



# FBE Design Laboratory Safety Manual

2009 Revised Edition by  
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Based on the 2003 original "Industrial Design  
Laboratory Safety Manual for Students" by  
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## What this safety manual is about

This safety manual tells you about the dangers you might meet when working in the FBE Design Laboratory. It tells you how to protect yourself from these dangers by explaining the safety policies and safe operating practices for the equipment and machinery in the lab.

All laboratory users must obey the policies and practices explained in this manual. You must do this for your own protection and for the safety of everyone else.

## The FBE Design Laboratory

A facility of the University of New South Wales Faculty of the Built Environment, the FBE Design Laboratory is located in the Ground Floor of the Squarehouse in the Kensington campus. The laboratory has a general workshop for modelling in foam and light materials; a wood workshop with heavy duty machinery for wood and plastic; a metal workshop; a light workshop with 24/7 access; design studios; computer laboratories; a materials shop; a spray booth; a vacuum forming room; a digital prototyping room; a welding room; and a research space for academic staff.

Anthony Jones is the FBE Design Laboratory Manager and Peter Kolasinski is the Workshop Senior Technical Officer. Both Anthony and Peter are qualified first-aid officers. They can be contacted at 9385 4819.

The FBE Design Laboratory is open Monday to Friday from 9am to 1pm, and from 2pm to 5pm. The light workshop areas are accessible 24/7 to FBE students by swipe card.

Only authorised students and staff can use the FBE Design Laboratory. You cannot bring your friends or other people without permission. For everyone's safety, there is a limit on the number of people who can be in the facility at any one time. There is no guarantee you will be able to use the laboratory whenever you want.

**WORKING SAFELY IS A CONDITION OF ACCESS TO THE FBE DESIGN LABORATORY. REPEATED FAILURE TO OBSERVE SAFE WORKING PRACTICES AND PROCEDURES WILL RESULT IN THE WITHDRAWAL OF ACCESS PRIVILEGES.**

## Hazards, Risks, other Nasty Things



The FBE Design Laboratory can be a high-risk workplace for the untrained and the inexperienced.

Through the IDES1012 Safe Workshop Practices course, you will be told about the dangers of using the FBE Design Laboratory. You will be trained in how to control these dangers and to use the facilities safely. Not all machines, equipment and tools present the same danger. Some can be safely used after a short demonstration; others need many hours of training and experience to be operated safely.

### Key Words

**HAZARD.** These are dangerous situations that can injure a person or damage facilities.

**RISK.** This is a way to rate hazards by balancing the chance of a hazard causing an injury against how bad the injury could be.

In a safe workplace hazards have been spotted, the level of risk they pose has been worked out and effective risk controls are operating.

Some hazards in the FBE Design Lab include:

- **MACHINES AND EQUIPMENT.** Tools and machinery can crush, burn, cut skin, cut off limbs, break bones, while people can also be hurt by sparks from welding, flying chips from grinding.
- **HAZARDOUS SUBSTANCES.** Chemicals, materials, dusts, and fumes can poison people, or damage the skin, lungs, eyes, and other parts of the body.
- **MANUAL HANDLING.** Poor ways of lifting, carrying, pushing, pulling, or holding equipment and tools can cause back injuries, or cause people to slip over or trip and fall.
- **NOISE.** Loud sounds or long exposure to sounds can damage a person's hearing.
- **ELECTRICITY.** Power tools can cause shocks or electrocution.
- **HEAT.** High-temperature objects and surfaces can cause severe burns to the skin.

Safety in the lab depends upon you following the prescribed work practices and using the

required safety equipment. These work practices are designed to help prevent you from harming yourself, equipment, your work, and other people.

Any laboratory user who has a medical condition that can affect his/her ability to work safely should report to the Lab Manager or Technical Officer before commencing any work. All medical information will be treated as confidential.

### Checklist

When using the FBE Design Lab keep in mind that all these hazards, and more, are around you. Don't rush in to do your work. Take time to ask your self these questions:

- What are the hazards in doing this work (eg. moving machine parts, heat, noise, sharp edges)?
- How could I be hurt if something goes wrong (eg. cuts, burns, broken bones)?
- Could someone else be hurt by what I am doing?
- Have I been trained in this process?
- Do I really know how to use this machine or these tools?
- Is there anything new or different about this process which I should ask my supervisor about?
- Am I following the safety rules for this machine or process?
- Can I do this work more safely and still get the same result?

Statistics show that young people are the most likely ones to be injured in the workforce. This is because they are inexperienced and don't always understand the importance of following safe working practices.

Think about it! It is in your interest to be informed and trained in how to protect yourself and others while you are in the FBE Design Lab.

**Your safety is in your hands.**

# Module 1

## General Laboratory Safety



*Safety rules apply in the FBE Design Laboratory.  
These rules MUST be followed.*

*People who ignore the safety rules may be stopped from using the lab.*

### Rule One: Entering the FBE Design Lab

When you come into the lab, stop by the safety noticeboard and follow these few steps:

- Sign the logbook so there is a record of your presence.
- Make sure you know the Emergency Evacuation Procedures, the Emergency Contacts, and where the Emergency Phone is.
- Make sure you know where the first aid kits and fire extinguishers are located. See Appendix C.
- Make sure you are wearing appropriate work clothing. See Rule Three.
- Make sure you know what personal protective equipment you need to use. See Rule Four and Appendix A.
- Make sure you are properly trained to safely use the tools and machinery you need for your work.
- Make sure you have read and understood the relevant safety module for the work you want to do.



The following are NEVER allowed in the FBE Design Lab: so don't even bother to ask!

- People affected by alcohol, drugs, medication
- Smoking
- Sandals, thongs, slippers, open-toe shoes
- Playing around
- Working alone



Eating and drinking are strongly discouraged in the laboratory because there can be hazardous dusts and fumes in the air.

### Rule Two: Safe Behaviour

**OBEY ALL WARNING NOTICES.** Before starting any work read the safety rules first! Stickers on each machine tell you what operating precautions you must take. Read them!



**FOCUS ON WHAT YOU ARE DOING.** If you are feeling unwell or find your mind wandering, turn off the machine you are using and take a break. Don't start work again until you are feeling better and can concentrate on what you are doing.

**AVOID DISTRACTIONS.** Don't distract others from their work, or get distracted yourself while operating machinery. An accident can happen in the moment your attention is elsewhere.

**NEVER WORK ALONE.** This is obvious – if something happens to you there must be somebody around who can go for help.

**DON'T PLAY AROUND OR RUN ABOUT.** The FBE Design Laboratory is not a playground, it is a serious workplace. Running about or playing around is plain stupid. What you may have meant as a bit of fun could end up being a serious accident.

**PLAN YOUR WORK BEFORE DOING ANYTHING.** Take time to plan your work so you know what you want to do before you turn on a machine or pick up a tool.



**LOOK WHERE YOU ARE GOING.** Watch out for any obstructions or carelessly stacked materials that could trip you up or catch you. Warn people to move out of your way when you are handling long or large materials, such as rods, tubing or boards.

**CLEAN UP AFTER YOURSELF.** Clean up any dust and material scraps on, or around, machinery, tools and workbenches when you

finish. That way people following you can safely use them.

**CARRY ONLY A FEW THINGS AT A TIME.** Overloading yourself with tools or materials could cause you to drop them. This could hurt you, hurt other people and damage the tools and materials.

**DON'T CARRY TOOLS IN YOUR POCKETS.** Carrying sharp or pointed tools in your pockets could cut you, or cut people who might brush up against you.

**MAKE SURE THERE IS ENOUGH LIGHT.** It's impossible to do a job safely if you can't see it clearly.

**DON'T FOOL WITH COMPRESSED AIR.** Don't point compressed air at other people or yourself. High-pressure air is dangerous: it can penetrate the skin and blood vessels, or can cause blindness if pointed at the face.



**CONTAIN HAZARDOUS FUMES.** Don't use hazardous substances where other people could be exposed to them. For example: only paint in the spray room, only mix putty under the fume extractor box, only dry sand in the open areas. Keep the doors to the vacuum forming room and the spray room closed so people don't breathe in fumes from heated plastic sheets and paints and solvents. Make sure the fume extractor fans are on. Keep lids on containers of body fillers, hardeners, glues, putty, resins, etc when not in use so they don't dry out or their fumes escape.

**WARN OTHERS IF YOU'RE GOING TO MAKE A NOISE.** Don't do noisy work without warning other people. This gives them the chance to move away or use hearing protection.

**PACK UP PROPERLY.** Don't leave tools or materials on the workbench or the floor when you've finished. Put them back in their proper place.

**SWITCH IT OFF IF IT'S NOT BEING USED.** Don't put down power tools without first turning them off. Don't leave a machine running without making sure it has come to a complete stop. Other people might not notice that the equipment is still on or the machine is still moving and thus injure themselves.

## Rule Three: Appropriate Clothing

Although there are no set work clothes that must be worn in the FBE Design Lab, for safety reasons, everyday clothes should be covered while you are working.

### Clothing

Close-fitting clothes are safest. Boiler suits and mechanic's coveralls are best, but smocks, aprons and overcoats are acceptable. Keep your clothing fully buttoned, including pocket flaps and wrist cuffs. If shirt sleeves and cuffs are not close fitting, roll them up to the elbows.



If you are wearing aprons or jumpers, make sure the tiebacks and shoulder straps are not hanging loose and likely to be caught in machinery.

### Jewellery & Accessories

Wearing jewellery or other loose objects while working around moving machinery is dangerous.

Dangling belts, neckties, scarves, or MP3 player cables could get caught in a moving part and pull your hands, head or body into the machinery.

Rings could catch under a splinter or on a moving piece of machinery, causing injury to your hand.

Dangling cables of MP3 players could be entangled in a machine, pulling you in or it could rip your MP3 player off and mangle it.

**REMEMBER: NO RINGS, BRACELETS, WATCHES, NECKLACES, TIES, SCARVES, OR LOOSE ORNAMENTS.**

### Hair

People have been scalped when long hair has been caught in rotating machinery. This is NOT a nice thing to happen. Tie up your long hair and cover it with a cap.

Long fringes should also be tied back. They could limit your vision and stop you seeing clearly what you are doing.

**REMEMBER: TIE UP OR COVER LONG HAIR IN A CAP OR HAIRNET.**

## Footwear

There are a lot of hazards at floor level in the lab. Tools falling to the floor, objects rolling along the floor or sharp objects on the floor could all hurt your feet. To prevent this you must wear strong, rubber-soled shoes or boots. The best protection comes from wearing approved safety footwear.

REMEMBER: NO SANDALS, THONGS, SLIPPERS, OPEN-TOED OR HIGH-HEELED SHOES.

