



The Manufacturing Jewellers SAFETY HANDBOOK

Jewellery Training Solutions guide to safe work practices by Peter Keep

This booklet outlines the Workplace Health & Safety provisions and it has been designed to assist in the implementation of safe work practices and procedures specific to the Australian jewellery industry. Employers are granted permission to issue a copy to employees. Please note policies and obligations may vary from country to country.

WORKPLACE HEALTH & SAFETY

Vision

Every Jewellery manufacturing workplace needs to aspire to achieving excellence in Workplace Health and Safety and Workplace Rehabilitation systems by providing a safe workplace environment free of hazards.

Employer Responsibility

That the Workplace Health and Safety Act and Regulations, Codes of Practice and any other relevant instructions are observed and adhered to with the aid of Management, Safety Officers, Safety Representatives and all staff.

The jewellery manufacturing workplace also recognises its obligations and responsibilities to provide, so far as practicable, a safe environment through the identification, control and elimination of hazards.

Employee Responsibilities

Observe and comply with all safety instructions.

- Use safe working practices and procedures, safety equipment or PPE. (Personal Protective Equipment)
- Ensure equipment is in an operational and a hygienic condition at all times.
- Report any likely hazards or unsafe acts immediately to their Manager.

Personal Protective Equipment (PPE):

If you are required to wear personal protective equipment such as, safety glasses, masks, and hearing protection you must maintain it in good order and use it when required to do so.

PPE may consist of: -

Eye and face protection

The eyes and the face are an important part of the body and must be protected from corrosive solids, liquids, vapours and foreign bodies. Tinted lenses in safety glasses or goggles can be used to screen out ultraviolet and infrared radiation. They should not be worn when not needed.

It is strongly recommended that eye protection is worn at all times in a jewellery workshop.

Welding protection

Welding produces visible, ultraviolet and infrared radiations. Face shields or goggles with appropriate lenses can be used for protection.

Masks for dust or fumes

Must be worn when handling dry casting investment powder or exposure to toxic fumes such as hot sulphuric acid.

Hearing protection

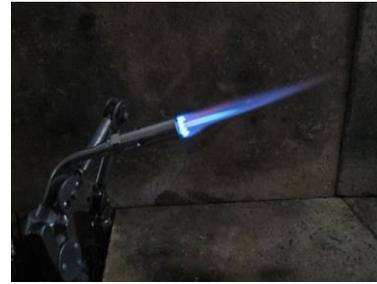
The type of hearing protection chosen will depend on: -

- Personal choice by the operator for comfort and fit
- Decibel reduction required (ear muffs will give better reduction than ear plugs)
- The work situation. (Where gloves are used, earmuffs are best, as earplugs have to be constantly adjusted.)

Remember: hearing damage is permanent. If you are required to wear personal hearing protection - make sure that you wear it at all times in noisy areas.

SAFETY AT THE BENCH

Torch Safety



- All torches using pressurised gas and oxygen must have flashback arrestors installed either on the handle of the torch or at the regulator.
- When lighting the torch always open the gas valve first, light the torch and then mix in the oxygen. When turning the torch off, close the oxygen valves first and then the gas valve. This will prevent build up of carbon inside the torch tip and stop the popping noise happening.
- At the end of the day, close both the gas and the oxygen valves at the cylinders and bleed any gas and oxygen from the hoses. Regulators should read “0” when turned off properly.
- Remember – Gas stored in cylinders can be very explosive. Keep cylinders of compressed gas chained. Gas and oxygen cylinders should be stored at least 3 metres apart and valve caps must be on cylinders that are not being used. If you need to move a cylinder, never roll them across the floor, always use a hand cart. If mishandled, cylinders, valves or regulators can break or rupture, causing damage as far as 100 yards away!

Soldering



- Use cadmium and antimony-free solders. Cadmium can cause pulmonary edema (fluid on the lungs) and can contribute to lung and kidney damage as well as lung and prostate cancer. Antimony poisoning is similar to arsenic poisoning.
- Don't have flammable materials on or near the soldering area. Make sure you have a fireproof surface.
- Have a fire extinguisher handy.
- Ventilate to remove any smoke or fumes from soldering.
- Wear protective goggles.
- Use leather gloves when handling hot metals
- If you are doing a repair, have a good look at the piece you are working on before you start to avoid any accidents e.g. a hollow piece will explode when heated and can cause injury.

