nzaid

Manaaki Whenua
Landcare Research

South Pacific Agricultural Chemistry Laboratory Network (SPACNET)

Generic Laboratory Safety Manual

(Needs to be customised for an individual laboratory)

compiled by

Linda Hill & Brian Daly

Landcare Research New Zealand Limited

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INTRODUCTION

Laboratories are inherently dangerous places. It is important that everyone in a laboratory, whether working there or not, is aware of the possible dangers. This manual contains rules, procedures and guidelines for creating a safe working environment in the laboratory. More detailed instructions regarding specific methods and procedures can be found in the Methods and Procedures Manuals, which should be consulted before beginning any new work. There is no substitute for common sense however, so a conscious effort to work safely and avoid carelessness is required. If in doubt about any aspects of laboratory work ask the Laboratory Manager before proceeding.

Although the information in this manual is specific to activities within the XYZ Laboratory, many of the details are applicable to other chemistry laboratories. In the interests of safety, please feel free to copy and use or pass on this information.

1 EMERGENCY NUMBERS

EMERGENCY SERVICES

Dial 1 - obtain dial tone
Dial 111 - state service required
(Fire, Ambulance or Police)

XYZ Laboratory emergency contacts and telephone numbers:

	Extension	After hours
Laboratory Manager:		
Laboratory Safety Officer:		
Laboratory Warden:		
Building Warden:		
Building Services:		
Building Security:		

2 SAFETY AND RESPONSIBILITY

The XYZ Laboratory is committed to protecting its employees and property from accidental injury or damage and ensuring that all staff work in a safe and healthy environment.

In accordance with the New Zealand Health and Safety in Employment Act 1992, the laboratory has implemented a hazard management system whereby hazards are identified and eliminated. Where this is not possible the hazard is isolated or the risk minimised.

Hazard identification is primarily via a monthly audit by a laboratory staff member (see Appendix 1) but is an ongoing process, and all employees are encouraged to report any new hazards promptly so that they can be dealt with. An annual safety audit is conducted by someone independent of the laboratory, using the checklist in Appendix 2 as a guide.

2.1 NEW STAFF

All new staff, not just those working in the laboratory, will be given explanations of the following as part of their induction procedure:

- Employee responsibilities for safety (their own and that of others)
- Health and Safety Manual
- On-the-job instruction in safety procedures including:
  - Hazards they may be exposed to
  - Hazards that they create which may harm others
  - Hazard control through safe operating procedures
  - OOS prevention
  - Field safety
- Hazard reporting
- Provision and use of safety equipment and clothing
- First Aid
  - Location of first aid kits
  - First aid officers available
  - First aid training
- Accident/Incident reporting procedure
- Emergency procedures
  - Fire safety, including use of fire extinguishers and hose reels
  - Evacuation plan, including assembly point, exits
  - Other emergencies, including earthquake, hazardous spills

In addition, new staff that will be working in the laboratory will be introduced to the Laboratory Manager who will provide more detailed safety guidelines related to hazards specific to the laboratory. They will be asked to sign a register stating that they have read and understood this safety manual and will comply with all instructions within.

2.2 PERSONAL RESPONSIBILITY

Under the New Zealand Health and Safety in Employment Act 1992, employees have a responsibility to work in such a manner that they do not endanger themselves **or** anyone else. It is your responsibility to ascertain any hazards involved with your work and take the appropriate precautions. Any new hazards you identify should be reported promptly to the Laboratory Manager. Any accidents or near misses must be reported as described in section

2.3 RESPONSIBILITY TO CLEANERS AND SERVICE PERSONNEL

Cleaners and service personnel cannot be expected to appreciate the specific dangers of a laboratory. The following guidelines apply:

- Equipment, bottles and chemicals must not be left in a position where cleaners may accidentally knock them
- Hazardous waste, including broken glass, must not be put in waste bins that are emptied by cleaners
- Do not leave experiments in progress unattended unless they can be visibly isolated from cleaners
- Where service personnel are working the surrounding area must be cleared so they can work safely
- The possibility of ignition of flammable vapours during welding, cutting or heating operations should be eliminated.

2.4 RESPONSIBILITY TO VISITORS

All visitors must be signed in at Reception and issued with a Visitor pass tag, and a laboratory staff member must take responsibility for their presence. This includes any external service personnel.

Access to the laboratory is restricted to essential personnel only. Visitors must be warned of any hazards relating to work in progress, and should be accompanied at all times. Casual visits to the laboratory area by other staff are discouraged.

3 EMERGENCY PROCEDURES

3.1 GENERAL

Familiarise yourself with the type and location of fire alarms and fire fighting equipment in the laboratory area. Training sessions in the use of fire extinguishers are held regularly and all laboratory staff are expected to attend.

Corridors, fire alarms, fire fighting equipment, emergency showers, eye wash stations and stairways must be kept free of obstructions at all times. Smoke stop doors must not be wedged open.

A warden system is used whereby trained wardens will check designated areas in the event of an alarm to ensure all staff have evacuated. Their instructions must be followed.

