench or wall: **free standing cylinders are not permitted**. Gas trolleys must not be used as stands. Cylinders should not be lifted by the cap, dragged, slid along the ground, or dropped. Cylinders should be transported by means of a suitable hand trolley chained at the top and bottom and then supported or secured in the vertical position. Cylinders of liquefied gas (e.g. ammonia, carbon dioxide, chlorine, nitrous oxide, acetylene) must be used vertically.

**NEVER MOVE HIGH PRESSURE GAS CYLINDERS WITH REGULATORS ATTACHED WITHOUT FIRST ENSURING THAT THE MAIN VALVE IS CLOSED**.

The number of cylinders in a workshop or laboratory must be kept to a minimum to minimise the fire and toxic risk. Empty cylinders should be returned promptly to the School of Chemical Sciences Store. Full and empty cylinders must be clearly identified and stored separately. Persons handling compressed gases must ensure they are familiar with procedures recommended by the various suppliers, and that the correct regulators and valves are used in a proper manner. Cylinder valves and regulators should be checked periodically by technicians-in-charge of laboratories. The contents of a gas cylinder must never be discharged without the use of a pressure control valve: uncontrolled admission of a compressed gas to glass apparatus could result in a serious explosion and so a safety valve device must be fitted between the reducing valve and such apparatus. A gas cylinder must never be discharge completely – a positive pressure of about 2 atmospheres should be left to discourage leakage of air into the cylinder.

A cylinder key should be kept with the gas cylinder. All main cylinder valves should be opened slowly to eliminate the possibility of compression heating causing and explosion within the regulator. Connections to flexible pipework should be made securely with "Jubilee" clips or a similar fastening. Gas cylinders should ALWAYS be turned off at the main valve of the cylinder when not in use.

The hazardous properties of a compressed gas e.g. flammability, toxicity, chemical reactivity must be fully known by every user. For example, particular care is required when acetylene is used because of its ability to form shock-sensitive explosive acetylides with copper, silver salts and metals. The pressure in any piped acetylene system must never exceed 1.6 bar and the system must be fitted with a flame arrester, and if other gases are involved non-return valves must be used. A heavy blow on an acetylene cylinder can ignite the contents as a result of adiabatic compression and the cylinder may explode sometime later if action is not taken immediately. Those responsible for the use of acetylene should be acquainted with the emergency routines to be followed should the cylinder start to warm up.

Oil or grease will ignite explosively in the presence of compressed oxygen and thus cylinders and valves must NEVER be greased and must be kept away from possible contamination. The too rapid opening of a valve on a hydrogen cylinder can cause ignition due to static electricity.

Also refer to Gases and Section 4.4.2 and 4.6.5 of the HSNO Code of Practice

## 4.3 Cryogenic Materials (specifically safe transportation) Safety Guidelines

Two most common cryogenic materials encountered are solid carbon dioxide and liquid nitrogen. Solid carbon dioxide has a temperature around –79$^{o}$C and liquid nitrogen has a boiling point of –196$^{o}$C.

Both are cold enough to cause severe "burns" on prolonged contact.

1. Never store these materials in closed containers. Both evaporate continuously in normal use and storage. The transition from liquid to gas phase is accompanied by large increases in volume, which may lead to explosive rupture of the container.

2. While neither carbon dioxide nor nitrogen is toxic in the usual sense, they are both capable of causing asphyxiation. The chest freezer where the dry ice is stored often becomes full of carbon dioxide gas. Care should be taken to avoid inhaling this gas when removing dry ice from storage.

3. The greatest danger with these extremely cold substances is that of receiving "cold" burns from contact from them. Dry ice is the warmer of the two and being a solid it is less likely to burn than liquid nitrogen. However solid carbon dioxide should never be handled with bare hands. Suitable scoops or thick fabric gloves should always be used. Liquid nitrogen, because of its intense cold, and because it is a liquid, is far more dangerous.

**Transportation**

Liquid nitrogen dewars and dry ice must travel **unaccompanied** in the lift. This is because any evaporation of cryogen from the Dewar will displace air from the lift leading to rapid asphyxiation and death.
Cryogenic material should always travel in the Goods Lift (Lift number 3 western bank Bldg 302) using the **Hazardous Goods** facility. This facility locks out potential passengers from entering the lift until the cryogens have been retrieved at their destination. Technicians and Stores staff have keys for this facility.

**Only** if the Goods Lift is unavailable, may cryogens be transported in lifts 1 or 2 of the western bank lifts of Bldg 302, and the following precautions must be strictly adhered to:

Before sending the Cryogens or gas cylinders unaccompanied, ensure:

- Clear signage is placed on the Dewar or other hazardous goods warning other lift users not to enter the lift while these products are in the car.
- The yellow barrier chain with the warning sign (found in the Goods Lift with spares in the PPE cabinet on the loading dock) must be used to physically block entry to the car.
- Another appropriate person is waiting to meet the lift at its destination.

When filling dewars directly from the tank, the person in charge must never leave the dewar unattended. Only those staff that have attended the BOC Cryogenic training session are authorized to fill dewars from the cryogenic storage facility (located in carpark 40) and understand and adhere to the prescribed safety precautions.

All liquid nitrogen containers should be completely emptied at least twice a year, because of the gradual accumulation of liquid oxygen.

Liquid nitrogen traps on vacuum lines tend to liquefy air passing through the trap as well as organic vapours, to give a dangerous combination. Do not draw air through a trap unnecessarily and always empty the trap immediately after use.