Pickling



- Wear eye protection. Gloves and an apron are also recommended.
- Do not quench hot metal in the pickle. Hot acids give off evil mists and vapours, and can burn your skin and eyes if splashed.
- Use a ventilation system or place the pickle pot in front of a window exhaust fan. Cover the pickle when not in use.
- Try and use sodium bisulphate pickle as apposed to sulphuric acid as this comes in dry granules and is safer to store than liquid sulphuric acid. Other alternatives are: household vinegar and salt and lemon and salt.
- Have some sort of eye bath nearby in case of splashes.

Sawing/Piercing

- Don't saw too fast or violently. This can result in the saw blade breaking and going into your finger. Also never put your fingers in the path of your saw
- Lubricate your saw with wax.
- Always wear eye protection. Blades have blinded people upon breaking.
- Make sure the frame is in good condition and all nuts and bolts are secure.
- Make sure your bench pin can't slip about.
- Make sure you clamp or hold your metal securely when you are sawing.
- Use good lighting.



Hammering

- Make sure the head fits tightly. Check this every time you use the hammer. Tighten your hammer every now and then with a blow to the end of the handle.
- Make sure any stamps and chasing tools are properly tempered so they don't snap and hurt you. Always wear eye protection.

Filing



- Make sure all your files have handles.
- Files are tempered very hard. Do not press down too hard on them as they can snap sending the metal into your eye. Always wear eye protection when filing.
- Only use files for their intended purpose.
- Be aware of the dangers of the material being filed.
- Damp mop the work bench to keep it clean of particles.
- Be aware that the metal you are filing can get hot with friction and can burn

Engraving/Setting



- If you slip when using your engraver, you can push the engraver straight into one side of your hand and out the other side. To minimise the chance of this happening, always keep your engravers sharp and cut away from yourself. You can also wear a thick leather glove.
- Whenever possible, keep your free hand protected by a bench pin or part of an engraver's ball.

- Small burrs raised by the engraving tool can badly slice your finger. Always brush away particles using a brush.
- Be careful when using pitches and shellacs as they can be harmful on skin contact. Hot pitch and shellac can burn and can also cause dermatitis and even skin cancer.
- Always wear eye protection.

Flexi – Drive Use

- Always wear eye protection. Face shields are recommended over safety glasses.
- Use hearing protection, especially with high pitched noises.
- If you are using a key in a chuck remember to remove it before you use the drive.
- Never wear dangling jewellery or loose clothes that could get caught.
- Hold the piece you are working on securely against the peg.
- Never use a drill or burr that appears to be wobbling, out of round, vibrating or not running true.

Polishing

- Beware of dust particles from the polishing compounds, these can cause lung disease and can promote dermatitis. Always wear a dust mask.
- Never wear loose gloves they can get caught in the wheel and your hand can be sucked into the machine.
- Avoid loose clothing and keep long hair tied back.
- Wear eye protection at all times. A face shield is a good idea as well.
- Have a soft pad below the polishing buff to prevent items caught on the wheel from bouncing back at you and causing injury.
- Use a dust collection system on your polishing motor and keep the filters and extraction system clean. Wipe down with a damp cloth to keep dust to a minimum.
- Wash your hands with mild soap and water or a citrus hand cleaner. Never clean your hands in the ultra – sonic.
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Working with Molten Metals

In your career as a jeweller as a matter of course, you will continually come into contact with hot materials, due to soldering and annealing, and molten materials. It is important that a few simple safety procedures are always followed so as to minimize injury from molten material.

- Always observe safe workshop procedures. Check all equipment for workability and worthiness before commencing. Assume that the area has recently been used and equipment is still hot.
- Always wear the appropriate Personal Protective Equipment. Full-face protection may be necessary for heat protection. Tinted eye protection is suggested for glare from the torch and the molten metal. Gloves and apron will also protect from heat.

- Never try to carry quantities of molten material any distance. Due to the nature of the substance it is difficult to control.
- Never overheat flasks, crucibles or equipment.
- Never operate a centrifugal casting machine without a fixed metal guard in place.
- When using centrifugal equipment be aware of a number of circumstances. *There is molten metal. There are moving parts.* A system should be initiated and rigidly adhered to by the operator so as to minimize the risk of injury or damage from such things.
- Do not try to melt more material than the crucible or flask will safely hold. This can lead to spillage and overflow.
- When using resistance heated vacuum assisted casting equipment always follow the procedures as set down by the manufacturer. Failure to follow such procedures can lead to costly repair bills and possible injury.
- After cooling period for flasks, be wary when quenching in water as the thermal shock can create spray of water and steam.
- Always be wary of work-mates when moving around the workroom when molten material is being used.
- If an injury should occur, flood the area with cold water; keep the area flooded with cold water and call for medical assistance.