Training is given in the use of emergency showers and eye wash stations in the laboratory. Familiarise yourself with their location and operation regularly.

3.2 IF AN ALARM SOUNDS

- Turn off any hot plates, flames and gas cylinders that may be on.
- If time permits and you are not in immediate apparent danger, shut doors and windows.
- Shut smoke stop doors as you leave your area.
- Do not go back to your office or work area to get your things.
- Leave the building quickly but don't run.
- Don't use the lift.
- Assemble in the agreed assembly area.

3.3 FIRE

If safe to do so, attack the fire with the nearest suitable equipment:

- If the fire is in a container, such as a beaker or waste bin, try to smother it by covering the container with a tray or damp cloth.
- If this does not succeed or if the fire is not in a container use a hose reel or extinguisher, making sure that it is suitable for the material burning i.e. water for wood, paper or textiles, and dry powder or CO2 for flammable liquids and electrical fires.

If you cannot control the fire within 60 seconds:

- Activate the nearest fire alarm.
- Call the Fire Service on 1-111 to confirm the emergency.
- Alert the people in the work area.
- Leave the building.

3.4 EARTHQUAKE

Countries in the South Pacific experience frequent earthquakes of varying degrees. Minimise the effects by securing tall or heavy objects such as gas cylinders, and by not storing heavy or sharp items on high shelves where they may fall on people. When an earthquake occurs get under a desk or in a doorway until the shaking stops, then:

- Check for any fires
- Check for electrical and gas hazards
- Turn off gas and electrical equipment
- Assist any injured people near you
- Do not go outside unless the building alarm sounds
- Wait for instructions from your wardens.

3.5 GAS LEAKS AND CHEMICAL SPILLS

If the spill/leak is major, activate the building alarm and evacuate immediately. Report the details outside to the Building Warden and Laboratory Manager who can then liase with the Emergency Services as to how to proceed. Prompt action is important to ensure that there is minimal effect on persons or the environment. For smaller spills contact the laboratory manager, who will ascertain the degree of danger, order evacuation of an area as necessary, and oversee the dispersal of fumes or spill clean up.

3.6 TERRORIST THREAT

Terrorists do not give warnings – their aim is to cause death and destruction or, at the least, disruption and fear. All threats however must be treated as genuine until proven otherwise. Recognising what belongs in an area and what doesn't is a major factor in deciding what is suspicious. Encourage all staff to be tidy, make regular checks of their work areas and report 'foreign' objects such as suitcases, parcels, vehicles etc. If a threat is received:

- Stay calm
- Get as much information as possible
- Contact the Building Security Officer, who will probably evacuate the building immediately.

If you are aware that an evacuation is due to a bomb threat, try to leave doors and windows slightly open. Assemble well away from the building.

4 FIRST AID

Unless the accident or injury is obviously minor then professional help should be sought. This is normally the casualty's own doctor. For serious injury the ambulance service should be called by dialling 1-111.

There are a number of staff members with First-Aid certificates, and this is indicated on the site telephone list. Lab staff are all encouraged to obtain First-Aid certificates and keep them current.

Sometimes assistance needs to be given immediately while awaiting qualified help. The most important general points to observe are:

- Stay calm
- Check the scene for your own safety first; you want to avoid becoming a similar casualty
- Try to find out what has happened and what is wrong with the casualty
- Apply basic first aid as described below.

4.1 BLEEDING

- Apply direct pressure to control bleeding by pressing with your fingers over a dressing pad or wad of clean material.
- Raise or support the part if the wound is on a limb.
- Place a sterile or clean dressing and padding over the wound and secure with a bandage.

4.2 BURNS

- Hold the affected part under slowly running cold water or immerse it in cold water for at least 10 minutes.
- Gently remove any rings, watches, belts or constricting clothing from the affected area before swelling begins.
- Dress the area with a clean, preferably sterile, non-stick, non-fluffy material.
- Do not apply any cream or ointment.

4.3 CHEMICAL SPLASHES IN THE EYE

- Flood eye with gently running water, such as from an eye wash station, for 10 to 20 minutes.
- Lightly dress the eye with a sterile eye pad or pad of clean, non-fluffy material.

4.4 CHEMICAL SPLASHES TO THE SKIN

- Flood the splashed surface with large quantities of running water. If the splash is large use the emergency shower station. Continue for at least 10 minutes.
- Remove any clothing that may be trapping the chemical against the skin.
- Dress the area with a clean, preferably sterile, non-stick, non-fluffy material.

4.5 ELECTRIC SHOCK

- Switch off the power. If this is not possible, stand on some dry insulating material such as a wooden box or rubber mat, and by means of a broom or such, remove the casualty away from the contact.
- If casualty is unconscious commence the ABC of resuscitation.

4.6 FOREIGN BODY IN THE EYE

- Use your finger and thumb to separate the eyelids. If you can see the foreign body try to wash it out with water, tilting the head so the water drains away from the good eye.
- If this is unsuccessful and the foreign body is not sticking to the eye try to lift it off using the moistened corner of a clean swab or handkerchief.
- If the foreign body is embedded, do not try to remove it. Cover both eyes to prevent unnecessary movement and seek medical aid.