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## Rule Four: Personal Protective Equipment

When doing certain work processes or when working in some areas of the lab you must use personal protective equipment (PPE). PPE gives you a basic level of protection when other risk controls aren't possible.

PPE includes things like:

- Ear plugs which guard against exposure to loud noise,
- Goggles and masks which guard the face against flying objects, splashed liquids or various types of radiation,
- Breathing devices which guard against breathing in dust and fumes.

Signs on the wall and stickers on machines will tell you when PPE must be used. Follow these directions for your own safety.

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## Rule Five: Proper Ventilation

For a number of work processes in the lab good airflow is important to stop the build-up of dangerous vapours, gases, dusts and fumes. This work must be done in the designated areas where ventilation can extract the dangerous vapours, gases and dust, or out in the open air where it can disperse safely.

## Spray Booth

Organic solvents such as paints, varnishes, acetone and thinners can only be used in the enclosed spraying area. Do not use them in other work areas as these solvents are very volatile and large amounts can quickly evaporate into the air. When spraying, make sure the exhaust fan is switched on.

## Dust Extractor

Switch on the dust extractor when you use the sanding, turning or sawing machines. Also turn on the dust extractor when cleaning up dust from the work areas. Make sure the gates from the machines in use are open to the dust extractor. Shut off the extractor gates to other machines that aren't being used to improve suction.

Shut down the extractor when the work you are doing won't cause dust because the extractor is a major source of noise in the lab.

## Fume Extractor

Vapour-emitting work processes – such as soldering and mixing auto body filler or fibreglass resin with hardeners – should only be done in the fume extraction boxes with the fans switched on. This is to protect you and other people from being exposed to fumes.

## Open Air

It is best to do your hand sanding in the open air outside. This means the dust produced doesn't circulate inside the enclosed areas and can be dispersed in the air. But be careful if there is a wind, so the dust doesn't blow back into your face.

Please don't spray paint in the open air outside: the overspray messes up the walls, floors and pavement. Use the spray booth instead.

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## Rule Six: Housekeeping

Good housekeeping is essential for workplace safety. A messy workplace is a dangerous place, with a lot of lurking hazards.

Keep the floor clear of any obstructions that could trip people up. A fall could have serious consequences.

Keep the floor free from spills, grease, oil, soap, water, fine dust or any thing that could cause people to slip. Clean up any spills immediately.



Keep all materials, power equipment and tools stored in their proper places when they are not being used.



Keep all off-cut pieces of timber, plastic, metals or foam in the designated bins, boxes or drawers. Make sure that there are no protruding corners that could catch people as they pass. Never throw materials on the floor where people could trip over them.

Keep gangways, exit doors, and access to emergency equipment clear.



Keep all machine beds, workbenches, and the floor around machinery, clean. Remove dust and other debris as soon as you finish your work. If possible use suction cleaning methods to avoid breathing in fine particles.

Keep oily or finishing rags in closed metal containers. Keep them away from grinders and welders where sparks could ignite them.

When using the dust extractor for cleaning never exhaust metal and wood dust through the same system. Sparks from metal can ignite wood waste and cause an explosion. Use the portable vacuum cleaner to suck up metal debris.

GOOD HOUSEKEEPING IS NOT BEING FUSSY, IT IS BEING SAFE. IF YOU DON'T KEEP YOUR WORK AREA CLEAN AND TIDY YOU MAY BE STOPPED FROM USING THE FBE DESIGN LAB.

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### Rule Seven: Accidents

Immediately report an accident, no matter how minor, to the Lab Manager or Technical Officer so it can be noted and first aid given, if needed.



Report any faults or hazards immediately so that accidents can be prevented, including:

- Faulty tools, equipment and machinery (such as blunt cutters, ticking sounds on bandsaw blade, etc.)
- Missing, inadequate or faulty machine guards
- Unsafe practices or procedures
- Slippery floors
- Spills or seepage of toxic substances
- Electrical faults, overheating, loose connections, damaged insulation and plugs
- Obstructions or tripping hazards
- Injuries, however slight
- Near misses

Be aware of other people using the lab, what they are doing and where they are going. Everyone must interact properly if a safe work environment is to be maintained.

It's against the law to muck around with anything provided in the interests of health and safety. This includes machine guards, fire-fighting equipment, fire exits and escape routes.

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### Rule Eight: Emergency response

Make sure you know where the emergency phone, first aid, and fire fighting equipment are located in the laboratory. You must also make yourself aware of the emergency escape procedures.

If you see a fire, call out to other lab users to shut off their machines and evacuate. Try to keep your head, if you panic you will confuse yourself and other people, putting everybody in danger. Follow the evacuation procedures and leave the laboratory as quickly as possible. Don't hesitate. Remember, your safety is much more important than the project you have been working on.

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### Rule Nine: Leaving the FBE Design Lab

- Clean up your mess before you go.
- Put tools and scraps back in their proper places.
- Sign out on the logbook as you leave.

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### Are you following the safety rules?

- Did I sign the logbook when I entered the FBE Design Lab?
- Am I wearing appropriate tight-fitting clothes?
- Have I taken off my jewellery?
- Have I tied back or covered my hair?
- Have I got the PPE I need for the work I'll be doing?
- Have I cleaned up my work area and put away all the tools and materials I have been using?

# Module 2

## Safety in Using Hand Tools

Hand tools may look harmless, but they can cause serious injuries. Always follow instructions on how to use hand tools and never use a tool that is damaged. Commonly used hand tools in the FBE Design Laboratory include: hammers and mallets ▫ spanners ▫ marking knives ▫ chisels ▫ hand drills ▫ clamps ▫ measuring tapes ▫ ratchet braces ▫ pliers ▫ planes ▫ vice grips ▫ saws



### General Precautions

Always use the right tool for the job. It's dangerous to use tools for something they are not designed to do.

For instance, don't use a screwdriver as a chisel, wedge or punch; don't use pliers as a wrench; or a file as a pry bar or lever.

Always use tools that are in good condition.

Make sure you have enough clear space around you to use a tool safely.

### Hammers & Mallets

You should practice with hammers and mallets to learn how to use them safely. These impact tools could hurt you and damage your material if they are not used properly.

### Problems

Injuries can happen with hammers when:

- you accidentally hit your own hand or finger
- the hammerhead comes off
- bits fly out of the thing being hammered and hit someone in the face or eyes.

### Precautions

Don't use hammers that are damaged in anyway. Don't use hammers that have loose heads.

Don't hit hardened steel directly with a hammer. Put a piece of soft metal between the hammer and the hardened steel.

Don't use the side or flat of the hammer. Only the face is meant to do the hammering.

Don't strike hammer faces together – you could shatter them.

Keep clear of anyone swinging a hammer.

### Protection

Always wear safety goggles or face shields when using hammers to protect against bits flying off.



### Chisels & Gouges

#### Problems

Cuts, stab wounds or eye injuries could happen when chisels and gouges aren't used properly. This can happen when:

- the handle or head of the chisel or gouge splits or comes off
- a blunt chisel blade forces the person to use extra pressure and the chisel slips off the work

#### Precautions

Don't use chisels with loose or damaged handles. Ask the Technical Officer to fasten the handles firmly.

Don't use dull chisels. Ask the Technical Officer to sharpen it on the grinder.

Don't test the sharpness of a chisel on your hand; test it on paper.

Don't hold a piece of work in one hand while using a chisel in the other. If the chisel slips

you could badly cut your hand. Use a vice to hold your work, that way your hands will be behind the cutting edge and be in better control of the chisel.

Don't use the chisel with an action towards you. Always use the chisel with it pointed away from you.

Don't use a chisel for opening cans.

## Protection

Wear safety goggles while chipping with a chisel or gouge if there is any risk of flying chips.



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## Planes

### Problems

You could be injured if:

- the plane slips and you hit your hand against something
- you drop the plane on your feet
- you touch the blade of the plane

### Precautions

Don't hold your work with one hand and use the plane with the other. This risks being cut. Use a vice to clamp your work at a height about level with your elbow.

Stand correctly when using the plane. Stand in front of your work with your left foot braced in front of you and in line with your right shoulder, right hip and right foot. This stance gives you the best control over the plane and also helps save you from backache.

If planing second-hand timber check the surface and remove any nails, screws or other objects in the wood.

Don't feel the sharpness of the blade with your fingers.

Don't use planes without their handles. Keep the handles firmly fastened.

## Protection

Wear safety goggles while planing if there is any risk of flying chips.

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## Handsaws & backsaws

### Problems

Saws can cause deep cuts if they are not used properly.

### Precautions

Use a vice or bench hook to hold your work, if possible.

If you use your thumb to guide the saw to the cutting line start cutting with a few slow backward strokes. Once you have started cutting get your thumb out of the way. Don't start with rapid forward cuts – you could lose the skin on your thumb.

Hold your forefinger against the saw handle to give better control and accuracy.

Use the appropriate stance when sawing to give better control and take pressure off your back.

Keep away from the cutting edge of the saw, and keep any loose clothing (including your apron) away, as well.



## Screwdrivers

### Problems

Screwdrivers can cut, stab or cause twisted wrists when:

- the handle accidentally splits
- the handle slips out of the hand because of grease or sweat
- the screwdriver is carried in a pocket with the blade pointing upwards
- the blade slips off the screw

### Precautions

Don't use screwdrivers with split or damaged handles, or when the handle has grease on it.

Don't hold your work in one hand while using a screwdriver. Keep both hands behind the screwdriver blade, especially when applying pressure, otherwise you could get stabbed.

Wash your hands and wipe them dry with a paper towel before using a screwdriver so they are not damp or slippery.

Always clamp your work against the workbench, on a vice, or on another firm support when using a screwdriver.

Use the correct type and size of screwdriver for the job.

## Files & Rasps

### Problems

Files and rasps can cause cuts, stabs or bruises when:

- the handle accidentally splits or comes off
- the file is used without a handle, and the tang stabs the hand

### Precautions

Don't use files without handles.

Don't use files or rasps with loose, split or badly fitted handles. Make sure the handles are firmly fastened. Ask the Technical Officer to replace the handle, if need be.

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### Are you using hand tools safely?

- Do I know how to check my tools before I use them?
- Is my work held securely?
- Could I hit my hand, or hit someone else, if the tool slips?
- Is there a clear space for me to work in?
- Should I wear eye protection while doing this work?

# Module 3

## Safety in Using Power Tools



Power tools can cause terrible injuries if used incorrectly. Only use power tools that you have been trained to use and been given permission to operate. If you aren't sure how to use a power tool – then don't use it! Get the Technical Officer or your instructor to show you how. Handheld power tools used in the FBE Design Lab include ▫ portable power sanders ▫ portable power drills ▫ power routers ▫ rotary power tools ▫ portable power saws

### General Precautions

Before using any power tool check that it is in good condition.