Good Housekeeping

These activities are easy to organise and are often neglected. They will reduce both minor and serious accidents and injuries if they become part of the normal working day.

You cannot just tidy up a bit when you have time. The design of the jewellery workplace can help to: -
Separate areas are required for different activities –

1. Dirty areas: Polishing. Casting. Gem cutting and polishing
 2. Wet areas: Sinks for clean-up. Pickling with extractor system. Plating area. Investment mixing
 3. Clean areas: Jewellers main workbench. Consulting with clients. Drawing and planning. Gem sorting. Wax modelling. Photographing. Valuations
- Procedures must be planned and established to clean and tidy the workplace as part of regular maintenance.
 - People should be taught and encouraged to keep the workplace clean and tidy.
 - Keep your First Aid kit in a place that everyone knows, and keep it clean and properly stocked.

Alphabetical list of possible dangerous substances used in the jewellery industry



Abrasives – see individual listings for silica's and dusts

Acetone – A solvent. Very flammable. Flash point – 4 degrees F. Acute toxic effects: headache, drowsiness, irritation of eyes, nose, throat; vomiting. It is one of the least toxic solvents, is quickly eliminated by the body and has little residual effect. Because it is highly flammable, it should be used with great care. Acetone will dissolve surgeon's rubber gloves.

Acetylene – Fuel. Commonly used in cylinder form. In low concentrations, acetylene is a mild narcotic or intoxicant. In large concentrations, it can cut off oxygen supply. Commercial acetylene is contaminated with Phosphine, Hydrogen Sulphide, Arsine, Carbon Disulfide and Carbon Monoxide – all are extremely toxic. See individual listings for these substances. Acetone is always present in the cylinder – **Do Not Lay the Cylinder Down!**

LP gas is now the preferred substitute for acetylene in many jewellery making workshops (including the SBIT workshop) due to its safe and cleaner application.

Acids – See individual listings.

Most acids are caustic and irritating to the skin, mucous membranes of the nose and eyes, and the lungs.

Always add acid to water, never the reverse! Heat is usually generated and an explosion could result. When working with acids, one should wear protective clothing, work under an exhaust fume hood and have an eye wash station close by. Respirators for acids are different than respirators for particulates. Acids should be returned to the distributor for proper disposal. **“Do what you 'oughta' – add Acid to Water”.** If acid is accidentally spilt in the workshop there are three steps to remember-

- Evacuate people from the area
- Isolate the area from other equipment as well as possible
- Call a supervisor

Ammonia – usually used for cleaning buffing compounds from a piece – it is caustic to the lungs, may lead to pulmonary oedema (when lungs fill with fluid, or pneumonia and lung warring. It is an eye irritant both in solution and in gas form (fumes), usually damaging the cornea. Effects of long-term exposure to ammonia in low doses have not been studied, but this would probably perpetuate chronic bronchitis and emphysema. Ammonia would best be used in extremely diluted solutions of soap and water.

Detergent is now a preferred substitute for ammonia and activax again due to safer and cleaner workshop environment.

Antimony – used in pewter. It has not been established if antimony is harmful. The oxide is probably not toxic, but it can cause dermatitis.

Aqua Regia – this acid, called 'royal water', is very powerful. It will dissolve or etch gold as well as silver. It is made by adding one part nitric acid very slowly to three parts hydrochloric acid. Its bottle should never be tightly stoppered. Its fumes are highly corrosive, and it should be stored and used in an area that is well ventilated.

Arsine – a contaminant in commercial acetylene; an eye, nose, throat and lung irritant. Can cause kidney damage; destroys red blood cells, can cause brain poisoning.

Benzene – a solvent for plastics. Very flammable. Flash point 12 degrees F. Intoxication, coma, respiratory failure; can be fatal. Causes severe damage to bone marrow leading to fatal anaemia or leukaemia. Use an alternative, less toxic solvent. DO NOT USE! Solvents, like acids, should be returned to the chemical distributor for proper disposal. Do not pour down plumbing.