4.7 FRACTURES

- Unless the casualty's life is in danger do not attempt to move them or apply splints.
- Remain with them and provide comfort until trained help arrives.

4.8 GAS INHALATION

- Only if you can do so with being affected yourself, open any doors and drag the casualty to safety.
- If casualty is unconscious commence the ABC of resuscitation.

4.9 INGESTION OF CHEMICALS

- Never attempt to induce vomiting - it is ineffective and may worsen the situation.
- If the casualty is conscious dilute the poison by getting them to drink some water.
- Place them in the recovery position even if not unconscious, as they may vomit.
- Send any samples of vomit or bottles of the poison with the casualty to aid treatment.

4.10 THE STEPS OF CPR

Cardiopulmonary resuscitation (CPR) is comprised of three steps, known as ABC.

A Airway

- Determine unresponsiveness by shaking and shouting.
- Call for help
- Position the casualty on back.
- Open the airway using the head tilt/chin lift.

B Breathing

- Look, listen and feel for breathing.
- If absent, begin rescue breathing by giving two full breaths.
- If unsuccessful, reposition the head and try again.
- If still unsuccessful, perform the airway obstruction procedure.

C Circulation

- Check for pulse.
- If present, continue rescue breathing at 12 times per minute.
- If absent, begin external chest compressions as follows:
  - Locate proper hand position.
  - Perform 15 compressions at a rate of 80 - 100 per minute.
  - Open airway and give two breaths.
  - Locate proper hand position again and give 15 more compressions at the same rate.
  - Continue sequence until four complete cycles of 15 compressions and 2 ventilations are completed.
  - Re-assess the casualty. Check the pulse.
  - If pulse absent, resume CPR.
  - If pulse present, check breathing.
  - If breathing present, monitor breathing and pulse.
  - If breathing absent, perform rescue breathing at 12 times per minute and monitor pulse.
  - Continue CPR until either breathing and pulse start again or advanced help arrives and takes over.

5 GENERAL SAFETY RULES

- No food, drink or smoking in the laboratory.
- Appropriate footwear must be worn - no jandals. Note that shoes with lace holes (track shoes in particular) can be very dangerous when working with acids as a small spill can seep in and cause damage before being noticed.
- Laboratory coats must be worn when working in the laboratory. Additional protective equipment such as safety glasses and gloves must be used whenever working with hazardous chemicals or equipment.
- No pipetting by mouth. Pipette fillers are available and must always be used.
- Do not use any equipment unless you have been shown how to use it.
- Before using any chemical for the first time read its MSDS sheet, taking particular note of hazardous properties and protective equipment required.
- The use of isotopes is restricted to the Tracer Lab.
- Working alone in the laboratory is discouraged. If it is necessary then the procedure outlined in section 7 must be followed.
- Wash hands before leaving the laboratory.

6 GOOD LABORATORY PRACTICE

General laboratory practice and housekeeping is to be of a high standard at all time, paying attention to the following:

- Personal items such as coats and bags are to be kept in offices, not the laboratory.
- Floors, shelves and benches are to be kept clear of materials such as boxes, samples, equipment and chemicals not in use.
- Water on the floor must be mopped up immediately.
- All spills must be cleaned up promptly and appropriately. Refer to the MSDS for advice on how to deal with chemical spills.
- Dispose of chemical wastes as specified in the Methods or Procedures Manual or MSDS sheet. Use plenty of running water for sink disposal, and leave the fume cupboard running if evaporating solvent waste.
- Do not place hazardous waste in bins emptied by cleaners.
- Syringe needles and scalpel blades must be disposed of in a proper "sharps" container.
- Remove labels, clean, dry and put away glassware and equipment as soon as you have finished with it.
- Fill in equipment logbooks, as they are used in determining maintenance requirements.
- All reagent bottles and flasks must be labelled as to the contents
- When diluting acids, always pour the acid into water to avoid local overheating and explosion.
- All accidents or "near misses" must be reported to the Laboratory Manager.
- Before leaving the laboratory turn all equipment off.
- Remember, you are responsible for the safety of any visitors you bring into the lab.

7 AFTER HOURS WORKING IN LABORATORY

Working alone in the laboratory is discouraged. However if it is necessary the following guidelines apply:

- Hazardous activities, eg, Kjeldahl digestions, using the nitrous oxide flame, are not to be performed while alone in the laboratory. If in doubt as to whether an activity is hazardous, consult the laboratory manager.

- Notify someone else (e.g. the building security service) that you are working in the building, your location and how long you expect to be.

- Notify them again when you have finished work.

- Check equipment is turned off and the laboratory locked before leaving.

8 HAZARDS AND PRECAUTIONS WITH CHEMICALS

8.1 MSDS sheets

All chemicals used in the laboratory have a Material Safety Data Sheet (MSDS). This is a document that provides workers and emergency personnel with the proper procedures for handling or working with that chemical. It contains physical data as well as information on toxicity, health effects, first aid, reactivity, storage, disposal, protective equipment and spill or leak procedures.