Use the operator's manual to find out how to adjust and use a power tool properly.

If a power tool is damaged DON'T use it. Don't try to fix it yourself. If you notice that the electric cord is frayed or torn; or the plug is broken, don't use the power tool. You could get electrocuted! Tell the Technical Officer about any faulty or damaged power tools.



Don't connect a power tool to the electrical supply without first making sure the switch is OFF.

Don't adjust or replace blades, cutters, or sandpaper on power tools without first disconnecting the cord from the electrical supply.

Don't chat to other people while using a power tool. It's operation needs your full concentration.

Don't leave a power tool running when you aren't using it. Switch it off when it isn't in use. Don't put it down until it has come to a complete stop.



Don't wear loose clothing or jewellery that could get caught in the power tool's rotating parts.

Don't use power tools in poorly lit areas. You must be able to see clearly what you are doing.

Don't have power tool cables trailing across walkways - someone could trip over them. Keep loose cables off the floor as far as possible.

Don't pull on the electric cord to disconnect the power tool from the wall outlet. Take the plug out carefully.

Don't pull the power tool cables across sharp metal edges, which could cut or scrape the cord covering and cause electrocution.

Don't use power tools if they are wet, greasy or dirty. Use a paper towel to clean the tool.

Some tools cause vibration, which can be harmful. The effects of vibration may be felt as a tingling in the hands and arms. Usually it goes away within an hour. Take a 10-minute break during each hour you are using a vibrating power tool.



Always wear hearing and eye protection when using power tools. They are very noisy and can cause flying chips. If wood dust is generated, wear breathing protection.

## Portable Belt & Disc Sanders

### Problems

Portable belt and disc sanders can cause injuries when the sander jerks off the bench and drops onto a person's leg or foot. This could happen if the sander is plugged into the electricity supply without first checking the power is switched off, or if someone puts the sander down but leaves it running.



Belt sander  
[www.blackanddecker.com]

### Precautions

Don't plug the sander into the electrical supply without first checking that it is switched off. Hold on to the handle of the sander as you plug it in: someone might have turned the switch on without your knowing.

Always keep both hands on the handles of the sander.

Don't feel the sanded surface while the portable sander is still running; you could injure your hand. Turn the sander off first.

Don't let the electric cord get caught by the abrasive belt or disc. Let the cord hang over your shoulder.

Don't replace sandpapers unless you have been shown how by your instructor or Technical Officer.

Don't change sanding belts or sheets without first disconnecting the plug from the power supply.

Always lift the portable sander before switching it on and turning it off.

### Protection

Portable sanders are very noisy: wear hearing protection! The motor fan can blow dust from the vents into your eyes and nose, so wear eye protection too.



## Portable Power Drills

### Problems

Power hand drills can cause injuries when:

- the drill bit breaks when the drill is running and then flies off. This can happen when the drill is forced or the wrong type of bit is used for the work.
- when the drill is operated with the chuck key still on
- the drill jams in the work



Electric hand drill & cordless hand drill  
[www.makita.com]

### Precautions

Don't replace drill bits until shown how by your instructor or the Technical Officer.

Don't adjust or change drill bits without first disconnecting the plug from the power outlet. [In the case of cordless drills, switch off the machine first.]

Don't do any drilling without making sure that the bit is securely fastened in the jaws of the chuck, that the chuck key has been removed, and that your work is clamped firmly on the bench or in a vice.

Don't use larger bit sizes than recommended by the manufacturer, only use the proper size and type of drill bit for the job.

Keep the air cooling vents on the drill housing free of sawdust.

Hold the electric drill securely with one or both hands, while drilling. Try not to force the drill, which could break the bit.

After turning off the power keep holding an electric drill until the motor has stopped. Then put it down on a firm surface.

### Protection

Wear hearing and eye protect because a drill can be noisy and bits of material could fly off during drilling.



## Rotary Power Tools

### Problems

Rotary power tools can cause similar problems to electrical hand drills.

### Precautions

Rotary tools cause vibration. Using them for a long time can cause pain and numbness in your hands and arms. You could feel a tingling sensation that usually disappears within an hour.

To avoid this problem take a 10-minute break during each hour you are using this type of tool. Only hold the tools as hard as is necessary for safe use.

### Protection

Rotary tools are noisy and cause dust. Always use hearing, eye and breathing protection when operating rotary tools.



Variable-speed rotary tools  
[www.dremel.com]



## Portable Jigsaws

### Problems

Portable power saws can cause bad cuts to hands and fingers.

The material being cut can also 'kick back' at you if the blade is forced or twisted.

Sometimes people accidentally cut through the sawhorse supporting their work causing everything to fall and losing control of the power saw.



Sabre saw or portable jigsaw  
[www.makita.com]



## Precautions

Don't try to replace blades without being shown how by your instructor or Technical Officer. Be extra careful handling small blades because they can easily cut your fingers.

Don't adjust or change saw blades without first unplugging the saw from the power supply.

Don't start a power saw until you have made sure the electrical cable won't become tangled in your work or with the saw blade while you cut.

Don't push the power saw through the material you are cutting because the motor could overload or the blade could break.

Make sure the blade isn't likely to come in contact with the sawhorse, if you are using one for support.

Clamp the stock to be cut so that it doesn't move or vibrate.

Keep a well-balanced position on both feet. Always stand to one side of the cutting line, so that if you slip, the blade will go past you.

Make sure you use the correct type and size of blade for the job to be done: using a blade for wood on metal will break it!

To prevent 'kickback' hold the base of the saw firmly against the work, and avoid forcing or twisting the blade. Before beginning to cut allow the blade to gain speed. Grip the power saw solidly at all times, right up to when the blade stops. But remember not to hold it harder than needed for safe use to avoid vibration problems.

### Protection

Power saws are noisy. Using a power saw creates sawdust, which can irritate the eyes and lungs. If you use second hand wood objects in the wood, like nails, could fly off and hit your face. Use hearing and face protection when using a power saw.

## Power Routers

YOU MUST GET SPECIAL PERMISSION TO USE THIS TOOL.

### Problems

Routers can cause injury when:

- the router is fed along the direction of rotation which can cause it to twist uncontrollably
- the router is not held firmly with both hands



Power router  
[blackanddecker.com]

### Precautions

Don't try to use or adjust the router without proper instruction and without reading the manufacturer's manual.

Don't adjust nor change bits, cutters, or attachments without first unplugging the tool from the electricity supply.

Don't use blunt router bits and cutters. Make sure they are sharp, and that you know what each is for before using it.

Let the router get up to full speed before lowering or pushing it into the work.

Always feed the router into the work against the rotation of the bit (the router bits rotate in a clockwise direction). Move the router from left to right when cutting straight edges, or in an anticlockwise motion when cutting circular or curved edges.

Keep both hands on the handles when using the router.

Keep a well-balanced stance when handling the router.

Clamp your work so that it doesn't move or vibrate.

Move the router at an even speed. Moving too fast could overload the motor, while moving too slow could burn the wood and damage the cutters.

Wait for the router to stop before lifting it off your work.

### Protection

The router is very noisy. Always wear hearing, eye and breathing protection when using it.

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### Are you using power tools safely?

Have you checked the power tool is in good condition?

Do you have the PPE needed for using the power tool?

Have you made sure the power tool is switched off before plugging it in?

Have you switched the power tool off when you aren't using it?

Have you made sure the cord of the power tool isn't trailing across the floor?

# Module 4

## Safety in Using Stationary Machinery



Fixed woodworking and metalworking machines can cause serious injuries. With fast moving parts and using high voltages they are a threat to people who are not trained or experienced in their use. You can only use these machines after you have been trained to do so. Anyone who tries to use them without being trained could be stopped from using the FBE Design Lab. Stationary machinery used in the FBE Design Lab include ▫ band saws ▫ scroll saws ▫ mills ▫ disk, bobbin and belt sanders ▫ grinders and buffers ▫ drill presses ▫ wood and metal lathes ▫ circular saws ▫ planer-thicknesser

### General Precautions

Do not use any power machines until you have been trained. If you still aren't sure how to use a machine after being trained in its use, or if you have forgotten how to use it, ask your instructor or the Technical Officer for help.

REMEMBER: THESE MACHINES WON'T GIVE YOU A SECOND CHANCE IF YOU MAKE A MISTAKE.

Don't enter marked work zones around this equipment when it is in use. Only one person should operate a machine at a time. Stay well away from the person operating the machine so there is no risk you could bump them.

Don't start work if the set-up leaves you in an awkward position in front of a machine. You could stumble into the rotating parts of the machine. Ask for assistance from your instructor, the Technical Officer, or your workmates.

Don't start any machine without knowing how to stop it in an emergency.

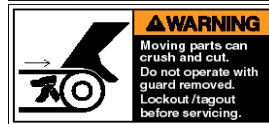
Don't operate equipment that can cause dust, like the sanding machines, without first switching on the dust extractor. But switch the extractor off if there won't be dust from the job because the extractor is a big source of noise in the lab.

### Authorization

THE CIRCULAR SAW, PLANER-THICKNESSER AND GRINDER MUST NOT BE USED BY UNAUTHORISED STUDENTS AND STAFF.

YOU MUST GET PERMISSION FROM THE TECHNICAL OFFICER TO USE THE MILLING MACHINE.

The lathes, drill presses, sanders, and band saws can only be used by people who have been trained and who have passed a safety assessment which shows they know how to operate the equipment.



Don't try to change the operations of a machine without authorisation. For instance, don't change the angle of the bandsaw table or the disc sander table, without getting the permission of the Technical Officer. If you get permission to make changes, put it back into its normal position after use.

### Setting Up

Layout and carefully plan your work before switching on any machine.

Read the machinery instruction manuals and make sure you understand them. Detailed operating instructions are on the wall beside all the stationary machines. Follow these instructions for your own safety. If in doubt, ask!



Don't use any machine unless you are sure that:

- you understand what the machine is used for and how it operates
- the machine is the right one for your job
- the machine is in good operating order and is safe to use
- the machine can do the job you want it to (for example, if the work is too large for the machine, you should move to a machine that has the capacity to handle your work)

If a machine isn't working properly or does things you don't expect report this to the Technical Officer straight away.



Don't wear loose clothing, jewellery, or other accessories.



Wear suitable hearing, eye and breathing protection. Don't wear gloves, as these could easily be caught in the moving parts.