Cadmium – is found in soldering and silver brazing compounds. Cadmium fumes can occur during caving and welding also. Know if your alloy contains cadmium. Change alloy or provide good ventilation. Cadmium affects the brain, nervous system, lungs, kidneys, bone, prostate and digestive tract. It can cause acute bronchitis, pneumonia, digestive disorders, dermatitis, allergic hyper sensitisation, chronic brain damage, lung damage, prostate cancer and kidney stones. Because of its extreme toxicity, products containing cadmium are required by law to be labelled. Ask your supplier to label solders.

Carbon Black – refers to the specific product of incomplete burning of fuel (natural gas, acetylene). Exposure to large quantities can cause lung scarring and promote skin cancer.

Carbon Monoxide – incomplete combustion when firing kilns, doing welding or copper enamel. Carbon monoxide poisoning affects the blood haemoglobin preventing the transport of oxygen to the heart, brain and lungs. It can be detected in extremely advanced stages because the victim's face and fingernails turn cherry red. Good ventilation will prevent carbon monoxide poisoning in the average studio. It should be remembered that carbon monoxide is colourless and odourless.

Chlorinated Hydrocarbons – solvent for plastic and waxes; very toxic – Dissolves fatty layer of skin, causes dermatitis, liver and kidney damage. In general, try to replace chlorinated hydrocarbons with less toxic substances. When this is not possible, use good exhaust ventilation and wear protective gloves. Neoprene rubber is best – do not use butyl rubber or natural rubber.

Chromium Compounds - fumes from chromium compounds are produced in welding. There is a much greater danger from a gas or fume form than from solid form of most toxins. It affects the skin, dermatitis, lungs; inflammation, asthma, and cancer; lining of the nose and nasal system. Use good ventilation.

Copper Compounds – copper has been found to be highly toxic to animals in test situation, but there has been little testing in industrial circumstances involving people. Fumes of copper oxide are poisonous, irritating the lungs and intestines. It causes metal fume fever; recovery is usually complete in 1 or 2 days. Eyes and skin are sensitive to copper. There is no conclusive evidence about long-term exposure. Good ventilation is recommended for processes that involve heat, leading to the formation of Copper oxides. If the metalsmith find some type of dermatitis developing, he/she may want to wear gloves when handling copper-containing alloys.

Cyanides – sodium cyanide, Ferro cyanide, cuprous cyanide and free cyanide are all used in electroplating bath formulas. It is known that the mist of cyanides is harmful, and one should use good ventilation and/or the appropriate respirator. It is also suspected that cyanide mists cause harm when absorbed through the skin, so protective clothing is advised. Today most plating solutions are cyanide free. NB. See the Material Safety Data sheet supplied by the manufacturer, (which should accompany any potentially harmful chemical) for further information about the ingredients, use, dangers, storage procedures and handling.

Epoxy Resins – cause contact dermatitis. It is recommended that gloves be used. During the mixing and curing processes, use good ventilation and avoid inhalation of dusts and fumes, and avoid skin contact with uncured epoxy resin and hardeners.

Ferric Chloride – used as a metal etching acid when a sharper etch is desired than can be achieved with nitric acid. Can irritate the skin and the respiratory tract. Use protective clothing and good ventilation.

Fluorides – found frequently in fluxes. They produce hydrogen fluoride vapours, which dissolve in the lungs where they produce hydrofluoric acid and burn the lungs. Have your supplier label flux contents. Use good ventilation. Avoid breathing fumes.

Flux - see Fluorides

Hydrogen Sulphide - a by-product of using liver of sulphur in combination with water and heat. It is characterized by an odour like 'rotten eggs'. **See Liver of Sulphur**
10ppm (parts per million) is the threshold limit value. It is more toxic than cyanide. In high concentrations it can paralyse the olfactory nerve.

Investment – avoid inhalation of dust; wear a particulate mask – use recommended ventilation when mixing large quantities or an extraction system would be preferable.

**** Product safety Warning**** this material contains crystalline silica and shows limited evidence of causing cancer in humans. Most people in the jewellery industry are aware that their work-place contains many potentially dangerous materials and processes. The same level of protection for working with investment should be worn when quenching flasks. Quenching hot flasks produces steam which can carry cristobalite into your lungs. This mineral can scratch the lining of the lungs and cause irreversible damage with prolonged exposure. Please note – simple dust masks do not provide sufficient protection. Always wear a respirator.