Both liquid nitrogen and solid carbon dioxide must be stored in a ventilated area – Never in a Cold Room.

Liquid air should never be used in the School of Chemical Sciences.

Splashes of liquid nitrogen represent a considerable eye hazard, therefore protective goggles must be worn when decanting and transferring this material. Brief contact of liquid nitrogen with the bare skin results in a layer of vapour forming between the skin and the liquid, and this has an initial insulating effect. However, this barrier quickly breaks down, the liquid nitrogen wets the skin, and a burn results. Where skin is covered with fabric, the fabric immediately gets wet and the skin is burnt at once. For this reason, porous or fabric gloves should never be worn when handling liquid nitrogen. Loose leather mitts are the safest form of hand protection as they can be quickly shaken off in an emergency. With both liquid nitrogen and solid carbon dioxide wet hands and clothing add greatly to the chance of being burnt. The water will provide a better path of heat transfer, and turning to ice, cement the skin to the cold surface.

The first aid for all these cold burns is the prompt immersion in cool, not hot, water.

When thawing vials that have been stored in liquid nitrogen perspex face protection must be worn. Any liquid nitrogen that has found its way into the vial will revert to gas very quickly, and the subsequent pressure rise is likely to result in an explosion if the vial has been weakened.
Also refer to Cryogenic liquids

## 4.4 Pyrophoric Solids Safety Guidelines

Researchers should not use pyrophoric reagents until they have read and fully understood these safe operating procedures. However, reading these procedures does not substitute for hands-on training.
New users of pyrophoric reagents must work under the close supervision of an experienced user.

### 4.4.1. Scope

A variety of solids are pyrophoric (spontaneously ignite in air) including (but not necessarily limited to):
Finely divided metals (bismuth, calcium, hafnium, iron, magnesium, titanium, uranium, zirconium)
Alkali metals (lithium, sodium, potassium, especially sodium potassium alloy – NaK, and even more dangerous are cesium and rubidium)
Low valent metals (titanium dichloride)
Nonmetals (white phosphorous)
Metal hydrides (potassium hydride, sodium hydride, lithium aluminum hydride, uranium trihydride)
Nonmetal hydrides (arsine, boranes, germane, phosphine, silane) (Most of these are actually gases.)
Partially or fully alkylated derivatives of metal and nonmetal hydrides (diethylaluminium hydride, diisobutylaluminum hydride, dichloro(methyl)silane) (Usually in liquid form or in solution.)
Alkylated metals (butyllithium, triethylboron, trimethylaluminum) (Usually in liquid form or in solution.)
Alkylated metal alkoxides or halides (dimethylaluminum chloride, diethylethoxyaluminium)
Metal carbonyls (dicobalt octacarbonyl, nickel carbonyl)
Used hydrogenation catalysts, e.g. Raney Ni, are especially hazardous due to adsorbed hydrogen
Copper fuel cell catalysts, e.g. $Cu/ZnO/Al_2O_3$ Methanetellurol ($CH_3TeH$)
Finely divided Iron sulfides (FeS, $FeS_2$, $Fe_3S_4$), Potassium sulfide ($K_2S$), Aluminum phosphide (AlP)

### 4.4.2. Hazards

In general these materials are pyrophoric - they ignite spontaneously when exposed to air. They also tend to be associated with flammable solvents. Other common hazards include corrosivity, water

reactivity, peroxide formation, and toxicity.

BEFORE working with pyrophoric reagents, read the relevant Material Safety Data Sheets (MSDS) and understand the hazards. The MSDS must be reviewed before using an unfamiliar chemical and periodically as a reminder.
Set up your work in a laboratory fumehood or glove box and ALWAYS wear the appropriate protective equipment.

**Eye Protection**

• Chemical splash goggles or safety glasses must be worn whenever handling pyrophoric chemicals. Ordinary prescription glasses will NOT provide adequate protection unless they also meet this standard. When there is the potential for splashes, goggles must be worn, and when appropriate, a face shield added.
• A face shield is required any time there is a risk of explosion, large splash hazard or a highly exothermic reaction. All manipulations of pyrophoric chemicals which pose this risk should occur in a fumehood with the sash in the lowest feasible position. Portable blast shields, which provide protection to all laboratory occupants, are advisable.

**Skin Protection**

• Gloves must be worn when handling pyrophoric chemicals. Nitrile gloves should be adequate for handling small quantities of most of these in general laboratory settings but they are combustible. Heavy chemical-resistant gloves are required for working with large quantities.
• *A flame resistant lab coat must be worn.*
• A chemical-resistant apron worn over the lab coat is required for working with large quantities.
• No open toe shoes are allowed.

## 4.4.3. Designated Work Area

**Eyewash**
• Suitable facilities for quick drenching or flushing of the eyes should be within 10 seconds travel time for immediate emergency use.
**Safety Shower**
• A safety or drench shower should be available within 10 seconds travel time from where pyrophoric chemicals are used.
**Fumehood**
• Many pyrophoric chemicals release noxious or flammable gases and should be handled in a laboratory hood. In addition, some pyrophoric materials are stored under kerosene (or other flammable solvent), therefore the use of a fumehood (or glove box) is required to prevent the release of flammable vapours into the laboratory.
**Fire Extinguisher**
• A dry powder fire extinguisher must be available within 10 seconds travel time from where pyrophoric chemicals are used.
• A container of powdered lime (calcium oxide, CaO) or dry sand should be kept within arm's length when working with a pyrophoric material.
**Glove (dry) Box**
• Glove boxes are an excellent device to control pyrophoric chemicals when inert or dry atmospheres are required.