Hard copy MSDS sheets are contained in a folder in the laboratory. In addition, there is a CD-ROM of MSDS sheets for most commonly used chemicals in the lab manager's office.

MSDS sheets should be requested from the supplier whenever new chemicals are purchased. Most chemical manufacturers have MSDS sheets available on their web sites, and information regarding more obscure chemicals can often be located by web searching.

The MSDS sheet must be read thoroughly before using any chemical.

8.2 Storage Hazards

There is a chart on the door of the solvents cabinet detailing common chemical incompatibilities. These incompatibilities have been taken into account when storing the chemical stocks. After use, always replace a chemical in the location where it was found. Care must be taken never to mix incompatible chemicals. Table 1 below gives some examples of the more common incompatibilities to watch out for:

Table 1. Incompatible chemicals

Chemical	Do not mix /store with
Acetic acid	Chromic, nitric & perchloric acids, peroxides, permanganates, alcohols
Acetone	Conc nitric and sulphuric acid mixtures
Ammonia	Mercury, bromine, chlorine & iodine
Calcium oxide	Water
Chromic acid	Acetic acid, alcohol, flammable liquids
Hydrocarbons	Bromine, chlorine, fluorine, chromic acid
Hydrogen peroxide	Flammable liquids & solids, most metals and their salts
Mercury	Ammonia
Nitric acid	Acetic acid, acetone, alcohol, chromic acid, flammable liquids & solids
Organic peroxides	Alcohol, paper, grease oils, wood
Perchloric acid	Acids. Avoid friction
Potassium permanganate	Glycerol, sulphuric acid
Sodium nitrate	Ammonium salts
Sulphuric acid	Chlorates, perchlorates & permanganates

8.3 Biohazardous materials

Soils, particularly those treated with effluent, can contain potentially hazardous organisms. Wear gloves when handling, and a dust mask when working with the dry material. Soils and plants from outside the country must be autoclaved prior to disposal, and the quarantine register filled in appropriately. Tetanus vaccination is recommended for staff who commonly work with soil or animal faecal material.

8.4 Carcinogenic Chemicals

Carcinogens are substances that induce uncontrolled tumorous growth in animal tissues. The period of time from exposure to induction of tumorous growth can be long, making screening for carcinogenicity difficult. Because of this many chemicals have not been screened or are only rated as "suspected" carcinogens.

Mutagens are substances that cause irreversible changes in chromosomal DNA. Most carcinogens are also mutagenic.

Teratogens cause malformations of the embryo during pregnancy. The embryo is at greatest risk during the first three months of gestation, so female laboratory workers who think they may be pregnant or who are planning pregnancy should arrange to avoid the use of such chemicals.

Work with carcinogens should only be carried out in a fume cupboard, and use protective equipment to avoid skin contact and ingestion.

The following are chemicals commonly used in the agricultural/environmental chemistry laboratories that should be handled with extreme care:

- Ammonium metavanadate - possible mutagen
- Chloroform - suspected carcinogen, implicated in birth defects and fetotoxicity
- DTPA - suspected carcinogen
- Hydrazine sulphate - suspected carcinogen

The methods that use these chemicals will provide specific details on how to use them safely.

8.5 Cryogenic materials

Cryogens are liquefiable gases with boiling points less than about –75 °C, such as liquid air and liquid nitrogen, used for cooling purposes. Skin contact with cryogens can cause injuries similar to burns. Skin contacting objects cooled by cryogens may stick fast and result in loss of a layer of flesh when removed. Eye protection and insulating gloves should be worn when working with cryogens or objects cooled cryogenically. Use cryogenic materials only in well-ventilated areas, as they are capable of displacing air necessary for respiration and causing asphyxiation.

8.6 Corrosive chemicals

These are chemicals that cause destruction of body tissues by direct chemical action. They are often also toxic, so may have secondary systemic effects as well. Many react violently with other chemicals, so consideration must be given to storage and disposal as well as use.

Eye protection (safety glasses or a face shield), lab coats and gloves are essential when working with corrosive materials. Contact lens wearers must be particularly vigilant with their eye protection as the lenses concentrate the effects of splashes in the eye. Check the location and operation of the nearest eye wash station and emergency shower before commencing work.

Corrosive gases and vapours (such as hydrochloric acid fumes) present a severe hazard since they can transfer from the lungs to other internal organs. Always use these in a fume cupboard. Corrosive solids (such as sodium hydroxide) are also hazardous as they can be converted to liquids by contact with skin moisture.

8.7 Flammable Chemicals

This category comprises chemicals with a low flashpoint (the temperature at which the material will give off enough vapour to form an ignitable mixture with air), or those that react with water to produce flammable gases. They pose a serious fire and explosion hazard since they are easily ignited, difficult to extinguish and burn rapidly. Note:

- All flammable liquids must be stored in a fire rated metal cabinet. It is not recommended to use a refrigerator or cold room for storage, as lights and thermostats can provide ignition sources.
- Wherever possible use these materials in a fume cupboard.
- Work with a minimum quantity of liquid in open containers
- Replace lids immediately after use to reduce vapours.
- Dispose of waste solvent by evaporation in a fume cupboard rather than pouring down the sink.