Lead - lead is a cumulative poison. Its compounds and its oxides should be treated carefully. It can be found in some bronze alloys and in some enamels (and we are all exposed to it from automobile exhaust fumes). It is harmful in dusts and in fumes, causing damage to the brain, central nervous system, red blood cells, bone marrow, liver and kidneys. Use protective measures and good ventilation. Lead fumes are very toxic. The body will absorb five times as much lead into the blood via the lungs than from the digestive tract. The body will retain lead for long periods of time, leading to cumulative poisoning; it is stored in the bone marrow.

Ketones - acetone, methyl ethyl ketone, methyl propyl ketone, methyl butyl ketone, ethyl acetate, amyl acetate. Lacquer thinner is a mixture of several of these solvents. Flash points vary from – 4 degrees F to +89 degrees F. Ketones are skin, eye and respiratory tract irritants. They cause defatting of the skin and peripheral nerve damage. Use gloves and good ventilation and/or appropriate respirator.

Lacquer Thinner – see Ketones

Liver of Sulphur – is potassium sulphide and it is used to oxidize metal (gold, silver, copper). When it is heated to decomposition, it will emit highly toxic fumes of oxides of sulphur. These can react with moisture to produce another toxin - hydrogen sulphide, which is caustic to the eyes, the lungs and corrosive to mucous membranes. In high concentrations (around 700ppm) it can cause suffocation and brain damage. Wear a respirator and work in a well-ventilated area. (**See Hydrogen Sulphide**).

Magnesium Compounds - in the forms of m. silicate, chromate, or oxide. Encountered in welding fumes. It is known to affect the lungs, and cause digestive disorders, metal fume fever, and is believed to affect the central nervous system. Use good ventilation when welding.

Manganese Compounds – m. carbonate, m. dioxide-black, m. dioxide-green, m. sulfates. Manganese is encountered in fumes from welding (it is frequently used to coat welding rods) and enamelling. It affects the liver, lungs and central nervous system. Symptoms are headache and weight loss. Diseases that can result are pneumonia and manganese, which is a permanently crippling disease of the central nervous system similar to Parkinson's disease. Provide good ventilation in welding areas.

Mercury – mercury is a cumulative poison. It may be encountered in gold and silver refining, and in welding. It affects the brain, kidneys and nervous system. Mercury can be used to gild silver; however, electroplating is more commonly used.

Methanol – (methyl alcohol) is often found in a small percent in denatured alcohol which is frequently used as a solvent for pitch, and a fuel for alcohol lamps that may be used when working up wax models for castings. In high concentrations, it attacks the respiratory system, gastro-intestinal system, central nervous system, the liver and the optic nerve. Use proper ventilation.

Mica – used for appliqué-a-jour enamel work. Can also be found as filler in some plastics. It is a silicate and should be handled carefully. It is advisable to wear a particulate mask.

Nickel Compounds - nickel is found in the alloy called German Silver. Ni-oxide black, Ni-carbonyl – are by-products of welding nickel alloys, like stainless steel. Nickel carbonyl is the most toxic of the nickel compounds. Its gas can be absorbed by inhalation and through the skin. Body systems affected are the lungs (asthma and cancer) and the central nervous system. Skin contact with nickel salts may cause nickel itch, an allergic dermatitis. Once this sensitivity develops, the person will react to even extremely small amounts of nickel. Wear protective clothing and work in a well-ventilated area.

Nitric Acid – usually used for etching metal. Very irritating to lungs. Symptoms of over exposure are chills, fever, and chronic cough. When etching copper, nitrogen oxide fumes are produced; these dissolve in the lungs and can cause pulmonary oedema and chemical pneumonia. Also, very irritating to the eyes. Exposure to low concentrations over extended periods of time is cumulative in terms of burning and scarring of the lungs. Wear protective clothing and work in a ventilated area or wear a respirator designed to cope with acid mists. Return all acids to the chemical distributor for proper disposal. Do not pour down plumbing or dump outside.

Oxy-Acetylene – (*see Acetylene*) use eye protection with tinted glass that is impact and heat resistant and will prevent penetration of radiation.

Ozone - occurs during welding. It destroys enzymes in body tissues. It has a distinctive odour (you can smell it during a lightning/thunder storm). Prolongs inhalation above 0.05ppm can cause burning of the cells in a manner similar to C-rays. It can be detected by continuous monitoring devices.