## 4.4.4. Protocols

**Handling Pyrophoric Solid Reagents**

• Pyrophoric solids are ideally used in a sealed glove box flushed with inert gas.
• Many pyrophoric solids are sold as solutions, or dispersions in mineral oil or are covered with hydrocarbon solvents to facilitate use.
• Mildly pyrophoric solids (such as lithium aluminum hydride and sodium hydride) may be handled in the air for brief periods of time, but the containers must be flushed with inert gas before storage in a desiccator.

**Transferring and Weighing Pyrophoric Solid Reagents**

• Gather all necessary experimental equipment first to avoid prolonged exposure of pyrophoric solids to air.
• Weighing alkali metals: Cut desired piece of alkali metal under packing oil using a knife. Using tweezers, transfer to adjacent flask containing toluene or heptane to rinse off oil. Use tweezers again to transfer to a weighed flask of toluene and measure weight to determine mass of metal. Use tweezers again to transfer to desired reaction flask.
• AVOID low boiling rinses such as ether and pentane that tend to condense water upon evaporation.

**Specific Recommendations for Working with Pyrophoric Solid Reagents**

• Lithium Aluminum Hydride reacts violently with water and has a significant heat of solvation. Therefore DO NOT add solvent to dry $LiAlH_4$. Instead, slowly add $LiAlH_4$ to anhydrous solvent in the reaction flask. The initial small amount of $LiAlH_4$ will react with any trace amounts of water.
• Potassium metal is considerably more reactive than lithium or sodium.
• Potassium metal oxidizes to potassium oxide ($K_2O$), potassium peroxide ($K_2O_2$), and potassium superoxide ($KO_2$). The yellow peroxides are shock-sensitive and can explode when handled or cut. Therefore dispose of potassium metal as hazardous waste if old or if significant amounts of yellow crust is visible.
• The mineral oil of potassium hydride or sodium hydride dispersions can be rinsed off using a light hydrocarbon solvent such as hexane. This is easily accomplished in a glove box or can be done in a hood **UNDER CAREFULLY CONTROLLED CONDITIONS**. Weigh out desired amount of dispersion and seal in a flask under nitrogen. Add dry hexane via syringe, swirl, and let metal hydride settle. Slowly syringe off hexane and then carefully discard into a separate flask containing isopropanol. Repeat rinse procedure.
• AVOID low boiling rinses such as ether and pentane that tend to condense water upon evaporation.
• Sodium amalgam, Na(Hg), (or potassium amalgam) is prepared by dissolving sodium into liquid mercury. This highly exothermic process produces the intermetallic compound $NaHg_2$ with enough heat to cause local boiling of the mercury. Thus it must be performed in a hood under dry nitrogen gas. The grey solid produced has the reducing potential of sodium, but is more air stable.

**Storage**

• Store pyrophoric chemicals under an inert atmosphere or under kerosene as appropriate.
• Avoid storage areas with heat/flames, oxidizers, and water sources.
• Containers carrying pyrophoric materials must be clearly labeled with the correct chemical name and hazard warning.

**Disposal of Pyrophoric Solid Reagents by Quenching**

• Small amounts of unused or unwanted pyrophoric materials must be destroyed by careful quenching of the residue. Transfer the materials to an appropriate reaction flask for hydrolysis and/or neutralization. **Dilute significantly with an unreactive solvent such as heptane or toluene and place the flask in an ice water cooling bath**. Slowly add isopropanol to quench pyrophoric materials. Upon completion, add methanol as a more reactive quenching agent to ensure completion. Finally, add water dropwise to make sure there are no pockets of reactive materials. Dispose of as hazardous waste.

• Alternatively, reactive substances can be quenched by slowly adding the dilute solution to dry ice, then adding a mildly reactive quenching agent such as methanol.
• **AVOID** low boiling diluents such as ether and pentane that tend to condense water upon evaporation.
• Do not leave containers with residues of pyrophoric materials open to the atmosphere due to uncontrolled ignition.
• When using the sodium press, ensure the attachments are all fully quenched when you are finished. This requires the removal of all traces of compressed sodium from the press and careful quenching with isopropanol.

**Disposal of Pyrophoric Solid Reagents by Submitting to Stores as hazardous Waste**

• Larger quantities of pyrophoric solid chemicals should be disposed of as hazardous waste.
• Carefully package and label the wastes.
DO NOT attempt to quench large amounts of pyrophoric solids – leave it to the professional disposal companies

## 4.4.5. Emergency Procedures

**Spill - Large**
• Exert extreme caution due to potential spontaneous combustion.
• Exert extreme caution due to potential ignition of flammable solvents or other materials.
• If anyone is exposed, or on fire, wash with copious amounts of water, ideally in the lab shower.
• Call 111 for emergency assistance.
• Evacuate the spill area.
• Post someone or mark-off the hazardous area with tape and warning signs to keep other people from entering.
• Provide emergency personnel with technical advice on the chemicals involved.
**Spill - Small**
• Exert extreme caution due to potential spontaneous combustion.
• Exert extreme caution due to potential ignition of flammable solvents or other materials.
• If anyone is exposed, or on fire, wash with copious amounts of water, ideally in the lab shower.
• Call for a coworker to provide backup.
• Place a fire extinguisher nearby.
• Carefully remove nearby flammable materials.
• Powdered lime (calcium oxide, CaO) or dry sand should be used to completely smother and cover any spill that occurs.
• Carefully quench by slow addition of isopropanol.
• After complete quench, double bag spill residues for hazardous waste pickup via stores.
• Call 111 for emergency assistance if necessary.