## Starting

Don't switch on any machine until you are sure:

- you know how to stop it
- nothing is obstructing or jamming the machine
- the feed and takeoff areas are clear
- you have proper feeding devices
- the cutting tools are sharp and not damaged
- the work is securely clamped and correctly located
- the wood to be used is clear of knots, checks, cracks, embedded nails or other material defects (these could fly off or cause damage to the cutters)
- all machine guards, cutter guards, wheel guards, and movable control surfaces are securely in place
- dust extraction or exhaust systems are properly adjusted and functioning correctly
- the flow of coolant (when used) is properly adjusted and correctly directed so as not to splash the operator or the floor
- the work light is properly adjusted
- people are clear of moving parts (on

large machines they may not be visible from the operator's position)

- any chuck keys are removed
- machine saw blades are correctly tensioned.

Stand to one side of the machine when switching on – this puts you out of the way if the stock kicks back.

If any machine doesn't work or makes a strange noise don't try to use it until you have checked it out with the Technical Officer.

## Operating

Don't try to force a machine to do more than it is capable of. Don't go beyond the manufacturer's recommended or maximum operating speeds for chucks, saw blades, and abrasive wheels.

Don't force stock into the machine faster than the machine can cut it. The motor could stall or throw the stock back at you.

Never reach across a machine when it is running. Keep your body and clothing away from moving parts.

Don't lean on machines when they are operating. If you slip you could be badly hurt.

Don't put tools on machine beds while the machine is running.

Always feed your work against the cutter's direction of rotation.



Don't go away and leave a machine running. Switch off even if you are leaving for just a short time. Other people might not realize it is running and accidentally brush against the dangerous parts.

If you have stopped a machine and left it for awhile check it over before you start using it again because the settings could have been changed without you knowing.

Don't talk to others while you operate a machine. These machines need your full attention. Stop the machine if you are distracted.

## Safeguards

Never try to bypass, interfere with, remove, or anyway misuse safety guards and machine saw fences. Make sure the guards are in place, working, rigidly secured and correctly adjusted. Guards are there to stop access to dangerous parts of the machinery. They are there to protect you from injury.



Make sure that guards with transparent panels are clear of dusts.

Don't make any changes to guarding without getting permission first.

Don't adjust the guide fence or safety guard on any machine while it is running. Switch it off first!

## Adjustments

Don't adjust machinery while it is operating: switch off first!

Don't adjust positions of work lights and coolant nozzles near running spindles: switch off first!

Don't try to free a jam from a machine when it is running: switch off first!

Don't hand-lubricate machine parts while the machine is operating: switch off first!

Don't gauge or measure your work while it is revolving, or when the work is near revolving cutters, blades, or bits: switch off first!

## Finishing up

Wait until all parts of the machine have come to a full stop before trying to get any loose material near the working parts. If you must push cut pieces out of the way while the machine is turned on, use a push stick or push block and NOT your hands. The stick can be replaced!



When you are finished with a machine make sure it has come to a full stop. Remove cutters, drill bits and work to show that you are finished and to prevent accidents. Brush off or vacuum any rubbish from work surfaces. Put tools and safety gear back in their proper place.

## Housekeeping

Keep the work areas and the area surrounding stationary machinery clean. Make sure it is clear of scraps, filings, off-cuts, dust, spills, and any other rubbish. Someone could slip or trip on these things if they are left on the floor.

Don't try to clean a machine or take away rubbish while it is still moving.

Don't remove metal grindings with your bare hands: they are sharp! Use a vacuum cleaner with the machinery switched off.

Don't use your hands to clear scraps or waste from around rotating cutters.

Tell the Technical Officer about any leaks of lubricants or coolants. These should be fixed immediately. Spilled liquids make the floor unsafe for walking.

## Bandsaws

### Problems

Bandsaws can cause bad injuries if the blade breaks and the wheel guard is not in place. Breakage could happen when:

- the tension isn't correct
- the work is pressed too hard or too fast on the blade
- the blade is twisted suddenly because of cutting tight curves
- the work is not fully supported on the table
- cutting is commenced without allowing the bandsaw to speed up
- the blade is making a rhythmic ticking or hammering sound (indication of brittleness) and the operator continues to cut



BANDSAWS  
[[www.meber.com](http://www.meber.com) +  
[www.gregmach.com](http://www.gregmach.com)]

Injuries can also happen if the person using the saw doesn't make sure it has fully stopped. With all the noise in the FBE Design Lab the next person who wants to use it might not hear that the bandsaw is still running and seriously cut themselves.

## Precautions

Don't begin cutting until the bandsaw reaches full speed.

Don't go on sawing if the bandsaw blade makes strange noises: shut the machine off and report the problem to your supervisor.

Don't have your fingers in line with the blade as you feed material into the bandsaw. Always keep your hand at least 50 mm (2") away from the blade. Use a push stick if you need to get closer.



Don't crosscut or rip long lengths of wood on the bandsaw by yourself. Get someone to help hold the piece.

Don't force the cut. Feed the board into the bandsaw blade firmly, but don't push it too fast.

Don't twist the blade when cutting curves. Cut curves gradually. Make sure the radius of your cut is not too small for the width of the blade.

Don't saw freehand on the bandsaw unless the work to be sawed is resting flat on the table.

Don't stop the machine with the saw in the cutting process.

Use a false table and auxiliary holding device when cutting small articles.

Have a well-balanced stance when cutting, facing the blade and just to the left of the bandsaw table.

Only use bandsaws with the proper guards in place. The front guard must cover the exposed portion of the blade. With the power cut off, adjust the frontal guard as close as possible to the material being cut, approximately 12 mm (½ inch) above it.

Use the correct size of bandsaw for your cutting. Bandsaws with narrow blades are best for cutting sharp curves. Wider blade

bandsaws are for larger circles and straight sawing.

Cut through the waste stock when possible, rather than backing out of your piece with the blade. Backing out of the work could cause the blade to pull off the wheels.

When it is necessary to back the saw blade out of a long cut, turn off the machine and allow the blade to come to a complete stop. Then withdraw the work carefully.

Don't leave the bandsaw after you finish without shutting it off and making sure the blade has come to a complete stop.

## Protection

Always wear face and eye protection.



Don't wear gloves: these can get caught in the machine.



## Scroll Saw

### Problems

Scroll saws, or jigsaws, are generally safe. But if the blade breaks and flies off into your face it could cause a serious injury.



SCROLL SAW  
[www.makita.com]

Blade breaks can happen when:

- the work is pressed too hard or too fast onto the blade
- the blade is twisted when cutting tight curves
- the wrong blade is used for the material being cut

### Precautions

Before switching the scroll saw on make sure:  
the proper type of blade is used  
the teeth of the saw are pointing down  
the blade is correctly fastened in the chucks

Keep your fingers away from the blade. Keep one hand firmly on the work being cut as you turn on the switch.

Don't push the work piece into the blade when making curve cuts or fine cuts. Turn it slowly on the table until the curve has been cut.

Don't leave the scroll saw without first making sure it is shut off and has come to a complete stop. Clean the machine bed as you go.

## Protection

Always wear eye protection.



## Belt, Disk & Spindle Sanders

### Problems

The grit from abrasives belts is like small blades: it will scratch and cut you.

Fingers and hands can get caught in the abrasive belts, disks or drums.

Sanding along the direction of rotation is risky because you can't control your work.



BOBBIN SANDER  
[\[www.gregmach.com\]](http://www.gregmach.com)

Loose hair or clothing could get caught in the machine.

### Precautions

Don't get your hands too close to the moving abrasive disks, belts or drums. Be careful when feeding your work into the sanding area.

Don't start sanding without making sure the sanding belt is properly tensioned, not too loose or too tight. Also make sure the sanding bobbin is securely locked.

Don't start sanding before working out the direction in which the belt, disk or drum turns. Always sand AGAINST the direction of rotation. For instance, don't sand on the up-stroke half (left-hand side) of the disk sanders: sand only on the downstroke (right-hand) side.

Don't sand small pieces on the sanding machines until you have set up a jig to hold

them securely. Better still, sand small items by hand!

Don't go away from the sanding machines without shutting it off and making sure the machine has come to a complete stop. Clean the sanding table as you go.

Two people must never work on the one sanding machine at the same time.

## Protection

Always wear face, eye and breathing protection.



Always turn on the dust extractor when sanding to catch the sawdust.



Don't wear gloves: they can get caught in the sanders.



## Drill presses

### Problems

Drill presses can cause injuries when:

- loose material, clothing or hair are caught into the machine by the twist drills, pulleys or belts
- pieces of swarf [sharp metallic shavings] are spun around
- work is not clamped down and it spin or flies around
- the chuck key is left on the chuck, and flies off when the drill press is switched on
- the twist drills break and fly off in pieces because of jamming; too much pressure used on the drill bit; or by using the wrong bit



DRILL PRESS  
[\[www.gregmach.com\]](http://www.gregmach.com)

### Precautions

Don't turn on the power without first making sure:

- the chuck key has been removed
- the covering guard on the pulleys and belt has been closed

Turn the power on and off quickly to make sure the drill bit doesn't wobble in the chuck.

Don't hold small pieces of work with your fingers. Clamp your work firmly on a drill vice. Bolt the vice to the table, if necessary, to stop it spinning around or flying off.

Don't bore extra large holes without clamping the material to the table and checking the speed.

Don't bore or drill holes with too much pressure. If the wood begins to smoke, release the pressure for a time and work more slowly.

Once you start drilling, watching closely how the drill cuttings are being formed. Be ready to stop the machine at the first sign of trouble.

Don't try to free a jammed drill, or make any changes to the work or to the machine, without first turning the machine off.

Reduce the feed and take extra care when the drill is about to break through the work.

Don't remove rubbish on the machine bed or around the drill bit with your hands. Use a brush and do it only while the machine is stopped.

Don't touch the drill bit or your work straight after finishing drilling. Both could be hot and there may be sharp burrs where the drill has broken through.

Don't go away from the drill press without shutting it off and making sure the machine has come to a complete stop. Clean the machine bed as you go.

## Protection

Always wear face or eye protection when using the drill press, particularly when high speeds are involved. Injuries can be caused by flying chuck keys, broken drill bits, metallic shavings projecting into the eyes, etc. Some dust could be generated, so it would be good to wear a dust mask.



Don't wear gloves; they can get caught in the machine.

## Wood & Metal Lathes

### Problems

Wood lathes can cause injuries when:

- a piece of work that is being turned is poorly glued together and it cracks or collapses and then flies off in various directions
- turning second hand wood or green timber which has knots, checks, cracks, nails and other defects and which cause the work to crack and collapse and then fly off
- fingers get caught between the tool rest and the work
- the rotating parts catch loose clothing, jewellery or hair

Metal lathes can cause injuries when the work isn't adequately sprayed with coolant, causing the material to overheat, crumble, and fly off as red-hot pieces.

### Precautions

Run the lathe at the correct speed for your work. Start at the slowest speed to prevent the lathe from vibrating. Rough down the stock before increasing the speed.