8.8 Highly Reactive or Explosive Chemicals

This category comprises products that can be made to explode by heat, shock, friction or sources of ignition. The most common chemicals in this category are acetylene and perchloric acid.

Acetylene gas can explode when compressed above 15 psi. When using acetylene with the atomic absorption equipment never set the pressure above 12 psi (the red region on the cylinder gauge.)

Perchloric acid can cause explosions if it comes in to contact with combustible materials such as wood, paper, and organic compounds. It can also explode spontaneously if it becomes concentrated e.g. by a digestion going dry. Use of perchloric acid requires special precautions and facilities so discuss the work with the Laboratory Manager to see if a safer alternative can be found.

The category also includes compounds with strong acid, base or oxidising characteristics, which therefore have enhanced reactivity. Work with such chemicals should be kept to as small a scale as possible. Care must be exercised to avoid mixing of strong oxidising agents with organic materials. Perchloric acid again is particularly hazardous in this respect.

Check the MSDS sheet for any incompatibilities before commencing work. Incompatibility must also be considering with respect to storage.

8.9 Radioactive materials

The use of radioactive materials is governed by the New Zealand Radiation Protection Act, which directs that no one shall use radioactive materials unless they are acting under the supervision or instruction of a licence holder.

Dr ABC is the licence holder at the XYZ Laboratory, and all work must have his approval. The work must be carried out in the Tracer Lab, and the specific rules applying to this laboratory, displayed on the wall, must be followed. Equipment from the Tracer Lab must not be used in other laboratory areas to avoid cross contamination.

8.10 Toxic Chemicals

This category comprises material that can cause death or serious illness when small amounts enter the body by ingestion, inhalation or skin absorption.

The MSDS sheet indicates the relative toxicity of a chemical by its PEL - personal exposure limit. The lower the limit the more toxic the chemical.

Work with toxic chemicals should be done in a fume cupboard, wearing safety glasses, lab coat and protective gloves.

9 HAZARDS AND PRECAUTIONS WHEN USING LABORATORY EQUIPMENT

Most accidents in laboratories occur as a result of inattention, either actively in the operation of equipment or passively in terms of maintenance of the equipment. It is therefore essential that personnel be fully trained in the operation of a particular piece of equipment before using it, and that a comprehensive maintenance log be kept for all pieces of equipment.

9.1 Autoclaves

- Do not use the autoclave without having received specific training in its use.
- Always follow the instructions, which are summarised on a sheet on the wall beside the autoclave.
- Wear heat resistant gloves when removing vessels.
- Do not tamper with the pressure relief valve.
- Do not leave the simmerstat set on full for prolonged periods. This may lead to boiling dry (and possible explosion) as well as spillage of material inside due to surges in boiling.
- Do not forget to turn the autoclave off before leaving work.

9.2 Centrifuges

- Inspect tubes for cracks before use and discard any faulty ones.
- Inspect the rotor for signs of corrosion or liquids spilled from a previous run.
- Do not operate the centrifuge at a speed greater than what that rotor is rated for.
- Balance the items in the rotor carefully.
- Check that the rotor is firmly screwed in place, with the chamber lid properly closed.
- Clean and dry the rotors after use, taking care to remove any inserts used as moisture can condense under them, leading to corrosion.

9.3 Compressed gases

- Handle cylinders carefully. Dropping on to its side could weaken the cylinder or break the valve off. The cylinder would then rocket like a projectile due to the sudden release of pressure.
- If a safety cap is supplied then it should be in place when the cylinder is being transported so the valve is protected.
- Cylinders should either be connected to an instrument or stored outside in the gas cage. In either instance it should be secured in position with a chain.
- Transport using a cylinder trolley. Dragging or rolling can cause injuries ranging from strained muscles to crushed toes.
- After connecting a cylinder, test for gas leaks using a soap solution.
- Never turn on a cylinder without a regulator in place.
- Close cylinder valves when not in use, rather than simply backing off the pressure at the regulator.

- Close valve on empty cylinders and place an "Empty" tag on its neck when returned to the gas cage.

9.4 Fume cupboards

Wherever possible, fume cupboards should be used for any operations involving volatile, flammable, toxic, carcinogenic or corrosive chemicals. In order for them to be available whenever required it is essential that users remove their equipment and clean up as soon as their work is finished.

Fume cupboards work most efficiently when obstruction of airflow from the face of the cupboard to the exhaust duct is minimal. Accordingly limit the contents of the cupboard to that which is immediately required. To minimise exposure to vapours it is best to position the work close to the rear of the fume cupboard and have the sash in the lowest convenient position. Fume cupboards should be tested regularly as part of the safety audit programme.

In order to avoid the potential mixing of incompatible chemicals in the fume cupboard or their ducting the fume cupboards should be designated for certain uses only e.g. one for use with organic solvents, one for corrosive materials such as strong acids, and radioactive substances restricted to the Tracer Lab fume cupboard.