## 4.5 Electrical Safety Guidelines

### 4.5.1 Faults and repairs

Switch off the faulty equipment and remove it from service, or leave a warning notice if it is likely to be a hazard to other workers.

Report any faulty equipment immediately to your supervisor or to the technician in the Electronics Workshop (Room 431, Ext. 88333). Outside of normal hours and where prompt attention is needed ring Unisafe (University Security), Ext. 85000. Your concern will be relayed to Property Services who are on call. The repair or modification to any equipment in the School can only be made by personnel in the Electronics Workshop. All work involving the electrical installation of the buildings, i.e. fittings, fixed wiring, switchboards, etc., must be carried out by Property Services staff.
Requisitions for such installations must be made through the technician from the Electronics Workshop.

### 4.5.2 Safe Working Practices

Before using any electrical equipment make sure it has an "electrical warrant of fitness" sticker indicating it has been electrically checked and the date. If the equipment has no sticker, do not use it until it has been checked by the registered electrical service technicians. Do not use electrical equipment that has frayed or exposed leads or faulty or damaged plugs – get it repaired immediately. In turn, protect electrical leads from mechanical, chemical, or heat damage.

Do not interfere with or alter the fixed electrical supply to an office, laboratory or workshop. This includes the opening of fuse boxes. Do not open covers on any equipment that leaves potentially "live" circuits exposed. Some equipment produce heat as a function of their operation – keep clothes, paper and other flammable materials well clear of heaters and such equipment. Also keep all objects and dust away from air vents required by equipment for cooling to reduce the risk of fire. Liquid spillages should be immediately removed as these can cause electrical short circuits that may lead to metal cases becoming "live" or to fire.

Turn off and preferably unplug all electrical apparatus that is not in use. Any electrical equipment left operating and unattended should have the control switch clearly marked and instructions for switching off in the case of emergency posted in a prominent position.

Any electrical equipment (heating or motional) that may require its power to be removed quickly in the event of any problems occurring with its use should have its power connection wall switch kept clear of obstructions.

When an item of equipment is situated at a distance from a power point, the electrical lead should not run along the floor. If necessary, place hooks along the wall to raise the lead above the floor. When power boxes are used that enable a number of appliances to be run from one power outlet, care must be taken to ensure that the circuit is not overloaded. Where possible, use power boxes with circuit breakers attached. However it is better to request more permanent power outlets.

Do not attempt construction of electrical equipment or carry out alterations or repairs to it.

Display warning notices in places where specific dangers are present – high voltage, high power transmitters, lasers, unearthed equipment, etc.

Three–phase outlets must on no account be used for single–phase equipment.

**Equipment inspection** – All electrical equipment and apparatus should be regularly inspected by qualified personnel for safety.

**Equipment fuse replacement** – Unplug equipment from the mains before replacing blown fuses in equipment. Ensure that the replacement fuse cartridge is of the correct physical size and electrical rating. It is best to consult technical staff to find the cause for the blown fuse before replacement. Always consult if in doubt.

**Imported equipment** – Equipment made outside New Zealand may have wire colours and voltage settings that are different from NZ standards. It is advisable to have new imported apparatus checked by an electrically certified technician.

### 4.5.3 Heat Gun Safety

Electric heat guns are a potential fire hazard if used and/or stored incorrectly. All heat guns should be stored in a holster, these have been installed at fume hoods throughout the School. Due to the fact that

electric heat guns also have the tendancy to switch off automatically due to inbuilt thermal cut-out switches it should never be assumed a heat gun is not working. When not in use heat guns should be disconnected from the power to by either turning off the power at the wall switch, switching off the power to the entire fume hood (with the power/services on/off button) or by unplugging the heat gun.

### 4.5.6 High Pressure Reaction Vessels

The following checklist MUST be completed before any reactions are carried out in a pressurized reaction vessel

| **Chemical Reactions conducted in Pressurised Vessels** | | | |
|---|---|---|---|
| **Specific Controls and Checks** | **Y/N** | **Location** | **Identified Hazard/Fault/Comments** |
| Has the pressure vessel been designed for the purpose? | | | |
| Has the vessel manufacturer provided technical data and operating procedures for the equipment? | | | |
| Has a maintenance schedule been provided by the manufacturer? | | | |
| Does the equipment require a log book? | | | |
| Has the equipment been modified in any way that may affect its performance? | | | |
| If the equipment was fabricated on site, are sufficient checks in place regarding its suitability? | | | |
| Can new users readily access operating procedures and training for the equipment? | | | |
| Is the immediate environment suitable and safe for the experiment eg: is a fume hood or blast shield required? | | | |
| Does the equipment require annual certification eg: an autoclave? | | | |
| | | | |

## 4.6 Field Work Safety Guidelines

**Approval of Field Activities** – The Head of School is to approve the field activity and must ensure that adequate consideration is given to aspects of health and safety. The responsibility for safe conduct of the activity rests with the designated supervisor.

**Supervisor** – is generally the academic staff member teaching the course but may be any person who has the authority to influence or direct the actions of students, employees or others involved in the activity. In general there should be a ratio of 1 supervisor/leader per 20 participants. The supervisor is responsible for ensuring the party is complete at the end of fieldwork.