The distance between the tool rest and work being turned should be as close as possible, NOT more than 5 mm (¼ inch). You will



WOOD LATHE

[www.ubeaut.com.au/wdfast1.htm](http://www.ubeaut.com.au/wdfast1.htm)



METAL LATHE

[www.gandmtools.com/Boxford.html](http://www.gandmtools.com/Boxford.html)

have better control of the chisels if the tool rest is close to the stock.

Hold turning tools firmly with both hands while cutting stock on the wood lathe.

Don't turn any piece of wood until you have checked it for knots, checks, cracks, nails and other defects. Make sure MDF boards, which have been glued together, have dried and bonded well before turning.

Use cutting tools at their optimum speed. Don't use a wood gouge for turning metal!

Don't start the lathe without making sure:

- the chuck key has been removed
- the wood is securely clamped in a chuck, or between the headstock and tailstock
- there is a proper clearance for the rotating piece of work, turn the work by hand first with the lathe switched off

Be sure to use screws only long enough to hold the faceplate to the wood block. When turning this piece avoid cutting too deeply and striking the screws.

Don't sand or apply finish on the work without first removing the tool rest. Your fingers can get caught between the tool rest and the work!

Shut off the lathe before you:

- measure the work with a calliper
- make any changes on the tool rest
- remove any rubbish
- load any work
- insert a finger into a hole to feel its finish

Don't try to hold a drill, tap or reamer with a carrier or other holder with your hand while the work is revolving.

Don't go away from the lathe without first shutting it off and making sure the machine has come to a complete stop. Clean the machine bed as you go.

## Protection

Always wear face, eye and hearing protection, especially when using the lathe at high speed. Always wear respirators when turning wood or fibreglass because of the toxic dusts given off.



## Off Limits

Everyone must have permission to use:

- the circular saw
- the planer-thicknesser
- the grinders-buffers
- the mill
- welding equipment



If you must use these machines get help or training from the Technical Officer.



# Module 5

## Safety in Using Hazardous Substances

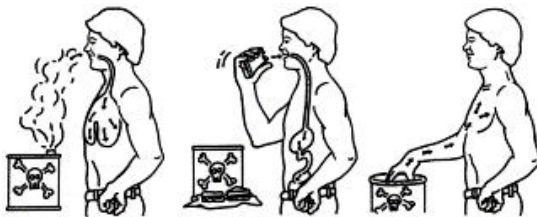
Many chemicals used in the FBE Design Lab can harm your health. They can also put you in danger by catching fire or exploding. That is why these chemicals are often called “hazardous substances”. Chemicals used which can be hazardous include ▫ paints ▫ glues ▫ thinners ▫ lubricants ▫ solvents ▫ cleaning materials ▫ fuels ▫ compressed gases.



### How Hazardous Substances Enter Bodies

Hazardous substances can get into your body in three ways:

- breathing them in
- swallowing them
- absorbing them through the skin



INHALATION, INGESTION, SKIN ABSORPTION OF HAZARDOUS SUBSTANCES [Source: Workcover NSW 1996. Managing Chemical Hazards in the Workplace]

### Breathing in hazardous substances

It's easy to breathe in things like solvent vapours, aerosol sprays, wood dusts, noxious gases, smoke, metal fumes and germs. They can immediately damage your lungs, and be carried to other parts of your body through the bloodstream. The smaller the particles, the further they can get into your lungs.

Moderate amounts of hazardous substances can irritate your nose, throat and mucous membranes. Higher amounts can cause headaches, dizziness, nausea, vomiting, and loss of appetite. Significant exposure can affect how you coordinate your body, can impair your judgment, and can even result in you falling unconscious.

It's important to remember that despite the bad effects they cause, chemicals can have a

nice smell or no smell at all. You can't tell by sniffing whether a chemical is dangerous or not.

### Swallowing hazardous substances

Hazardous substances can poison you if you swallow them. Eating and drinking in the FBE Design Lab can result in vapours and dusts getting into your drinks or food. Paint or solvents can get onto your hands and then be carried to your mouth. Smoking can have the same result. When you have been in the lab always wash your hands before eating, drinking or smoking.

Swallowing a large amount of hazardous substances has the same effect as breathing them in.

### Absorbing hazardous substances through the skin

Hazardous substances mainly enter your body through skin contact. Brief contact with the skin may cause mild to moderate irritation. Longer term or repeated exposure can cause defatting, degreasing and drying of the skin, resulting in allergic or irritant contact dermatitis.

Chemicals can enter your body through open sores, cuts and abrasions in the skin, but many of them can be absorbed without any break in the skin. Once in your body, they get into the bloodstream and can travel anywhere. Chemical-resistant gloves should be worn to stop hazardous substances entering your body through your skin.

## Chemical Reactions

Hazardous substances can cause either acute or chronic reactions.

### Acute Reactions

Acute reaction happens straight after using a hazardous substance. They include things like acid burns on skin, eye irritation, skin rash, or nausea from exposure to organic solvents.

### Chronic Reactions

Chronic reactions build up over time, after repeated or prolonged exposure to small amounts of a hazardous material. It could be years before symptoms appear. Examples are chronic lead poisoning, cancer, nerve damage, and chronic bronchitis.

## Protection from Hazardous Substances

To protect yourself from hazardous substances you must know how to use them safely. There are some straightforward safety precautions you should always follow.

Read the label. Containers of hazardous substances give essential information about what's inside – name of the chemical, what it's made of, possible health hazards from misuse, and how to use the chemical safely. You need to take extra care if the label has words like: DANGER, WARNING or CAUTION.

If a container doesn't have a label and you don't know what's inside then don't use it. And don't try to identify the substance by sniffing or feeling it. It could be corrosive or poisonous!

For more information about a substance, read the Material Safety Data Sheet (MSDS) provided by the manufacturer.

Always wear chemical protective equipment recommended by the MSDS or by your instructor or Technical Officer. The right gloves will protect you from skin contact, while chemical safety glasses will protect your eyes from splashes. Wear a respirator to protect yourself from inhaling dusts, vapours and gases. The wrong type of safety gear could do more harm than using none at all!

Don't eat, drink or smoke while working near hazardous substances. Don't put any tool you

have been using with hazardous substances into your mouth.

Always wash your hands, face, and other exposed areas with soap and water before going to the toilet, eating, drinking or smoking.

Keep your work area well ventilated.

Spray only in the spray booth, or outside if you are working at home.

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## Dangerous Goods in the FBE Design Lab

### Flammable Gases & Liquids

[UN Hazard Classes 2.1 and 3]

Labels: Red diamond with flame symbol.

Most solvent-based substances in the lab are flammable liquids. These include oil-based paints and finishes, kerosene, all-purpose thinners, mineral turpentine, acetone, methylated spirits, epoxy resin, polyester resin, linseed oil, and "Liquid Nails".



Aerosol products – such as spray paints, spray putty spray adhesives, and spray fixatives – contain flammable hydrocarbon gases as propellants.

The vapours of flammable liquids and gases can easily burst into flame. They can also become explosive when mixed with air. This means absolutely no smoking, no open flames, and no sparks wherever these substances are used.

The vapours of flammable liquids can put you to sleep, while breathing them in for a long time can cause complete unconsciousness or even death. Only use flammable liquids in well-ventilated areas.

Swallowing flammable liquids while smoking, drinking or eating can cause nausea and vomiting.

Many flammable liquids can dry the skin on contact; chemical-resistant gloves must be worn.

Pressures can build-up in closed containers such as spray cans, paint cans and solvent

bottles. This can cause an explosion if they are heated. Don't put these empty cans and bottles under heat lamps!

### Organic Peroxides

[UN Hazard Class 5.2]

Label: Yellow diamond with flaming symbol

Organic peroxides are oxidising agents that help other materials to burn by giving off oxygen. If exposed to fire or heat organic peroxides can burn or explode. They can also change into harmful gases or acids that may react dangerously with other chemicals.



Common organic peroxides used in the design lab are benzoyl peroxide and MEKP (methyl ethyl ketone peroxide). They help in casting resins and are used for hardening body fillers. These substances are flammable and explosive, and can irritate the skin.

A SINGLE DROP OF MEKP GETTING INTO YOUR EYES WILL CAUSE IRREVERSIBLE BLINDNESS, EVEN WHEN FLUSHED OUT WITH WATER.

Don't take chances with MEKP, always wear safety goggles, along with breathing protection and gloves. Only use MEKP in an area with plenty of ventilation or with local exhaust systems. Stir the mixture carefully to avoid splashing.

Don't add acetone to MEKP, or plastic resin accelerators to any peroxides: the mixture will explode when mixed!

Don't heat peroxides or expose them to friction or shock. Benzoyl peroxide and MEKP explode when heated to 80°C and 110°C respectively. Keep them away from all sources of heat, sparks, or open flames, and out of direct sunlight.

### Toxics or Poisons

[UN Hazard Class 6.1a]

Label: White diamond with skull-and-crossbones symbol



These substances can cause death or serious illness if you are exposed to them.

Some of these poisons are thought to cause cancer [carcinogenic]. They produce malignant tumour cells that multiply uncontrollably, destroying healthy tissue.

Other chemicals can cause mutations or changes in inheritable characteristics [mutagenic] or can cause malformations of the foetus in pregnant women [teratogenic].

Some poisons in the FBE Design Lab are:

- COMPOUNDS OF LEAD, CADMIUM, MERCURY AND ARSENIC. These are used in many paints and varnishes. They are carcinogenic, teratogenic and possibly mutagenic.
- BENZENE OR BENZOL. These are found in paint removers, and are used as a solvent for plastics and lacquers. They are carcinogenic, teratogenic, and possible mutagenic.
- TOLUENE, XYLENE AND N-HEXANE. These are used in aerosol adhesives, paints, rubber cement and their thinners. They are teratogenic and can harm the central nervous system.
- CHLOROFORM, TRICHLOROETHYLENE, METHYLENE CHLORIDE (ALSO KNOWN AS DICHLOROMETHANE). These are used in rubber cement, plastic solvents, paint removers and spray paint cans. They are thought to be carcinogenic, teratogenic and mutagenic.

### Corrosives

[UN Hazard Class 8]

Label: White-black diamond with dripping test tube symbol



These substances can corrode or eat away materials like steel and aluminium. Epoxy curing agents, and most acids and caustics, are corrosive.

Many corrosives evaporate quickly and their vapours can irritate your nose and eyes. They can also quickly damage skin and eyes. Many corrosives are incompatible with each other. If they are put in unsuitable containers they can eat through the container and leak out.

## Paints and lacquers

### Problems

Many paints contain harmful pigments that have been shown to cause cancer. These include chrome yellow (lead chromate), zinc yellow (zinc chromate), vermilion red (cadmium mercuric oxide), lead white (basic lead carbonate).