Pewter – pewter used to be made from tin and lead. Modern pewter is an alloy of tin and antimony and copper. Extreme care must be used if one is working with the older alloy because of its lead content.

Phosphine – a contaminant in commercial acetylene. Has been known to cause kidney damage and is an irritant to eyes, nose, throat and lungs.

Pitch – when pitch is made from a coal tar derivative like asphalt, it can be a skin irritant and photo sensitiser leading to skin cancer after repeated, intermittent exposure over any years. When using pitch for chasing, repousse and engraving, it is advised that gloves be worn when handling the pitch itself. Once the work is secured in the pitch, the gloves can be removed to use your chasing, repousse, and engraving tools efficiently. If the fingers need to be braced on an area that is exposed to pitch, the pitch can be covered with Saran wrap with a very thin coating of petroleum jelly, if desired, as a separating agent between the Saran wrap and pitch.

True “Brown Swedish Pitch” is a pure vegetable pitch and can be differentiated from pitch adulterated with rosin and bitumen (coal tar products) by colour; it is brown, and has an agreeable odour. Pitch that is not the pure vegetable type is black and gives off offensive vapours. To test for colour, Swedish pitch, when melted and pulled out very thin, shows clear translucent brown when held to a light. Precautions should be used when working with either type of pitch but the Brown Swedish Pitch is far less hazardous.

Care should be taken not to overheat pitch. Boiling destroys the tenacity and it becomes a fire hazard. Pitch, when heated, tends to form a skin on its top surface and to trap explosive gases underneath. To avoid this, heat the pitch slowly and evenly, occasionally stirring to break the skin and release these gases. It is wise to use good ventilation when melting either type of pitch.

Extra care is needed when a large bodied vessel with a narrow opening has to have pitch removed from it. Pitch expands with great force when heated. If the mouth of the vessel becomes clogged with hard pitch, while the pitch behind it approaches the melting point, an explosion can result. This problem can be solved by laying the vessel so the opening is a little lower than the body and warming the opening first. When the opening has been cleared of pitch, direct the soft flame to the ‘top’ of the vessel.

Platinum – metallic platinum is non-toxic, but some platinum compounds can cause contact dermatitis and respiratory allergic reactions, which have been known to lead to asthma and emphysema. Fumes from

platinum that are encountered in soldering, casting, or refinishing, should be avoided. They are lung and skin irritants.

Polyester Resins – one of the many plastics that metalsmiths use. They are skin irritants, and protective clothing should be worn. When casting these substances, harmful vapours are given off from catalysts, thickeners, binders and other additives. They should be used with good exhaust ventilation or respirators. Read the labels regarding proper storage. Some organic catalysts are heat sensitive and explosive.

Silica – encountered as abrasive dusts, in metal finishing procedures, sand blasting, buffing, sanding, etc., and in lapidary work. Silicosis, a lung scarring disease, results. Wear a mask for particulates, some substitutes are silicon carbide, steel shot or glass beads.

Silver Compounds – s. chloride and s.nitrate. Absorption of silver into the tissues is called argyria. This is indicated by a blue-black discolouration in the skin and eyes. (This is not the same as when your skin will turn grey from silver jewellery – this is a colouration in the skin that cannot be washed off). These silver compounds harm the body when they are in vapour or dust form. When using mechanical devices for abrasion (sanding, buffing, etc.) of silver, wear eye protection because silver deposits in the eyes will cause night blindness. Other body parts affected are the lungs and kidneys.

Silver Solder – frequently contains cadmium, brass (copper and zinc). All soldering should be done with good exhaust ventilation.

Solvents- used for machinery clean-up maintenance, dissolving plastics, and removing pitch. Solvents can enter the body by inhalation, skin absorption or ingestion. Ingestion is rare. Wash hands before going to eat. Wear gloves when working with solvents; do not smoke when using solvents (this also presents a fire hazard). Swallowing solvents is usually fatal and will cause blindness. All solvents should be used with good exhaust ventilation. The ventilation should be at the same level as the work rather than above the work. Gloves should be worn to prevent skin contact; solvents can dissolve the fatty layers of the skin and can cause systematic poisoning. **See Acetone, Ammonia, Benzene, Ketones, Methanol, Toluene, Turpentine, Xylene.** Please note that this is a very broad definition of solvents. It would be wise to investigate more thoroughly the specific products in use in your own studio. When in doubt return solvents to a local distributor. If your supplier can't tell you who the distributor is, check with local machine shops, the national manufacturer or your state board of NIOSH. **(National Institute of Occupational Safety and Health).**

Stainless Steel – when welding stainless steel, harmful nickel compound fumes are produced. **See section on Nickel Compounds.** Do all welding in a well-ventilated area.