**Emergencies** – organisers of field activities must have strategies for dealing with emergencies.
Important refer to Faculty Field guidelines

## 4.7 Common Laboratory Hazards

- Eye damage by splashes of chemicals or by flying glass.
- Heat burns and scalds.
- Chemical burns to the skin and absorption of toxic chemicals through the skin.
- Swallowing toxic chemicals.
- Cuts from broken glassware.
- Inhaling toxic gases.
- Electric shock from faulty equipment.
- Fire from flammable materials, especially solvents.

### 4.7.1 Common Sense and Good Housekeeping

Entry to laboratories is restricted to appropriate students and members of staff. Students in laboratories must be under the direct supervision, guidance or authority of appropriate staff. Smoking, eating or drinking is not permitted. No food is to be stored in laboratories, including cold rooms, refrigerators and freezers.

Good condition footwear must be worn at all times. The wearing of sandals, jandals, and open type footwear in laboratories is forbidden. Long hair should be securely fastened at the back of the head. Eye protection MUST be worn at all times in laboratories. Use appropriate protective clothing, gloves, safety screens and fume hoods as necessary. Cuts and abrasions must be covered. Laboratory coats or gowns are to be worn and must be removed on leaving the laboratory. Personal music equipment such as Ipods, Walkmans, MP3 players should not be used whilst in the laboratory or whilst transporting chemicals or equipment around the building. They reduce the users awareness of hazards, incidents, alarms and other people in a laboratory and therefore reduce safety. Care must be taken that contaminated gloves do not contaminate furniture, phones, door handles etc., and are disposed of in the proper solid waste bins – never in ordinary rubbish bins. Hands should be washed after completing each task and always before leaving the laboratory.

General good housekeeping rules apply at all times:

- Maintain clear working spaces, keeping aisles free of obstacles.
- Avoid creating trip hazards with cords, cables, hoses etc.
- Store items correctly in their correct place so that they do not topple or fall.
- Do not leave cupboard doors and drawers open.
- Promptly clean up all spills. (Beware, some may require specialist techniques.)
- Remove from service and report all faulty or damaged equipment.
- Treat naked flames with care and do not leave bunsen burners and torches unattended with the flames burning.
- Turn off equipment on completion of the day's work.
- Dispose of wastes in the correct containers.

No experiment may be commenced without firstly assessing the hazards of all materials involved and the risks associated with the experimental procedures. All experiments require the consent of a member of the academic staff. The assessment should include the hazards (toxicity, flammability, mutagenicity/carcinogenicity, etc.) of all materials involved (including solvents, compressed gases and cryogenic liquids), the risks associated with the experimental procedures (vacuum pressure, radiation, etc) and an indication of how waste materials are to be disposed.

Be aware of the location of the fire extinguishers, safety shower, the location of emergency exits and the evacuation procedure for the building. Never pipette by mouth. Do not place pens or pencils in the mouth. Wastes are to be properly disposed of.

Water–cooled systems should only be connected to the low–pressure water system. Tubing attached to a tap must be securely clamped. The drain line must be firmly held in position. Note that at night the water pressure increases considerably. It is preferable that the drain line be weighted or tied down. If cooling water is not required overnight, then turn it off before you leave.

If a hazardous experiment or equipment needs to be left on overnight in research labs the experiment or equipment in use should be clearly labelled beside the equipment. Information such as chemicals involved, incompatible procedures (ie No water to be used if on fire etc), and any important safety information should be clearly stated. It is advisable that the laboratory manager be informed for particularly hazardous experiments.

Electrical equipment like ovens, water baths, stirrers, etc not required for immediate use should be switched off.

Report all accidents including minor cuts and grazes. University of Auckland Accident / Incident Report form and the Accident / Incident Investigation Form must both be completed and handed to the School Manager as soon as possible after the incident. These forms are required as part of our measures to reduce accidents in the workplace. The information contained on the forms will also be used to improve the School's safety practices.

### 4.7.2 Handling Glass

All but elementary operations on glass are to be done by trained personnel. For advice, talk to the School of Chemical Sciences Glassblowers Alistair Mead and Mike Wadsworth (Bldg 312 Rm 172 Ext. 87508).

- Carry lengths of glass tubing vertically.
- Use a piece of protective material round the hand when snapping glass at a previously made scratch.
- Smooth off cut glass ends with heat, a file or emery paper.
- Use the correct methods for inserting glass tubing into a rubber bug, bending glass, or cutting glass.
- Inspect new glassware for cracks or other flaws before use.
- All glassware subject to vacuum conditions must be of the correct design and manufacture, it should be periodically checked for strain and damage, and all such glassware drawn "new" from store should be similarly checked before use. Strain checks and annealing, if required, can be carried out by the School of Chemical Sciences Glassblowers.
- All flasks containing gases must have a metal disc wired onto the flask identifying their contents.
- Do not recycle or leave lying around broken or cracked items of glassware.
- Glassware can be disposed of by rinsing and then placing in "Glass Only" waste bins marked as such.

All dirty glassware should be rinsed free of harmful chemicals before being set aside for cleaning. Consider using KOH/ethanol as a means of cleaning glassware rather than Chromic Acid (which is hazardous and difficult to dispose of properly).