Surface coatings give off volatile organic compounds (VOCs) into the air while being used and during drying. Solvent-based coatings contain 30–70% VOCs by weight while water-based coatings contain about 6%.

Paint left on your hands could be swallowed when you eat food or smoke.

Paints can get into the bloodstream through cuts on your skin.

For paints that use solvents there is the problem of breathing in solvent vapour while using paintbrushes, airbrushes and spray cans.

The fine harmful mists from aerosol paints can hang in the air for hours before settling. They can also penetrate deep into the lungs.

Aerosol spray cans can explode and are usually flammable. Use of flammable gases like propane as propellants have resulted in a number of fires.

### Precautions

If possible, don't use aerosols such as spray paints; use liquid non-aerosol products instead.

Wherever possible, use lead free paints or low-solvent products such as water-based coatings or powder coatings.

Spray paint only in the spray booth.

Keep aerosol cans away from heat lamps! Even empty spray cans explode!

### Protection

Wear chemical resistant gloves when brushing paints by hand.



When spraying water-based paints, wear a respirator with a filter for paint spray, dusts or mists.

When spraying solvent-based paints, wear a respirator with an organic vapour cartridge and spray pre-filter.

MATERIALS IN WOOD FINISHING OPERATIONS  
<http://es.epa.gov/techinfo/facts/refinish.html>

Process/Operation	Material Used	Typical Material Ingredient
Refinishing or stripping	Paint removers, varnish removers, enamel removers, shellac removers	Acetone, toluene, petroleum distillate%, methanol, methylene chloride, alcohols, ketones, oxygenated solvents, paint solvents, turpentine
Painting	Enamels, lacquers, epoxies, alkyds, acrylics	Toluene, pigments, titanium dioxide, epoxy-ester resins, aromatic hydrocarbons, glycol ether, halogenated hydrocarbons, vinyl-acetate acrylic
Finishing	Varnish, shellac, polyurethane, lacquers, wood treatments, polishes	Denatured alcohols, resins, shellac, petroleum distillates, toluene diisocyanate
Cleaning Brushes and Spray Guns	Paint thinners, enamel reducers, varnish removers, shellac removers, white spirits	Acetone, toluene, petroleum distillates, methanol, methylene chloride, isopropanol, mineral spirits, alcohols

## Solvents & Thinners

Organic solvents are a common hazard in the lab. They are used to dissolve, mix or remove paints, varnishes, lacquers, and resins; to clean brushes, tools and even hands.

### Problems

Almost all organic solvents are poisonous if sufficient quantities are swallowed or breathed in. Most cause dermatitis after prolonged or repeated skin contact.

Large amounts of most solvents can affect your central nervous system with narcotic effects (causing dizziness, nausea, headaches,

fatigue, loss of coordination or intoxication). This increases the chance for accidents.

Long-term exposure to high concentrations of many solvents can also cause brain and liver damage, blackout or even death.

Solvents can also irritate skin and eyes.

## Precautions

Organic solvents must be treated with great care. Always use them on the basis that they can cause immediate or chronic harm to people. Don't leave them in open containers and keep away from heat and ignition sources. Store them in the correct type of containers – organic solvents can dissolve some plastic containers.

Close the lids of solvent containers when you are not using them to stop vapours getting into the air.

Keep paintbrushes covered when soaking them in organic solvents for cleaning.

Use solvents only where there is adequate ventilation.

Don't work near open flames or other sources of ignition

## Protection

Put on a barrier cream or hand lotion to stop your skin from cracking and to replace the natural oils in the skin that have been removed by the solvents.

Always wear face/eye, skin and breathing protection.



## Important Note

If you are pregnant and you want to use the FBE Design Lab, read the article "Pregnancy and the Crafts Professional" in [www.craftsreport.com/september97/pregnancy.html](http://www.craftsreport.com/september97/pregnancy.html)

Until more is known about the reproductive effects of various substances used in the lab, it is wise to avoid unnecessary exposure to these and other hazards.

## CHARACTERISTICS OF ORGANIC SOLVENTS.

[References: McCann 1992, Artist Beware; Spandorfer 1993, Making Art Safely; Rossol 1994, Artists' Complete Health and Safety Guide]

Organic Solvent	Examples	Uses	Characteristics
Alcohols	Methanol (wood alcohol), ethanol (ethyl alcohol), glycerine	Thinning shellac and lacquer. Removing paints and varnishes.	Damage to liver and central nervous system (CNS)
Ring or Aromatic Hydrocarbons	Benzene and benzene derivatives, toluene, Xylene	Dissolving resins. Removing paints and varnishes. Thinning lacquers. Washing up silk screens. Propelling aerosols in spray cans.	Flammable. Depression of CNS and bone marrow. Damage to liver, lungs. Can cause cancer, esp leukaemia.
Halogenated or Chlorinated Hydrocarbons	Chloroform, carbon tetrachloride, perchlor ethylene, trichloro ethylene	Dissolving waxes, oils, resins, grease and plastics. Removing paints.	Usually non-flammable. Severe CNS depression and liver damage.
Straight-chain or Aliphatic Hydrocarbons (Petroleum Distillates)	Gasoline, kerosene, turpentine, mineral spirits	Thinning paints. Dissolving rubber cements and silkscreen poster inks. Cleaning up.	Flammable. May be heavier than air. CNS depression. Damage to nervous tissue, liver, kidneys, eyes, lungs.
Glycol Ethers (Cellosolve)		Thinning lacquers and paints. Propelling aerosols in spray cans.	CNS depression. Damage to liver, kidneys. Can cause birth defects, miscarriages, testicular atrophy & sterility. Explosive.
Aldehydes, ketones, esters	Formaldehyde, acetone, methyl ethyl ketone (MEK), ethyl acetate	Dissolving lacquers, oils, waxes, plastics, and vinyl silkscreen inks.	Flammable. CNS depression. Affects skin, lungs, kidneys.



## Filling compounds

Fillers are used for patching holes, gaps, dents and chips in models. When dry they can be sanded, nailed, planed, painted or lacquered. Filling compounds include:

- **SOLVENT-BASED FILLERS.** Include wood filling cement ("PlasticWood"), automotive body fillers, spot putty, and spray putty. The bases for these filling compounds are typically polyester or epoxy resins, and use styrene or other solvents.
- **WATER-BASED FILLERS.** Include patching plaster ("Spakfilla").

## Problems

Solvent-based fillers have dangers similar to solvents and paints.

Repeated or prolonged contact with the skin can cause skin drying, defatting and dermatitis.

Dusts from patching plaster and from dry-sanding dried fillers can irritate the mouth, nose and throat.

## Precaution

Don't let fillers get on your skin and don't breathe in their vapours.

Mix and apply filling compounds in well-ventilated areas only: in the fume extractor box, spray booth, or outdoors.

## Protection

Wear appropriate gloves, safety goggles and an organic vapour cartridge respirator when mixing and applying solvent based filling compounds.



Wear a dust mask when dry rubbing or sanding dried fillers.



## Adhesives

Different types of adhesives are used in the lab to glue modelmaking materials and components together. These include

- **WATER-BASED ADHESIVES.** Contains polyvinyl acetate or alcohol (PVA). Trade names include White Glue, Elmer's Glue-All and Aquadhere.
- **SOLVENT-BASED ADHESIVES.** Contains methylene dichloride, ethylene dichloride, trichloroethane, synthetic rubber, n-hexane, methyl ethyl ketone (MEK) or other solvents. Trade names include GelGrip, KwikGrip Solvent Contact Adhesive, Tarzan Shoe Glue, Liquid Nails, Acrylic Cement, Rubber Cement, and Styrene Cement.
- **INSTANT ADHESIVES.** Contains cyanoacrylate. Trade names include SupaGlue, Super Glue, and Tarzan's SuperGrip.
- **TWO-COMPONENT ADHESIVES.** Contains epoxy. Trade names include Araldite.
- **HOT MELT ADHESIVES.**
- **FORMALDEHYDE ADHESIVES.** Contains urea or phenol formaldehyde. Trade names include Weldwood and Resorcinol Glue. Often used for gluing wood veneers and for large woodworking projects.
- **SPRAY ADHESIVES.** Contains toluene, acetone, chlorinated hydrocarbons, or petroleum distillates as solvents. Trade names include 3M Spray Mount and 3M Foam Fast.

## Problems

Solvents in adhesives cause the same problems as is paints and thinners. The vapours are harmful if breathed in. They are highly volatile, flammable, and can ignite easily.

When using instant adhesives there's a danger of sticking skin to skin.

When hot melt adhesives are badly overheated, the fumes given off can irritate the throat, lungs and eyes and cause sick feelings.

Hot molten glue sticks can burn the skin.

The cyanoacrylate in instant adhesives can irritate the eyes, producing tears and causing light-headedness or dizziness when the vapour is breathed in.



In two-component adhesives, when the epoxy resin and hardener are combined the mixture gives off heat that vaporizes any solvents in it. Too much hardener can cause the epoxy to heat to the point of decomposition and ignition.

Epoxy resins can irritate the skin.

Epoxy hardeners can cause rashes, allergic dermatitis and asthma. Allergic reactions sometimes appear only after repeated exposure over a long time.

Formaldehyde adhesives release formaldehyde gas, which irritates the eye, causes asthma and other breathing allergies, and is a suspect carcinogen.

## Precautions

Don't inhale the vapours or mists of adhesives.



Don't smoke! A lighted cigarette will ignite the fumes of solvent-based adhesives.

Don't use solvent-based adhesives in poorly ventilated areas, near open flames or spark-producing devices.

Don't leave cans of spray adhesives under the heat lamps: even empty ones could explode! Use solvent glues sparingly. Spreading adhesive around only increases the amount of solvent vapours released into the air.

Keep the lid on containers of solvent-based adhesives as much as possible.

Whenever possible use liquid non-aerosol adhesives. The fine toxic mists in spray adhesives can remain in the air for hours before settling and you can breathe them in.

## Protection

Don't handle glues (especially instant adhesives!) with bare hands. Wear vinyl or latex gloves.



Wear chemical respirators when working with solvent-based and spray adhesives.



Wear goggles to prevent splashes, mists or vapours of adhesives from getting into your eyes.



When using large amounts of

adhesives (especially epoxy), do your gluing in the spray booth, fume extractor box, or outdoors.

## Warning

Instant adhesives will stick skin within seconds of contact. Skin stuck together can be separated by soaking in warm, soapy water for several minutes and then gently peeling the bond. With appropriate care, acetone or nail polish remover can also be used.

If instant adhesive gets into the eyes, it can stick eyelid-to-eyelid or eyelid-to-eyeball. Flush eyes with a lot of water and get medical attention. Usually the eye will open in 1 to 4 days without too much damage. Do not try to force the eyes open!

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## Dusts

There are many sources of dust in the lab: timber, MDF (medium-density-fibreboard), plaster-of-Paris, fibreglass castings, plastic sheets, and blue foam. Dry sanding of body fillers and putties also causes dust.

## Problems

Dusts irritate the mouth, nose and throat.

When dust is coughed up as phlegm it could be swallowed.

Occupational exposure to wood dust has been shown to cause cancer in the nose and sinuses.

Some wood dusts contain harmful substances such as pesticides, preservatives and silica.

Fine wood dust in a confined area can form flammable clouds in the air, which can explode if ignited by a spark or match.

## Precautions

Use dust extraction at the point where the dust is being produced, if possible.

Clean up all dust at the end of each day.

Don't dry sand. Constantly wet your sandpaper while hand-sanding to stop dust getting into the air.

Don't dry sweep because it spreads dust in the air. Collect dust with a vacuum cleaner or with the dust extractor.

Sanding must be done in a well-ventilated area.

### Protection

Wear a dust mask when dry-sanding, using dust-producing equipment, or using plaster of Paris.



If dust causes irritation, cover your skin by wearing long sleeves or gloves.

### Are you using hazardous substances safely?

Have you read the label on the hazardous substances container before using it? (Find the MSDS if you need more information)

Are you using the necessary PPE?

Are you eating or drinking while working?

Have you washed your hands after using any hazardous substances?

Have you kept the lids on hazardous substance containers when not using them?

# Module 6

## Safety in Using Other Tools and Processes

*There are other tools, materials and processes in the FBE Design Lab which must be used carefully or they can cause hazards. These include ▫ hot wire foam cutters ▫ plastic strip heaters ▫ heat guns ▫ vacuum former ▫ heat lamps ▫ guillotines ▫ compressed air ▫ spray guns*



### Hot Wire Foam Cutters

#### Problems

Hot wire foam cutters can be hazardous because:

- The wire on the cutter gets very hot and can cause serious burns.
- Cutting materials like PVC sheets, polyurethane and blue foam give off dangerous gases which can harm your eyes, skin, and internal organs.

#### Precautions

Don't touch the hot wire to see if the power is on or the wire is hot enough. Check the pilot lamp on the switch, or test the hot wire with scrap blue foam.

Don't get distracted while foam cutting: concentrate on your job.

Never cut PVC or polyurethane foam on the hot wire. Work only on polystyrene foams such as "blue foam" and "Styrofoam".

#### Protection

Wear a respirator so you don't breathe in fumes from heated foams.



### Guillotine

#### Problems

The guillotine knife is very sharp and can cause serious cuts.

#### Precaution

Keep your fingers right away from the cutting edge.

### Plastic Strip Heater

#### Problems

The plastic strip heater can cause hazards similar to the hot wire foam cutters:

- The heated strip gets very hot and can cause serious burns.
- Leaving the strip heater on can burn the plastic sheet, giving off dangerous fumes.
- Fumes from overheated or burning acrylic sheets, PVC and polystyrene can give off dangerous gases which can harm your eyes, skin and internal organs
- The heat-bent plastic sheet could be hot.

#### Precautions

Don't touch the heating strip to test if it is on or is hot enough.

Don't touch the heated plastic sheet with bare hands: you could burn your fingers.

Don't go away and leave the plastic strip heater on, even if it could take awhile to soften the plastic sheet.

Don't use the plastic strip heater on foams. Don't overheat the plastic sheets.

Don't breathe in fumes while heating either acrylic or PVC sheets.

#### Protection

Wear a respirator so you don't breathe in fumes from overheated plastic sheets.



Wear thick leather gloves while you are shaping the heated plastic on to the bending guide or mould.



## Heat Gun

### Problems

The heat gun uses very hot air - it can burn your skin.



Heat Gun  
[www.makita.com]

### Precautions

Don't let the hot air from the gun hit your unprotected skin.

Don't touch the heated plastic sheet with your bare hands, or you'll burn your fingers.

Don't put the hot air gun too close to the plastic you're working on. The vents could get blocked and the gun could overheat.

Don't put the hot air gun down while it is still running. Turn off the power first.

Don't go away and leave the hot air gun on.

### Protection

Wear thick leather gloves as you shape the plastic sheet with the hot air.



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## Heat Lamps

### Problems

The heat lamps can cause hazards when:

- foam models are put too close to the heat lamps and they melt or even burst into flames.
- cans of paint, thinners, spray adhesives, and spray finishes are put under the heat lamps and they overheat and explode.

### Precautions

Keep your foam models at a reasonable distance from the lamps.

Keep flammables away from the heat lamps. Even empty aerosol cans still have flammable propellant residue in them which can explode.

Switch off the lamps when you're not using them.

## Vacuum former

### Problems

The vacuum former can be hazardous when:

- Overheated plastic sheets give off toxic gases.
- The clamping frame and the softened plastic sheet get very hot.

### Precautions

Don't leave the vacuum former - you've got to keep an eye on the plastic or it could overheat and start burning.

When you finish your work make sure the vacuum former is turned off - and that means all switches, including those for the heaters and vacuum pump.

Make sure there is good ventilation when using the vacuum former - open the exterior door and the exhaust fan in the vacuum forming area.

### Protection

Wear thick leather gloves when shaping the heated plastic sheet into the mould and when handling the clamping frame.



## Compressed Air

### Problems

Compressed air can be hazardous because:

- Compressed air pointed at the eyes can cause serious injuries, even blindness.
- Compressed air pointed at the ears can burst the eardrum, leading to permanent hearing loss.
- Compressed air getting into cuts or scratches on the skin can cause painful swelling. If high-pressure air goes through the skin and gets into the bloodstream, it can kill.

### Precautions

Always use compressed air carefully.

Don't point compressed air at other people or towards yourself.

Don't use compressed air to try to blow dust off your clothing or skin.

Don't use compressed air to blow away sawdust or metal grindings from machinery.

Before using compressed air, make sure it will not blow particles in the direction of any other person.

Use compressed air only with the lowest possible air pressure.

Do not attach a spray gun to the compressed air supply without permission from the Technical Officer.

Don't muck around with compressed air.

### Protection

Wear eye and hearing protection when using compressed air.

Wear leather gloves when pointing compressed air at small handheld pieces of work.



## Spray Guns



Gravity Feed and Suction Feed Spray Guns.  
[[www.orangepea.com](http://www.orangepea.com) + [www.hvlp.com](http://www.hvlp.com) ]

### Problems

Spray guns can be hazardous because:

- Spray guns use very high pressures and can actually force paint through your skin.
- Paints and solvents used in spray guns are dangerous chemicals.
- Paints and solvents are also highly flammable, they can burst into flames.

### Precautions

Don't point a spray gun towards yourself or at anyone else.

Don't spray where there are hot surfaces, sparks, or open flames.

Before you spray make sure you know where the nearest fire extinguisher is.



### Protection

Wear safety goggles and an organic respirator to stop vapours or mists from sprayed paint, primer or putty getting into your eyes or lungs.

Wear disposable gloves to stop skin contact with solvents and paints.

Even if you have worn gloves while spray painting, wash your hands before you eat, drink or smoke so you don't swallow any chemicals that could be on your skin.

Only use the spray gun in the spray booth with the exhaust ventilation turned on.



## Digital Prototyping

### Problems

- The support material is brittle: it can break into bits and pieces during removal from the built prototype, leaving sharp edges.
- The solution for dissolving the support material is caustic and can cause skin problems, particularly for people with sensitivity to soaps and detergents.
- The water in the dissolving tank is 70°C: that's hot!

### Precautions

Avoid handling parts inside the dissolving tank with your bare hands.

Take extra care when breaking off the support material from the built prototype.

### Protection

Wear eye protection to avoid flying debris.



Wear rubber gloves when taking your prototype out of the dissolving tank.



### Are you using other tools and processes safely?

Have you been shown how to use the tools you need?

Are the tools you are going to use in good condition?

Have you got the PPE you need?

Do you know where the nearest fire extinguisher is?

Have you got enough room in which to do your work?

Are you working in the place set aside for the tools and processes you are using; eg spraying in the spray booth?

Did you clean up when you finished and put tools and materials away where they belong?



# Appendix A: Personal Protective Equipment

*Sometimes you will have to use Personal Protective Equipment (PPE) in the FBE Design Lab. This is a must when doing certain types of work or when working in some parts of the lab.*

Workplace safety can be enhanced and the severity of an injury can be reduced or prevented through the use of PPE. PPE gives you a basic level of protection, so don't fall into the trap of thinking that using PPE alone will keep you safe. PPE is limited in the protection it can give and should only be used as part of a number of safe work practices and any other hazard controls that are possible, like using ventilation and keeping the work area clean.

The PPE you use must fit well and be the right PPE for the job. For instance, use a face shield when goggles don't give enough cover, use a chemical-protective respirator instead of dust masks around fumes.

## Breathing Protection

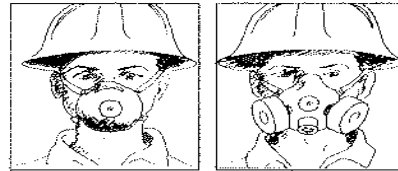


Whenever you are working in an area where toxic dusts, mists, vapours, gases, or fumes are present always wear the appropriate breathing protection and use the local exhaust ventilation.

Breathing protective equipment usually comes in four different types:

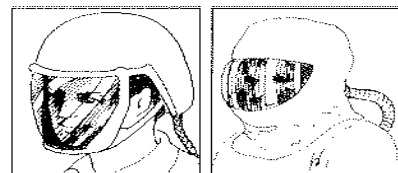
- **DUST MASKS** are used when there are low levels of dust from activities like grinding, spraying and mixing toxic materials such as synthetic mineral fibres, asbestos, silica, caustic mist and lead. Dust masks cover the lower half of the face and are made from felted or matted fabric, or they can be made from paper. Dust masks are meant to be thrown away after use.
- **CARTRIDGE RESPIRATORS** are used when there are low to medium dust

levels. They form either a half or full face mask and are reusable. Cartridge respirators come with either one or a pair of disposable filtration cartridges. Depending on the cartridge used in the mask, they can protect against things like dusts, spray paint and chemicals.



Disposable dust masks (for low to medium dust levels).

Cartridge respirator (for low to medium dust levels).



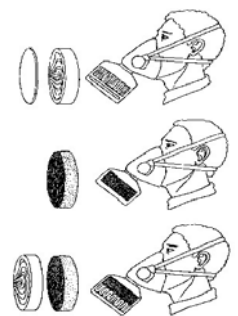
THIS TYPE FILTERS THE AIR  
Battery powered respirator (for medium dust levels).