9.5 Glassware

Cuts from glassware are one of the commonest injuries in a laboratory. To minimise these hazards:

- Inspect glassware for cracks, chips or scratches that may cause a breakage under stress. Digestion tubes are particularly prone to this.
- Heat beakers via a gauze on a tripod rather than with a direct flame.
- Freeze jammed stoppers to release them. Do not force or heat.
- Use the glass cutting and sanding kit to modify glass tubing.
- Use a scalpel to cut plastic tubing from glassware.
- Use a lubricant when inserting glass tubing into plastic or bungs.
- Dispose of all damaged or broken glassware in the Broken Glass Bin beside the main sink.

9.6 Instruments and electrical equipment

- Never use any instrument until you have received full training.
- Use in accordance with the specific operating protocol or manufacturers instructions.
- Instrument maintenance and servicing is only to be carried out by trained persons.
- Electrical repairs should only be undertaken by licensed persons.

9.7 Operations under vacuum

- Evacuation of glassware not designed for that purpose, or flaws in the glass may lead to implosions and possible injury due to flying glass.
- Where practical, use a safety screen to shield the apparatus. Inspect the glassware for cracks or scratches prior to use, and dispose of any with such defects.
- Wear safety glasses at all times, even with low vacuums such as that produced by a water pump.

9.8 Ovens, hotplates and furnaces

- Use appropriate gloves or tongs when removing items.
- No heating apparatus is to be left on overnight except for the soil and plant drying ovens and the soil moisture factor oven. Leave a notice advising that the oven is to be left on.
- Before drying plasticware in the glassware drying oven check that the thermostat is not set higher than 50°C and that the cut-out thermostat is set no higher than 55°C.

9.9 Shakers

- Always make sure tops are screwed on firmly to avoid leaks. Wipe out and dry compartments after use if any leaks do occur.
- Items placed in the shakers need to be balanced approximately in opposing compartments.
- Ensure items are wedged in place by using empty plastic containers to fill vacant spaces, and place rubber mats over the top.
- Make sure nothing can get tangled in the spindle before switching the shaker on.

10 PERSONAL PROTECTIVE EQUIPMENT (PPE)

10.1 Dust masks

Disposable dust masks should be worn whenever working in a dusty environment, such as when grinding plant or soil samples. Sensitive persons, such as those suffering hayfever, may find it helpful to wear a mask when weighing out samples as well. Dust extraction equipment should be used wherever available, but masks should always be worn as well. Dust masks are located on the PPE shelf in the laboratory.

10.2 Earmuffs

Earmuffs are stationed alongside all equipment noisy enough to require hearing protection. Smaller earplugs are also available, located on the PPE shelf. All staff regularly exposed to noise levels above 85 decibels are entitled to have a free annual hearing test. An initial test for baseline comparison purposes should be done as soon as possible after commencing work.

10.3 Gloves

Soil can act as a strong desiccant and abrasive on the hands, so it is advisable to wear a pair of light gloves for mechanical protection when preparing or sieving samples. Gloves also provide protection from biohazardous materials. Barrier cream may be used but depending on the type of analysis to be done could lead to contamination problems.

Gloves should always be worn when handling chemicals. Table 2 below is a chemical resistance guide that indicates what glove type should be used when handling specific chemicals.

Table 2. Chemical resistance of glove materials

Material	Recommended	Not Recommended
Butyl	Aldehydes, ketones, esters, polar solvents	Aliphatic, aromatic & chlorinated solvents
Latex	Weak acids & bases, alcohol, aqueous solutions	Organic solvents
Neoprene	Acids, bases, alcohols, oils, fats, aniline, phenol	Chlorinated solvents
Nitrile	Oils, greases, acids, caustics, aliphatic solvents	Aromatic & chlorinated solvents, ketones
PVA	Aliphatic, aromatic & chlorinated solvents	Acetone, acids & bases, alcohol, water
PVC	Strong acids & bases, aqueous solutions, alcohols	Aromatic & chlorinated solvents, ketones

Latex and nitrile gloves are located on the PPE shelf, butyl and neoprene gloves on top of the solvent cabinet and heat-resistant gloves on top of the oven. If you are uncertain about which type of glove to use please ask the laboratory manager.

10.4 Laboratory coats

Laboratory coats should be worn at all times when working in the laboratory. Coats are issued to each new staff member as part of the induction procedure. If a coat becomes damaged or is worn out then the old coat should be handed in along with a request for replacement.

Coats should be put out for laundering regularly and changed whenever dirty or have a spill on them. Laundry is to be placed in the laundry bag at the end of the main corridor.

In the interests of hygiene, coats should not be worn in the staff common room or when working in the offices.

10.5 Safety glasses

The eyes are the most easily damaged of all the body tissues. Safety glasses are issued to each new staff member as part of the induction procedure, and must be worn at all times when working with chemicals. Contact lens wearers are warned that these lenses can aggravate the injuries received from chemical splashes.

11 EMERGENCY EQUIPMENT

11.1 Eyewash Stations

An eyewash station is located in the laboratory, just inside the door. It is of the drench hose type and can be latched on to provide a constant flow without operator assistance. Familiarise yourself with the mode of operation.