### 4.7.3 First Aid

**Chemical burns -** Diphoterine® is an external rinse solution for the skin and eyes that has been shown to be very effective against a variety of chemical burns. Diphoterine® aerosols are distributed throughout the laboratory areas in the School. Diphoterine® is effective for use in eyes, as well as on the skin.

If anyone is burnt by a chemical, apply Diphoterine® to the affected area immediately and keep the area irrigated for 30 minutes. Diphoterine® is effective on burns caused by acid, base or any corrosive compound. There is no need to first irrigate the area with water, use the Diphoterine® immediately.

Diphoterine® is effective against all chemical burns but **NOT** hydrofluoric acid (HF). Please **DO NOT** substitute the use of calcium gluconate with this product. It is important to note that Diphoterine® shows **no benefit** over standard treatments on thermal burns or cold burns (dry ice, liquid $N_2$).

If Diphoterine® is not available, irrigate the area with water for 30 minutes.

**Foreign matter in the eye** – Irrigate with a full cup of water, or preferably 1% sterile saline eyewash. If the object will not wash out, pad the eye and see a doctor.

**Minor burns and scalds** – keep under cold water for 20 – 25 minutes. Do not apply any creams or dressings.

**Major burns** – these are indicated by a waxy appearance of the skin and, in contrast to minor burns, NO PAIN. Keep under cold water for at least 25 minutes. Do not apply any creams or dressings. Seek medical advice as soon as possible.

**Electric shock** – SWITCH OFF THE POWER and remove the plug BEFORE touching the victim. Apply resuscitation if necessary.

refer to http://www.stjohn.org.nz/tips/

### 4.7.4 Centrifuges

- Operators must receive adequate training in the correct use of centrifuges, especially in the necessity for cleanliness, precise rotor balancing and correct use of centrifuge tubes.
- Centrifuges should be turned off immediately if there is any vibration. This should be then reported to the laboratory supervisor.
- Excessive speed relative to the mass being centrifuged is hazardous. Never operate above the maximum safe speed. Refer to the manufacturers specifications for each rotor
- Maintenance of the centrifuge is important.
- High speed centrifuge Rotors are expensive and should be meticulously cleaned to prevent corrosion, carefully handled and stored correctly (always refer to the manufacturers handbook)

### 4.7.5 Guidelines for Safe Use of Chemical Syringes

Syringes are used in research labs for multiple tasks including injection of gases or liquids into chromatographs, chemical apparatus or reactions. Syringes can range from precision microsyringes to inexpensive disposable units. Needle-stick injuries remain a significant hazard during syringe use, but is not the subject of this guideline. This guideline addresses proper syringe use and chemical handling to prevent eye and face injury due to syringe spray-back.
Syringe spray-back accidents typically occur when the syringe or injection needle become plugged or if the needle is not properly attached to the syringe. If possible always use a luer-lock syringe to prevent separation of needle and syringe during use. If the syringe becomes plugged, do not push the plunger harder. High pressures inside the syringe can cause the plunger seal to fail or the barrel to crack spraying out liquid. The following steps are recommended for safe syringe use.

1. Use only new disposable syringes or cleaned re-usable syringes.
2. Examine all syringes for evidence of physical damage before use.
3. Check the plunger for ease of motion before drawing up liquids or gas.
4. Check again for free plunger movement after installing needles or tubing.
5. Syringes with frozen plungers or plugged needles should be removed from service.
6. Clean re-usable syringe after each use.
7. Special wash solvents, detergents, and brushes may be needed for cleaning. Use a squeeze bottle to force cleaning liquid through syringe.
8. Always wear eye protection or a face shield when cleaning syringes and handling chemicals in a lab.

9. For stubborn stains or contamination ultrasonic cleaning in an appropriate solution may be effective.
10. After cleaning, the syringe plunger should be removed for drying and all seals checked. Syringe bodies should also be dried using compressed air.
11. Reassemble the syringe and plunger for storage.
12. Avoid using lubricants on plungers unless required by the manufacturer.
13. Plugged needles usually occur from coring rubber septa. These can usually be cleared with fine wires that come with the needle. If not replace the needle.
14. Some syringes are temperature sensitive and rapid heating or cooling should be avoided. Check with the manufacturer for maximum and minimum use temperatures
15. Ensure that the needle hub is engaged with the luer-lock mechanism. You may need to use a small pliers to make sure the hub is rotated into the luer-lock. If using a slip connection ensure it is fully seated by pushing on with a twist.
16. Take steps to secure the plunger when drawing a sample or injecting material into a high pressure system thereby preventing plunger blowout and chemical release.

## 4.8 Laser Safety Guidelines

Supervision should be provided until an employee can demonstrate competence and an understanding of operating procedures involving lasers, and a record of training should be maintained.
Full requirements are detailed at

Lasers Policy

Lasers Safety guideline

## 4.9 Manual Handling Safety Guidelines (Safe Lifting)

In general, any difficulty in lifting or moving an object by yourself indicates that your technique is incorrect and that assistance is required.
Comprehensive details can be found at:

Manual Handling

OSH training manual

## 4.10 UV Light Safety Guidelines

The biological effects of exposure to UV radiation are dependent on the wavelength of the radiation. As the penetration of UV radiation is small, the effects are limited to the eyes and skin. The principle effect of excessive exposure is kerato–conjunctivitis which is more commonly known as "snow–blindness". The symptoms are similar to that resulting from grit in the eyes and an aversion to bright light. The cornea and conjunctiva show inflammation.