THIS TYPE SUPPLIES CLEAN AIR  
Air line hood respirator (for very high dust levels).

Equipment for respiratory protection  
[Source: WorkCover Authority of NSW. Publication #351:  
Dust in the Workplace - How to prevent silicosis]

## Warning

People with asthma or other breathing problems could find respirators uncomfortable to use. However, many disposable respirators have exhalation valves to make breathing easier.



You should have your own breathing protection devices. This stops the chance of being exposed to someone else's bodily fluids, like sweat, saliva or blood.

Different filters for cartridge respirators. Top to bottom: cotton filter for dusts, activated charcoal filter for organics, combined cotton and activated charcoal filter. [Source: [www.itcilo.it/actrav\\_cdr\\_om2/en/osh](http://www.itcilo.it/actrav_cdr_om2/en/osh)]

Make sure respirators fit properly before using them. Having a beard could stop the face seal from working properly.



## Face & Vision Protection

There are three ways that your eyes and face can be injured in the lab:

- **MECHANICAL.** Flying particles, projectiles, sparks, grindings, turnings,

or dust

- **CHEMICAL.** Splashes and vapours of acids, alkalis, solvents, detergents, coolants, steam
- **RADIATION.** Glare, intense light, ultraviolet, infrared, microwave, laser, or ionising energy

Work activities which put your face and eyes at risk include:

grinding	polishing	chipping
drilling	machine tooling	cutting
impact of steel on steel or other materials	welding brazing soldering	use of any high-speed rotating device that might break or disintegrate
sandblasting	saw milling	spraying paint

Always wear face or eye protection appropriate to task you are doing. Wear protection at all times in the machining area even when you aren't using the machines.

Face and eye protective devices include:

- **SAFETY GOGGLES OR GLASSES.** These cover the entire eye area. Special safety goggles provide protection against chemical splashes and fumes.
- **OVERGLASSES.** These can be worn over personal prescription glasses.
- **FACE SHIELDS OR MASKS.** These safeguard the face against splashes or flying chips. But they **DON'T** give adequate eye protection, so goggles should be worn under the face shields.

## Warning

Prescription glasses and contact lenses are **NOT** impact resistant and do **NOT** provide adequate eye protection when working with machinery or chemicals.

## Hearing Protection

Exposure to loud or continuous noise can cause loss of hearing. Hearing protection should always be worn when there is loud or continuous noise.

Equipment in the design lab which cause loud noise include bandsaws, circular saws, routers, power sanders and the dust extractor.



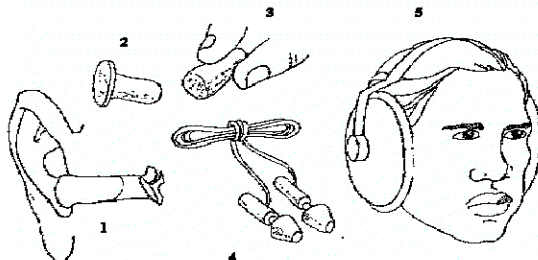
The law defines too much noise as sound levels that exceed an 8 hour noise equivalent of 85 dB or peak at more than 140 dB. Noise at 85 dB is something like the noise of a busy city street or the sound of a heavy truck. A 140 dB sound is as loud as a jet engine.

There are two types of devices which protect the ears from loud noise:

- **EARPLUGS** are worn in the ear canal. They are less effective than earmuffs. They can cause ear infection if pieces of the plug are left in the ear or if a dirty plug is used. Foam earplugs are disposable, while the solid plastic or rubber earplugs can be used again.
- **EARMUFFS** are worn over the whole ear. They protect better than earplugs if used correctly. They are less efficient when they do **NOT** fit tightly or when glasses are worn with them. In hot, humid conditions people often prefer earplugs because earmuffs make the ears sweaty and uncomfortable. But, remember, this lowers the level of protection.

## Warning

Don't make your own hearing protectors using cotton balls or other materials. They give no protection at all!



### HEARING PROTECTORS

1 formable wadding-acoustical fibres; 2 plastic-covered acoustical fibres; 3 expandable plastics; 4 reusable plastic earplugs; 5 earmuffs

[www.itcilo.it/actrav\\_cdrom2/en/osh](http://www.itcilo.it/actrav_cdrom2/en/osh)

## Foot Protection

It is a University requirement that enclosed footwear must be worn at all times by users and visitors in all laboratories: no bare feet, thongs, or sandals at any time.



If you handle or move heavy

pieces of equipment or materials, or you frequently change tools on lathes and mills, then you feet run the risk of being crushed or stabbed by falling objects. Steeled-toed safety footwear isn't compulsory in the design lab, but it's a very good idea.

## Hand & Skin Protection

Your skin is at risk from oils, grease, cutting fluids, turpentine, thinners, kerosene, and other solvents. Prolonged contact can cause dermatitis or other skin problems.

Use a barrier cream like sorbolene or lanolin on your hands before starting work to help protect you from dermatitis. Put the cream on a number of times during the day if you are working for a long time in the design lab. But make sure your hands don't become slippery

### Warning

Don't use spirit solvents to take oil or grease off your hands. These will remove the natural oils from the skin and lead to skin troubles.

Don't put oily rags in your pockets. Oil stained clothing in contact with the skin can cause serious health problems.

Always wear leather gloves to protect against cuts and burns when working with sheet metal or when vacuum forming plastics.

Always wear chemical-resistant gloves (such as rubber, latex or vinyl) when you are going to be doing a lot of work with chemicals. Check out the chart below to find out which glove material is suitable for the chemicals you are handling.

Don't wear gloves when using rotating machinery! The gloves could get caught in the machine and drag your hand in.



## Important Note

The FBE Design Lab has a number of face shields and earmuffs for everyone's use.

USE THESE PPE AT YOUR OWN RISK. If you have sensitive skin there is a chance you could develop allergies or other dermatological problems from using it.

For hygienic reasons you are advised to bring your own PPE, such as earplugs, dust masks, half-face respirator with filter for paint sprays and dust, and safety glasses.

In the interest of your safety you will not be allowed to use machines and tools which require protective gear for their safe operation if you don't have the necessary PPE.

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## Appendix B: Working after Hours

*The light workshop is accessible 24/7 to authorized users by swipe card.*

The primary concerns with people working after hours are:

- The possibility of bringing persons who are not permitted to be in the space
- The increased personal safety risks of actually being alone after hours
- The lack of access to emergency response support, in the event that the person is injured or requires medical attention

The following issues should be considered when contemplating working after hours:

- The nature of your work and what could go wrong
- Your experience and training
- Having another authorized user as a companion who could assist in calling for help in an emergency

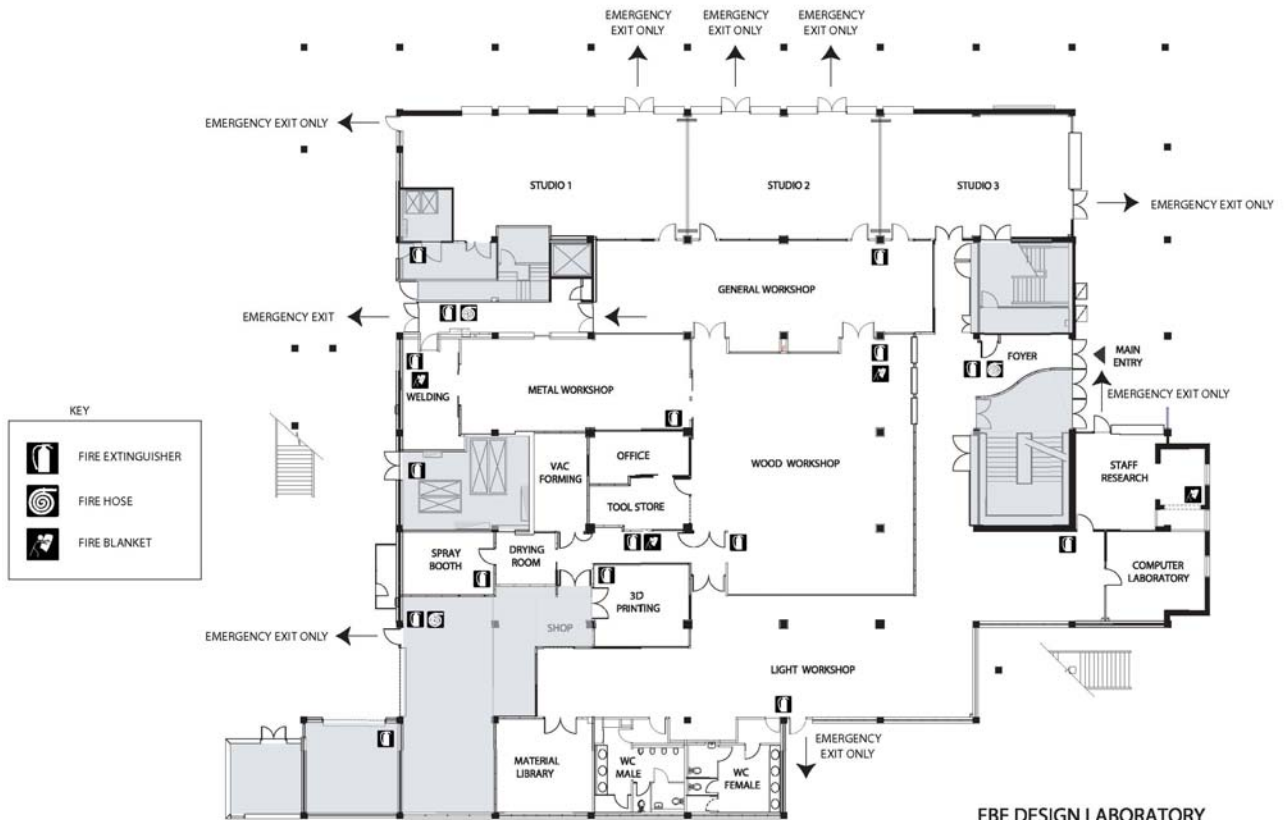
The following should be contacted in case of after-hours emergencies:

- 56666 UNSW Emergency, from the FBE Design Lab Emergency Phone
- 938 56666 UNSW Emergency from a mobile phone
- 1800 626 003 UNSW Security Freecall (not-so-urgent cases)

# Appendix C

## FBE Design Laboratory Emergency Response Plan

All laboratory users should be familiar with the locations of fire fighting equipment and emergency exit locations within the Squarehouse, as well as the evacuation assembly point at the University Mall facing the Blockhouse.



FBE DESIGN LABORATORY  
GROUND FLOOR, THE SQUAREHOUSE  
ICONS DRAWN INTO FLOOR PLAN BY ANTHONY JONES