Styrofoam – occasionally used for models for casting. Heating Styrofoam for forming and for burnout releases toxic gases and requires efficient exhaust ventilation. All Styrofoam's are different. Contact your supplier for a Safety Data Sheet.

Sulphuric Acid - used for cleaning metals. Very irritating to the respiratory tract, skin and clothes. Sparex is a product used as a substitute for sulphuric acid. Both substances can be neutralized with bicarbonate of soda and water or soapy bisulphate in granular form. This makes for safer, convenient storage than is possible with pure sulphuric acid. However, once Sparex is mixed with water, it is as comparatively dangerous as sulphuric acid, especially when it becomes concentrated due to water evaporation. When Sparex solution is heated, the fumes given off are equal to sulphuric acid fumes. Use ventilation.

Sulphur Dioxide – is found in fumes from tin compounds when they are melted. It is also a breakdown product of liver of sulphur. It is harmful to breathe sulphur dioxide gas. It is a highly soluble gas and dissolves in the watery passages of the breathing tubes. It does most of its damage in the upper respiratory tract, which will then go into spasms and prevent the gas from getting further into the lungs. This gas is also encountered in environmental smog and is considered to be a major eye irritant. Use ventilation and/or appropriate respirator.

Talc – occasionally used as a separating agent with rubber moulds and frequently used in plasters. Talc is mined from mineral deposits that frequently contain asbestos. So far, it has not been determined if the

health problems caused are from the talc, or the asbestos, or both – American talc tends to have less asbestos content than French. Like with asbestos, the lungs cannot remove talc. Most diseases related to talc take 20 to 30 years to show up. It is advised that a dust preventative respirator be worn because most damage caused by talc is to the respiratory tract.

Teflon - dusts from Teflon are respiratory irritants and cause chronic bronchitis. Wear a mask for particulates.

Tellurium – fumes generated in copper, silver and gold refining and alloy making; also in welding. Extremely poisonous. Attacks the skin and the gastro-intestinal system. Early symptoms are 'garlic' breath and a metallic flavour in the mouth. Use good exhaust ventilation.

Tin Compounds - are harmful in dust form and in fumes. Tin is found in bronze alloys, pewter and solders. Organic tin compounds are skin-irritants. Stenosis is a 'disease' caused by dusts of tin oxide that are in the lungs. These dusts are insoluble in lung tissue but are not irritating, do not cause symptoms and do not appear to cause disability. They will appear in X-rays of the lungs. However, if inorganic tin compounds are eaten, they can be fatal. Avoid breathing fumes and dust.

Titanium – metallic titanium, as encountered by most metalsmiths, has not been traced to any occupational health problems.

Toluene/Toluol - is an alternative solvent for Benzene. Its flash point is 40 degrees F. It can produce intoxication, hallucinations, lung and brain damage and fatal cardiac arrhythmias. Toluol can damage the red blood cells. It should be used with the appropriate ventilation.

Turpentine – is not as flammable as other solvents. It is skin irritant and harmful to the brain and lungs. Wear gloves and work in a ventilated area.

Wax – many of the waxes that are used for modules for casting contain plastics to give them desirable working characteristics. When these waxes are melted for modelling or burnout, the plastics can give off harmful vapours which should be avoided.

Xylene – alternative solvent for Benzene. It is skin irritant; dissolves the fatty tissues; can cause a decrease in the number of red and white blood cells. It is an eye and upper respiratory irritant. Wear gloves and use good ventilation.

Zinc Compounds – are found in solders and alloys of brass, bronze, German silver and gilding metals. Zinc acetates and zinc oxide are harmful in dusts and fumes. All soldering and welding should be well ventilated. The parts of the body affected are the central nervous system, lungs and skin (dermatitis). Symptoms of zinc oxide fume poisoning are nervousness and depression and metal fume fever. Metal fume fever indications are: flu symptoms, muscular aches and pains, chills, fever, nausea, burning throat, dry cough. This illness is usually very brief with complete recovery in 12 to 24 hours.