When using UV irradiation to examine TLC plates take care not to expose the eyes to direct light or any reflection of it. Wear full-face masks provided which absorb UV light.

Other sources of UV light to be aware of are the special bulbs used in spectrophotometers, fluorometers and electrical arcs. The hazard from ozone generated by UV lights can be minimised by ensuring that there is adequate ventilation.

UV Light

## 4.11 Workshop Safety Guidelines

Machines or tools in a workshop may only be used under the direct supervision, guidance or authority

of the University's technical staff. A minimum of 2 people must be in a workshop when operating heavy machinery. Personal safety equipment to protect sight, hearing, breathing, and hands is provided and must be worn when appropriate. Safety footwear must be worn at all times. Long hair and loose clothing that may be caught in machinery must be secured.

Safety devices on workshop machinery must not be removed or altered except under the direct supervision of the technical staff. Ensure that all safety equipment is in position before using machinery. If equipment becomes defective during operation, the machine must be shut down and reported. When changing tools the machine must always be stationary and isolated electrically.

Avoid as far as possible skin contact with oils and solvents etc. Make use of the disposable wipes, clean rags, barrier and cleansing creams provided. Solvents should not be used to remove oil from the hands as these can cause dermatitis.

Maintain workshops in a clean and tidy condition and all workshop users should assist by replacing tools and equipment immediately after use and removing swarf and filings etc. as soon as possible. The only material on the bench should be the item being worked on and the required tools. Tools are not to be „stored" on machine beds while the machine is running. Nothing should be stored on the floor where a tripping hazard may be created and any spillages must be cleaned up immediately.

Report all breakages on tools and machinery, faulty wiring, worn or defective equipment and unsatisfactory storage arrangements.

Ensure a safety chain or bar is in place on vertical racks. Store material in horizontal racks so that accidental contact with protruding ends of rods and sharp corners of sheet materials is minimised.

Keep cables off the floors as far as possible and certainly out of circulation areas. Disconnect portable appliances when not in use. Plugs should not be withdrawn by pulling the cable. Machinery should be switched off when not in use. Never use compressed air for blowing dust or swarf off clothing, skin, or machinery. Wrongly used compressed air can cause embolism, blindness or deafness to personnel and damage nearby machinery.

Ensure that local and specialist extraction facilities, where installed on some types of machinery, is satisfactorily maintained to prevent a build up of contaminant in the workshop atmosphere. This applies particularly to carbon turning and woodworking machinery extract and ventilation systems.

## 4.12 X-Ray Safety Guidelines

For questions and/or issues regarding the use of X-ray facilities in the School of Chemical Sciences, the following people should be contacted:

- X-ray diffractometer: Dr Tilo Soehnel ext: 89722
- $^{60}$Co source: Associate Professor Bob Anderson (Room 529A, Ext. 88315 or 85888).

Also refer to Xray safety

# SCHOOL OF CHEMICAL SCIENCES

## Emergency Telephone Numbers

| | |
|---|---|
| Fire, Ambulance, Police | 1-111 |
| Doctor (Student Health) | Ext. 87681 |
| Campus Security (UniSafe) | Ext. 85000 |
| Poisons Centre (Dunedin) | 0800 764-766 (0800 POISON) |

## University of Auckland Hazards and Containment manager:

## University of Auckland Health, Safety and Wellbeing manager (Science):

Howard Fox Ext: 88872 Location: 620-410

## School of Chemical Sciences Safety Committee 2021

| Name | Position | Room | Email | Ext |
|---|---|---|---|---|
| A/Prof Gordon Miskelly | HoS and Chair of Safety Committee | 302-627 | g.miskelly@auckland.ac.nz | 81178 |
| Dr Dan Furkert | Academic Coordinator | 301-729A | d.furkert@auckland.ac.nz | 87478 |
| Mike Wadsworth | Technical Manager | 302-949 | m.wadsworth@auckland.ac.nz | 87399 |
| A/Prof Geoff Waterhouse | Academic Rep | 302-963 | g.waterhouse@auckland.ac.nz | 87212 |
| Dr Lisa Pilkington | Academic Rep | 301-527A | lisa.pilkington@auckland.ac.nz | 86776 |
| Dr David Ware | Academic Rep | 302-1049 | d.ware@auckland.ac.nz | 88270 |
| Dr Kang Huang | Academic Rep | 302-873 | kang.huang@auckland.ac.nz | 88091 |
| Dr Jianyong Jin | Academic Rep Newmarket | 903-227 | j.jin@auckland.ac.nz | 86624 |
| Tasdeeq Mohammed | HSNO Officer | 302-B10 | t.mohammed@auckland.ac.nz | 87505 |
| Radesh Singh | Technical Rep | 302-1057 | radesh.singh@auckland.ac.nz | 84750 |
| Aljo Anand | Student Rep | 302-831 | aana902@aucklanduni.ac.nz | n/a |

***In Building 301 on each of the 5th, 6th and 7th research floors First Aid cabinets are housed in the main corridor.***

***In Building 302, 303, 902, and Waiheke First Aid cabinets are held in the laboratories.***

## Current lists of First Aid providers are displayed:

1. Near each First Aid kit (See cabinet on each of the Research Floors)
2. Near lifts at each floor level

# SCHOOL OF CHEMICAL SCIENCES
## Safety Guidelines Acknowledgement Form

I have received and read a copy of the "Safety Guidelines" handbook for the School of Chemical Sciences, University of Auckland, and accept responsibility for obeying the safety rules therein and exercising good judgment in following the codes of practice.

| **For the work space where I ordinarily will be, the location of the nearest ….. is:** | |
|---|---|
| Telephone | |
| Fire Alarm | |
| Fire Exit | |
| Hose Reels and fire extinguishers | |
| First Aid box and list | |
| Sand bucket and spill kits | |
| Emergency shower and eye wash | |
| Defibrillator | |

| **As a lab user I understand and will perform the following tasks as required:** | **Tick** |
|---|---|
| · **Conduct a Take Five Safety Assessment** for new and repeat experiments and place the check box label and any relevant comments in my lab book. | |
| · **Use the Unattended/overnight experiments Form** ensuring all details are updated. | |
| · I will have relevant **MSDS and SMOU safety information accessible**. | |
| · **Will adhere to the Universities Access Policy**, having a signed approval form for After Hours work. | |
| · **Safely dispose of chemicals I will be using**, paying particularly attention to chemicals prohibited in the sewer system via sinks or fume hood drains | |
| · **Report accidents and incidents and near misses** within a reasonable time frame. | |
| · If an incident involves serious harm or damage to property after attending to the needs of people, **I will leave the scene of the incident untouched**. | |
| · If the **Lab/Floor/Building is evacuated through an incident where I or my experiment was involved, I will be available to answer questions** (for building 301 and 302 evacuation meet at Symonds Street entrance). | |

| **I have read the information above and will abide by requirements of the School of Chemical Sciences Health and Safety Guidelines** | | |
|---|---|---|
| Name (Block Capitals) | My Signature and date: | |
| My usual Lab location: | Access Card Number | UOA ID Number |
| My usual desk/office location: | | |
| My status in the School (e.g. Masters student/Academic staff/Visiting Lecturer/Intern) | My Degree | |
| Supervisor/ Host Name/Line Manager | Supervisor Signature and date: | |

Please complete and scan this form together with the Access to Facilities Individual Approval form (below) back to fos.accessrequest@auckland.ac.nz including "Safety Forms" and your name in the subject line.

# SCHOOL OF CHEMICAL SCIENCES
# ACCESS TO UNIVERSITY FACILITIES INDIVIDUAL APPROVAL FORM **Please note that when communicated to you this Approval and the conditions in it become a Rule as defined in the University Disciplinary Statute 1998.**

| | | |
|---|---|---|
| | Buildings | Any building that the School uses on a temporary or permanent basis: City 301, 302, 303, Grafton 529, Newmarket 902<br>**Excludes Waiheke: specific guidelines to be followed** |
| | Approval Timeframe | 01/04/2021 to 31/03/2022 |
| | University Normal Operating Hours | 7.30 am – 7 pm Monday to Friday.<br>**Excludes weekends, statutory/public holidays, and University closure days** |
| | School of Chemical Sciences Normal Working Hours | 8 am – 6 pm Monday to Friday.<br>**Excludes weekends, statutory/public holidays, and University closure days** |
| **Requires this form signed and compliance as below.**<br>**Details on Low Risk work included in the School Safety Guidelines.** | **After Hours** period when only **"Low to High Risk"** work can be undertaken. | 6 pm to 10 pm Monday to Friday<br>8 am to 10 pm Weekends and statutory/public holidays<br>**Excludes University closure days** |
| | **After Hours** period when only **"Low Risk" work** can be undertaken. | 6 am to 8 am Monday to Sunday and statutory/ public holidays<br>10 pm to 12 am midnight Monday to Sunday and statutory/public holidays<br>**Excludes University closure days** |
| **Requires special approval. See School Manager.** | **Total Closure**<br>You are **not allowed in the building** during these times. | 12.00 am to 6.00 am every day<br>Full 24 hours of **all** University closure days.<br>**Includes End of Year closure period.** |

To maximise access to First Aid, Emergency and Security services, whenever possible your work should be conducted during the **School of Chemical Sciences Normal Working Hours**.

**Approval for work to be conducted in the After Hours periods requires the holding of a signed copy of this form and that the following procedures are followed** (see School of Chemical Sciences Safety Guidelines for full details):

- ✓ You have attended an annual School of Chemical Sciences Safety Seminar (or Annual Safety Refresher for Staff) and completed the Safety Guidelines Acknowledgement Form
- ✓ You have obtained training for any potentially hazardous operations that are specific to your laboratory and/or research and are not covered in the Chemistry Safety Seminar
- ✓ School of Chemical Sciences **Working After Hours Guidelines** must be adhered to
- ✓ School of Chemical Sciences **Take 5** assessments must be undertaken

During **After Hours** periods: (i) You will use your access card and have it and your University ID available on your person at all times. (ii) You will take care to be safe entering and leaving the building and avoid personal hazards. (iii) You will also ensure you are able to communicate with Security/UniSafe in an emergency and that you are familiar with fire safety exits and procedures.

| **I have read the information stated above and will abide by The University of Auckland Policy on Access to University Facilities** | | | | |
|---|---|---|---|---|
| **Name** | **ID Number** | **Access Card Number** | **Signature** | **Date** |
| **Supervisor/Line Manager Signature:** | | Please complete and scan this form and the Safety Guidelines Acknowledgement form back to fos.accessrequest@auckland.ac.nz including "Safety Forms" and your name in the subject line. | | |

**Note that an individual's approval for working outside of Normal Operating Hours can be withdrawn at any time by the Head of School.**