11.2 Fire blanket

There is a fire blanket attached to the wall just inside the entrance to the laboratory.

11.3 Fire extinguishers

There are water-supplied hose reels in the corridors outside the laboratory.

CO_2 extinguishers are located in the laboratory and in all corridors beside the hose reels. A portable CO_2 extinguisher on wheels is kept beside drench shower. Dry powder-type extinguishers are not recommended in laboratories because of the sodium contamination that would arise after discharge.

11.4 First aid kits

The laboratory first-aid kit is located on the shelf above the sink in the laboratory. If you use the last of an item please inform the Laboratory Manager. Smaller kits for field use are kept with the field gear, and in every vehicle glove compartment.

11.5 Showers

A drench shower is located beside the eyewash station in the laboratory. Pulling the handle on the chain beside the shower head starts the flow, then no hands are required for continuous operation. Pulling the chain again stops the flow. After use of the shower please make sure the floor is dried to avoid any slips on the wet floor.

11.6 Spill kits

There is a spill kit contained in a green bag on the back of the door to the laboratory. It contains inert absorbent material in various shaped parcels that can be used to soak up spills of chemical liquids. In addition, there are two buckets of absorbent granules on the floor of the chemical pantry. Notify the Laboratory Manager if any of this equipment is used, so stocks may be replaced.

12 ACCIDENT REPORTING

In the instance of a serious harm accident (usually something requiring professional medical treatment) the Human Resources officer should be informed as soon as possible as there are specific procedures to be followed in accordance with the New Zealand Health and Safety in Employment Act 1992.

For a non-serious harm accident or incident, the details must be recorded on an accident/incident form held by the laboratory manager. This will be followed up by an investigation as to why the event happened and whether a significant hazard exists. If it does then steps will be taken to eliminate, isolate or minimise the hazard.

An incident where no one was injured or anything damaged may become a major accident the next time it happens. This is why it is important that all accidents and incidents are thoroughly investigated.

Although an event may seem trivial at the time there may be further developments (such as infection) that may require later medical treatment and involve insurance companies, which in turn requires accurate documentation of the original injury.

APPENDIX 1 DECLARATION OF UNDERSTANDING

I have read and understood the XYZ Laboratory Safety Manual and agree to abide by the rules and directions therein.

Name	Date	Signature

APPENDIX 2 MONTHLY SAFETY AUDIT

This checklist should be used as a guide to check for any hazards present in the laboratory. The completed sheet should be given to the Laboratory Manager, who is responsible for taking action on all items identified. Before starting each monthly audit refer to the checklist from the previous month to check that all items identified have been dealt with satisfactorily.

XYZ LABORATORY
MONTHLY SAFETY AUDIT CHECKLIST

Items To Check:

1. Are benches & floor areas clean and tidy? Yes/No
2. Are all chemicals stored, correctly segregated, in appropriate locations? Yes/No
3. Are the fume hoods working and not being used for storage? Yes/No
4. Is the eyewash station free from obstruction and working? Yes/No
5. Is the shower free from obstruction and working? Yes/No
6. Are there enough gloves and masks for next month's work? Yes/No
7. Are the fire extinguishers charged? Yes/No
8. Is waste, including sharps, being disposed of correctly? Yes/No
9. Are all gas cylinders secured? Yes/No
10. Can any new hazards be identified? Yes/No

Comments:

Signed:_____ Date:_____

APPENDIX 3 ANNUAL SAFETY AUDIT

This checklist should be used as a guide to check for any hazards present in the laboratory. It is preferable to have someone from outside the laboratory to conduct the audit, as a fresh pair of eyes will often spot a hazard that has been overlooked. The completed audit document should be given to the Laboratory Manager, who is responsible for taking action on all items identified.

XYZ LABORATORY
ANNUAL SAFETY AUDIT CHECKLIST

Date: _____

Auditor: _____

1. LABORATORY WORK PRACTICES

	Yes	No
Is there a designated laboratory manager?	❒	❒
Is a monthly safety check carried out?	❒	❒
Are the monthly checks displayed prominently?	❒	❒
Has action been taken on items raised from the monthly checks?	❒	❒
Is the safety manual available?	❒	❒
Is food & drink not stored in lab containers and areas?	❒	❒
Are visitors informed of lab hazards?	❒	❒
Are pipetting aids available and used?	❒	❒
Are work surfaces cleaned after use?	❒	❒
Are used needles & broken glass disposed of in suitable containers?	❒	❒

Comments:

2. HOUSEKEEPING

	Yes	No
Are lab and storage areas uncluttered and tidy?	❒	❒
Are aisles and exits free from obstruction?	❒	❒
Are the tops of cabinets free from stored items?	❒	❒
Are heavy items confined to lower shelves?	❒	❒
Is glassware free from cracks/ sharp edges?	❒	❒
Is glassware stored to prevent fall from shelves in an earthquake?	❒	❒
Are fume hoods free from clutter/stored items?	❒	❒
Are fume hoods tested regularly?	❒	❒
Do fume hood sashes function correctly?	❒	❒
Is cleaning scheduled out of work hours?	❒	❒

Comments:

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3. PERSONAL PROTECTIVE EQUIPMENT

	Yes	No
Do staff wear lab coats when working in the laboratory?	❒	❒
Do staff remove their lab coats in non-lab areas e.g. common room?	❒	❒
Are dirty lab coats stored in a bag until removed for laundering?	❒	❒
Is suitable eye protection available and used?	❒	❒
Are protective gloves available?	❒	❒
Is there a selection of gloves available according to hazard type?	❒	❒
Are dust masks available and used?	❒	❒
Is suitable hearing protection available and used?	❒	❒

Comments:

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4. HAZARD COMMUNICATION AND LABELLING

	Yes	No
Is the correct signage present at the building entrance?	❒	❒
Is the correct signage present at the entrance to the lab?	❒	❒
Is a glove suitability chart posted in the lab?	❒	❒
Is there a table of incompatible chemicals posted in the lab?	❒	❒
Do storage areas have signs consistent with the hazards within?	❒	❒
Are all chemical containers labeled as to contents?	❒	❒
Are MSDS sheets available for all chemicals used?	❒	❒
Do the staff know the location of MSDS sheets?	❒	❒

Comments:

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5. ELECTRICAL SAFETY

	Yes	No
Is electrical equipment tested for safety regularly?	❒	❒
Are electrical cords in good condition?	❒	❒
Is equipment in good repair?	❒	❒
Are cords tidy?	❒	❒
Are power points and multiboards not overloaded?	❒	❒

Comments:

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6. CHEMICAL STORAGE AND SAFETY

	Yes	No
Is there a register of chemicals held and their quantity?	❒	❒
Are chemicals dated on arrival?	❒	❒
Are unnecessary chemicals removed back to the store?	❒	❒
Are toxic chemicals stored in a locked cupboard when not in use?	❒	❒
Are organic acids stored away from inorganic acids?	❒	❒
Are acids stored away from alkalis?	❒	❒
Are other incompatible chemicals segregated?	❒	❒
Are corrosives and flammables stored below eye level?	❒	❒
Are hazardous materials limited to small quantities?	❒	❒
Are safety carriers available and used?	❒	❒

Comments:

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7. FLAMMABLE LIQUIDS STORAGE

	Yes	No
Are flammable liquids stored in an approved cabinet?	❒	❒
Are flammable liquids used away from ignition sources?	❒	❒
Is the quantity of flammables stored in the cabinet within limits?	❒	❒
Is the flammable liquids cabinet appropriately labeled?	❒	❒
Does the flammable liquids cabinet door close properly?	❒	❒
Is there less than 15 l of flammable liquid out on benches?	❒	❒

Comments:

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8. COMPRESSED GAS CYLINDERS

	Yes	No
Are gas cylinders securely chained?	❒	❒
Are gas cylinders transported on a suitable trolley?	❒	❒
Are gas cylinders not attached to an instrument stored externally?	❒	❒
Are empty gas cylinders labeled as empty?	❒	❒
Are supply valves turned off when not in use?	❒	❒
Are hoses, tubing and regulators in good condition?	❒	❒
Are acetylene cylinders fitted with flashback arrestors?	❒	❒

Comments:

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9. TRAINING

	Yes	No
Do staff receive training in use of fire fighting equipment?	❒	❒
Do fire wardens receive training?	❒	❒
Is first aid training available to all staff?	❒	❒
Is there a trained first aider on every level?	❒	❒
Is there a list of trained first aiders displayed prominently?	❒	❒

Comments:

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10. FIRE SAFETY

	Yes	No
Are exits clearly marked?	❒	❒
Is there an emergency lighting system?	❒	❒
Are exits free from obstruction?	❒	❒
Are fire doors either self closing or kept closed?	❒	❒
Are fire alarms tested regularly?	❒	❒
Are telephones labelled with emergency numbers?	❒	❒
Is an evacuation procedure available?	❒	❒
Are staff familiar with evacuation procedures?	❒	❒
Are regular fire drills held?	❒	❒
Do staff have training in use of fire fighting equipment?	❒	❒

Comments:

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11. WASTES

	Yes	No
Are hazardous wastes not accumulated?	❒	❒
Is there a waste disposal procedure?	❒	❒

Comments:

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12. SAFETY EQUIPMENT

	Yes	No
Are safety showers present?	❒	❒
Are eye wash stations present?	❒	❒
Are showers and eye wash stations free from obstruction?	❒	❒
Are showers and eye wash stations in good condition?	❒	❒
Are showers and eye wash stations tested regularly?	❒	❒
Are fire extinguishers available?	❒	❒
Are fire extinguishers appropriate to the hazard types?	❒	❒
Are hose reels available?	❒	❒
Are fire extinguishers checked regularly?	❒	❒
Are fire detection devices present?	❒	❒
Are first aid supplies available and visible?	❒	❒
Are first aid supplies checked and maintained?	❒	❒
Are spill kits available?	❒	❒
Do staff know the location of spill kits?	❒	❒

Comments: