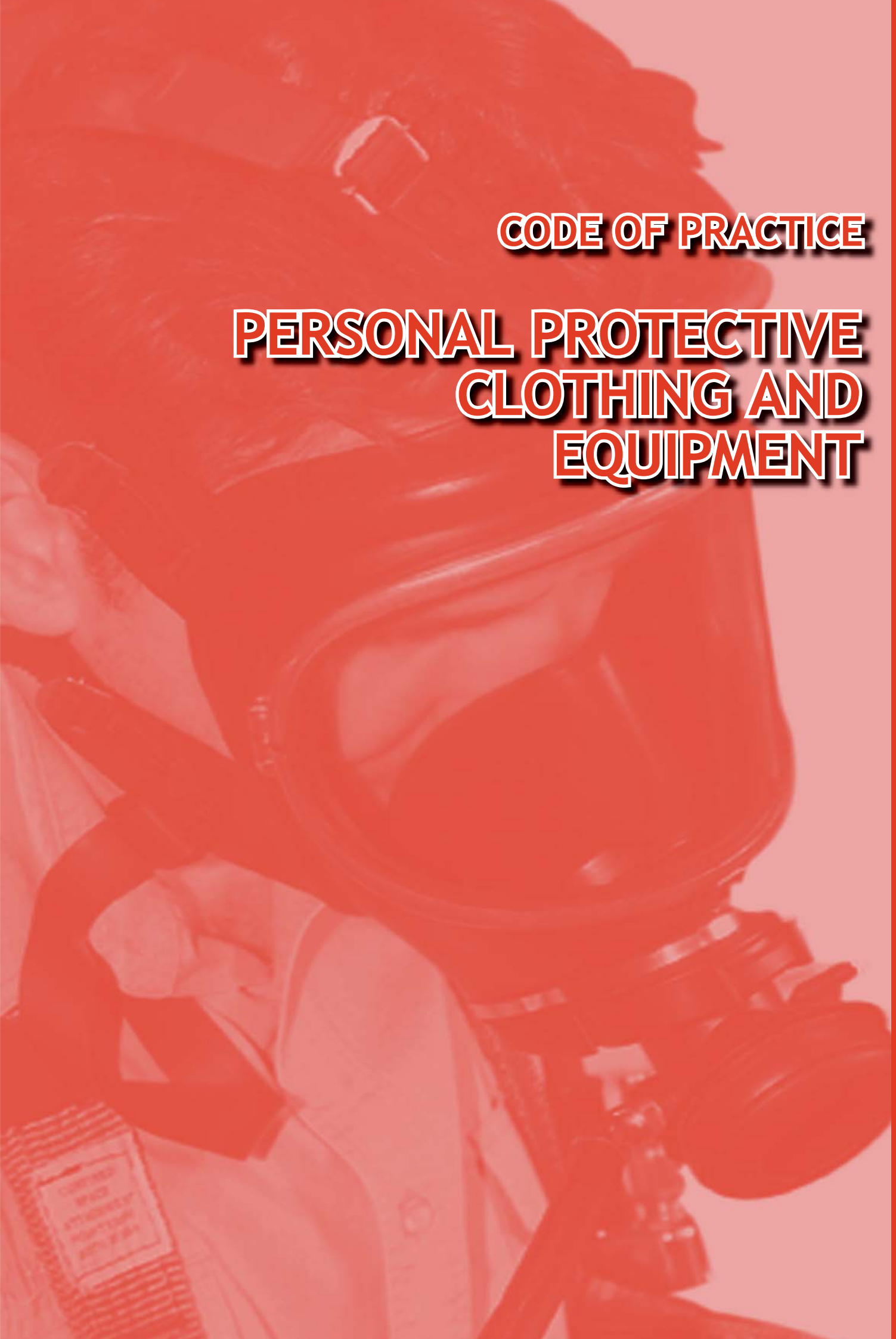

CODE OF PRACTICE

PERSONAL PROTECTIVE CLOTHING AND EQUIPMENT

In this Code a reference to personal protective equipment, unless specifically stated otherwise, also refers to personal protective clothing.

This Code provides general advice about using personal protective equipment to minimise exposure to risks associated with workplace hazards. It provides guidance on selecting, using, storing and maintaining such equipment.

The use of personal protective equipment (and administrative controls) is lowest in the order of control priorities. These controls should not be relied on as the primary means of risk control until the options higher in the list of control priorities have been exhausted (See Table 2, Appendix 1). Personal protective equipment may be used in conjunction with other controls where the risk of exposure is high.

If personal protective equipment has been identified as one of the control measures to minimise exposure to a risk, the employer must make sure such equipment is provided.

The employer should also provide training and instruction in the use of personal protective equipment to ensure employees receive the desired level of protection from the equipment.

3.1 Selection of personal protective equipment

See Appendix 7
The Act s.19, s.20
Regulations 3.1, 3.32, 3.34 and 3.35

The selection of appropriate personal protective equipment requires consideration of the hazards and risks of the work processes. The hazard identification and risk assessment required by the *Regulations* should ensure hazards and risks of the work processes are clearly identified.

If, in addition to implementing control measures to eliminate or reduce the risk, it is determined there is a need for personal protection, the next step is to ensure the provision of personal protective equipment is appropriate to the hazard and the risk.

In selecting personal protective equipment it should be considered whether the protection is required for a specific risk or to control multiple risks presented by the same hazard or a combination of hazards. For example, using a power saw to cut wood presents risks to the eyes (flying chips, dust), lungs (dust), whole of body (electrical), hands (cuts) and ears (noise).

Personal protective equipment should be selected that will best protect workers in the circumstances. In some cases use of personal protective equipment may create a secondary risk not identified in the original assessment. These risks should be evaluated. An assessment of the effectiveness of the equipment chosen should be made to ensure it is providing the desired protection and is not creating any additional safety or health problems.

Personal protective equipment should be checked to ensure it fits properly and is worn correctly. Comfort of personal protective equipment is an important factor in ensuring its use. To ensure personal protective equipment is selected appropriately, the following process should occur:

- employers and employees should familiarise themselves with the potential hazards and the availability of personal protective equipment;
- employers and employees should have an understanding of the criteria for selecting appropriate personal protective equipment which provides an adequate level of protection against the risks present; and
- employers and employees should evaluate the selected equipment to ensure it fits properly, is used appropriately, can be maintained according to manufacturers' specifications and does not create secondary safety or health risks.

3.1.1 Records

Records of risk assessment should be retained at the workplace. Such records would assist the employer and employees in examining where hazards have been controlled and improvement made through design, substitution, separation or administration rather than the provision of safety equipment.

Records of use allow the maintenance and effectiveness of personal protective equipment to be monitored. Certain Australian Standards require the keeping of records, for example, the use of eye filters to protect against radiation generated in welding and allied operations (*AS/NZS 1338 Filters for eye protectors*).

See Appendix 8 Other sources of information

3.1.2 Consultation with employees

Consultation with employees is one of the easiest and most effective means of identifying hazards and establishing controls at the workplace. Employees are usually well aware of what can go wrong and why, based on their experience with a job. This consultation should be done after the initial risk assessment, which should take place during the design stage, prior to commencement of the project or process.

Where a safety and health committee exists, the committee and safety and health representatives should be part of the consultative process.

3.2 Provision of personal protective equipment

See Appendix 7
The Act s.19(1)(d)

Where it is not practicable to avoid the presence of a hazard and employees need personal protective equipment to protect them against the hazard, the employer must provide personal protective equipment. Factors to be considered in deciding the most appropriate equipment for a particular workplace include:

- the absolute requirement for personal protective equipment at that workplace;
- the availability of the personal protective equipment;
- the location of the workplace;
- the need for a personal fit;
- the training and information to be given to employees;
- industry practice, such as personal protective equipment being a normal requirement for that industry sector;
- the nature of the work and associated hazards; and
- the ability to properly maintain the personal protective equipment in the workplace.

The need for personal protective equipment at the workplace should be made known to employees before they start any new work, and before they are required to use the equipment.

Where individual fit is important for the safe use of personal protective equipment, it may be better for employees to choose their own (e.g. footwear).

3.3 Use of personal protective equipment

3.3.1 Training

See Appendix 7
The Act s.19(1)(b)

All employees exposed to workplace hazards should be trained in safe work practices including the correct use of personal protective equipment. The employer has a duty to provide this training and relevant information. Where items of personal protective equipment are to be worn by non-employees at a workplace, sufficient instruction should be provided to ensure the correct wearing of these items.

A follow-up assessment of employees' safety training should be carried out periodically to ensure the work is being done in a safe manner and personal protective equipment is being properly used and is effective. Training should also cover maintenance of the personal protective equipment where required.

Training can be separated into induction and more specific job training.

❑ **Induction Training**

General information about personal protective equipment should form an integral part of an induction training program for new employees.

An induction program relevant to personal protective equipment should include:

- duty of care under the *Act;*
- safety and health policies and procedures;
- provision, use, storage and maintenance of personal protective equipment, particularly the risks caused by incorrect use or maintenance of the equipment; and
- emergency procedures in case of special risks e.g. chemical spills or fires.

❑ **Job Training**

Training of new employees for their specific jobs should cover the hazards and risks identified in a hazard identification and risk assessment process. It should also include instruction in the use of personal protective equipment required by the job including:

- correct selection, use and wearing of personal protective equipment;
- comfort and fit requirements;
- limitations in use and effectiveness; and
- maintenance and replacement procedures.

Ongoing training should be provided to employees as work practices or equipment are up-dated or changed.

3.3.2 Consultation with the supplier

The employer must consult with the supplier to ensure personal protective equipment is suitable for the work and workplace conditions.

There is no singular form of personal protective equipment that can be used universally for all types of hazards and work conditions.

There are many different types of gloves, respiratory and hearing protective devices available on the market. For example, no one type of glove will provide hand protection from all hazards. Selecting gloves that will provide the appropriate level of protection is a complex task as is the selection of respiratory and hearing protection equipment.

See Appendix 6 Types of gloves

3.3.3 Signs

See Appendix 8 Other sources of information

Signs posted in conspicuous locations at the workplace are a useful reminder of the kind of personal protective equipment that should be worn. Signs should comply with *AS 1319 Safety signs for the occupational environment*.

3.4 Storage and maintenance of personal protective equipment

3.4.1 Storage

An employer or principal contractor should ensure that personal protective equipment is stored in a clean and fully operational condition. Storage arrangements should ensure the equipment is safe from interference and damage, and is easily accessible when needed. Personal protective equipment should also be checked regularly, both during storage and in use as specified by the manufacturer or supplier, to ensure it is in a good condition.

3.4.2 Maintenance

An employer should ensure personal protective equipment is maintained in a condition that ensures its continued effective use. Damaged or defective personal protective equipment should be discarded or repaired according to the manufacturers' specifications.

A system to ensure appropriate maintenance of personal protective equipment should be implemented.

The system should cover:

- the responsibilities for maintenance according to the manufacturers' specifications;
- the designation of personnel;
- storage procedures;
- cleaning procedures;
- checking procedures;
- protective life of gloves, respiratory canisters, etc.;
- training on correct maintenance of personal protective equipment; and
- criteria for replacement, maintenance or calibration of personal protective equipment.

3.4.3 Soiled protective clothing

Soiled protective clothing may pose a risk during laundering. To minimise the risk, laundering should preferably be done at the workplace or by a specialist laundry service. If disposable clothing is worn, suitable procedures need to be developed to ensure the clothing is appropriately disposed of without risk to the safety and health of others.

3.5 Risk protection through personal protective equipment

A risk assessment should have identified the types of hazards and risks present at the workplace. Some of the more common hazards and risks and the types of personal protective equipment used to reduce them are outlined below.

See Appendix 7 Regulation 3.1

3.5.1 Objects or persons falling from heights

Falling objects

Protective headwear is standard protection against injury from falling objects. *AS/NZS 1800 Occupational protective helmets – Selection, care and use* contains recommendations for the selection, care and use of safety helmets for head protection in building and construction work, underground work, mining, quarrying, forestry and other occupations with similar hazards.

Some circumstances may require head protection other than a safety helmet. The selection of appropriate protection will depend on circumstances. Bump hats may be appropriate, for example where small objects are likely to fall short distances on to the head.

Protective headgear is highly recommended on building and construction sites higher than one level.

Appropriate footwear to guard against objects falling on feet should be selected according to the hazards and risks identified by the risk assessment. Safety footwear that complies with *AS/AZS 2210 Occupational protective footwear* is generally required in workplaces where there is a risk of heavy objects falling and causing crush injuries to feet. Where smaller objects fall short distances, footwear that covers the foot may be sufficient.

See Appendix 8 Other sources of information

Some workers, e.g. tree pruners, may need eye protection against falling objects. Goggles or face shields may be suitable protection.

Falling persons

See Appendix 8 Other sources of information

Fall arrest systems and devices are designed to prevent falls from elevated workplaces where redesign of the work area is not practicable. In many circumstances, guard rails are effective protection against falling and provide greater mobility to workers than safety harnesses. The WorkSafe Western Australia Commission Code of Practice *Prevention of Falls at Workplaces* should be referred to for further information and guidance.

Table 2 summarises some of the risks associated with objects or persons falling from elevated workplaces. It also indicates some of the occupations commonly exposed to these risks and personal protective equipment designed to protect against them, where the other controls, e.g. design, substitution, redesign, etc. are not practicable.

Table 2 - Objects or persons falling from elevated workplaces

Area of Exposure	Risks	Protection
Head	Falling objects	Safety helmets
	Moving objects	Bump hats
Eyes	Falling fragments	Safety goggles, face shields
Hands	Falling objects	Safety gloves
Feet	Heavy falling & rolling objects	Safety footwear
	Light objects	Protective shoes
Whole Body	Falls from one level to another level	Fall injury prevention system
	Falls from slippery surfaces	Slip resistant shoes

Persons who may fall or be struck by a falling object include: painters, labourers, construction workers, agricultural workers, timber workers, roof workers, window cleaners, welders, manual handlers, storemen and packers, metal workers, shipping and receiving clerks, assemblers, machine operators, freight handlers, maintenance workers and demolition workers.

3.5.2 Non-mechanical penetration or impact injuries

Non-mechanical moving objects likely to strike against or penetrate the body include hand tools (ie. hammers, spanners, knives and screw drivers), materials being worked on or handled, and debris from work processes.

A variety of protective headwear may be used depending on the mass, velocity, and texture of the moving object. Bump hats, for example, may provide adequate protection against injury caused by slowly moving objects on an assembly line. A safety helmet may be required where objects are larger and are moving more quickly. A risk assessment will identify the particular risks associated with such hazards. Separation of people from the hazard is better than personal protective equipment.

Protective gloves are useful to prevent cuts where knives or other sharp tools are used. Arm guards may be required in hazardous tasks such as meat cutting.

Protective footwear can prevent sharp objects from penetrating and injuring the foot. It can also be effective protection from knocks and against items and materials used in the work process. See *AS/NZS 2210 Occupational protective footwear.*

See Appendix 8 Other sources of information

Table 3 summarises some of the risks associated with non-mechanical objects striking or penetrating the body. It also indicates some of the occupations commonly exposed to these risks and appropriate personal protective equipment designed to protect against them, where other controls, e.g. design, substitution, redesign, etc. are not practicable.

Table 3 - Non-mechanical penetration or impact injuries

Area of Exposure	Risks	Protection
Head	Cutting, flying, protruding objects, sharp objects	Safety helmets, protective headwear
Eyes	Protruding, flying objects	Eye protectors, face shields
Hands	Cutting, flying, protruding objects, sharp objects	Safety gloves
Feet	Cutting, flying, protruding objects, sharp objects	Safety shoes
Whole Body	Cutting, flying, protruding objects, sharp objects	Protective clothing

Persons who may incur impact and penetration injuries caused by a non-mechanical object include: timber or logging workers, agricultural workers, mechanics, labourers, carpet layers, welders, cloth cutters, metal workers, carpenters, cabinet makers, chefs and cooks, butchers, abattoir workers, doctors, nurses, veterinarians, gardeners, groundsmen and cleaners.

3.5.3 Being crushed or caught in or between moving machinery and equipment

Injuries associated with the operation of machinery and equipment include being caught between moving parts, or being struck by moving machinery, or striking against an object while operating machinery and equipment.

Due to the serious risks posed by moving parts of many industrial machines, guarding devices are usually a more appropriate form of protection than personal protective equipment. Risks associated with industrial presses, for example, can only be controlled effectively by guarding of the pinch point on the machine, rather than by the use of personal protective equipment by the operator.

Some mechanical equipment may present a risk of striking a worker. In some cases, the danger is that the operator will be struck by the equipment. In other cases, materials or debris associated with the operation of machinery will present the risk. In both these cases, a combination of redesign and personal protective equipment may be necessary to protect workers from injury.

See Appendix 8 Other sources of information

Safety eyewear is required in many industrial processes involving chipping, grinding, drilling, sawing, etc. Spectacles with side protection, goggles or face shields may be required depending on the hazards and risks involved in the work process. *AS 1336/NZS Recommended practices for occupational eye protection* contains recommendations for safe work practices for eye protection, and *AS/NZS 1336 Eye protectors for industrial applications* outlines the requirements for industrial eye protection.

Face shields may be more appropriate than either spectacles with side protection or goggles where there is risk of facial injury. In any event, guarding of the work process may prevent the risk at the source, thereby reducing the possibility of injury.

Another common type of risk associated with the operation of machinery and equipment is the risk of collision. Drivers of vehicles may be thrown from the vehicle on collision, or crushed if the vehicle overturns. Other workers are exposed to the risk of being hit by vehicles or by materials being lifted, moved or carried. The design of vehicles and the provision of operator protective devices (e.g. seat belts, roll bars, etc.) should, for the most part, protect drivers of vehicles. Reflective clothing will make other workers more visible to the driver of vehicles.

Other hazards related to machinery and equipment (e.g. noise emissions) will be covered in the relevant hazard and risk categories.

Table 4 summarises some of the risks associated with the operation of machinery and equipment. It also indicates some of the occupations commonly exposed to the risks and appropriate personal protective equipment designed to protect against them, where the other controls, e.g. design, substitution, redesign, etc. are not practicable.

Table 4 - Being crushed or caught in or between moving parts of machinery and equipment

Area of Exposure	Risks	Protection
Head/Hair	Moving, swinging parts of machinery	Safety helmets, hairnets
Eyes	Projected debris, off-cuts	Safety goggles, face shields
Hands	Crushing	Machine guards are an effective means of preventing crushing of hands by machines in general and presses in particular.
Feet	Moving, swinging parts of machinery	Safety shoes
	Crushing	Safety shoes
Whole body	Collisions, crushing	Seat belts, ROPS, reflective coats
Persons who may be caught in or between, or crushed by moving machinery or equipment include: drivers, construction and building workers, labourers, machine operators, mechanics, process workers, shipping and receiving clerks, maintenance workers, lathe and press operators, agricultural workers and demolition workers.		

3.5.4 Hazardous Substances

Hazardous substances generally affect the skin, eyes, respiratory system or body. Splashes from chemical substances may result in burns to the skin or eyes. Harmful vapours may harm the eyes or the respiratory system. Substances handled without protection may result in contact dermatitis. Other substances may be carcinogenic and could lead to long term health effects.

The use of Material Safety Data Sheets (MSDS) in the control of hazardous substances is critical. The MSDS, which must be made available by manufacturers and suppliers, will list both the harmful properties of these substances as well as the range of control measures required to control their effects. Control measures outlined in the MSDS should be assessed with regard to the work environment in which the substance is used. Product labels are also a valuable primary source of information.

See Appendix 8 Other sources of information

The National Occupational Health and Safety Commission publication *Exposure Standards for Atmospheric Contaminants in the Occupational Environment - Guidance Note [NOHSC: 3008(1995)]* and *National Exposure Standards [NOHSC: 1003 (1995)]* contains information regarding the upper levels for airborne concentrations of a large number of individual hazardous substances.

A wide variety of personal protective equipment is available to guard against risks from hazardous substances. Basic equipment includes respirators, goggles, face masks, gloves, footwear and aprons.

More extensive protection will be required where the risk of exposure is great due to working in confined spaces or in emergency conditions such as chemical fires or accidental spillages of hazardous substances. In such cases, self contained breathing apparatus or hazardous chemical suits may be required.

In many working environments, employees are exposed to a variety of substances that may be in the form of gas, vapour, dust, mist, fume or smoke. Not all substances in working environments have been tested for their toxicological effects, however most substances are capable of causing harm if exposure is sufficiently high. For airborne substances with defined properties and known toxic effects, reference should be made to *NOHSC: 3008 (1995)* and *NOHSC: 1003 (1995)* to ensure employees are not exposed beyond acceptable limits.

A substance may have a harmful effect if it comes into contact with a susceptible site in or on the body. The basic routes of entry into the body of gaseous substances are inhalation, skin absorption and ingestion.

Respiratory protection

See Appendix 8 Other sources of information

See Appendix 7 Regulation 3.40, 3.41

Inhalation is by far the most common route by which substances enter the body. Where it is not practicable to prevent employees being exposed to toxic atmospheres the employer must provide respiratory equipment. Respiratory equipment must be selected in accordance with *AS/NZS 1715 Selection, use and maintenance of respiratory protective devices* and comply with *AS/NZS 1716 Respiratory protective devices*.

Before selecting a respirator, the physical characteristics of the contaminant or combination of contaminants needs to be known, i.e. whether it is particulate, a gas, vapour or a combination of them, and such conditions as the boiling point and vapour pressure. In some cases gas detectors may be required to ensure that levels of toxic, noxious or explosive gases remain within acceptable limits.

Where the type or extent of atmospheric contamination (gaseous or particulate) remains unknown and a safe level of oxygen cannot be assured, respirators designed to give protection against all three types of hazard, gas, particulate matter or oxygen depletion, should be used.

There are two ways of providing personal respiratory protection. These are:

- Purifying the air that the person breathes by way of the inhaled air being drawn though a filter. The type of filter will be determined by the composition and physical state of the contaminant. Filters do not provide protection in an oxygen deficient atmosphere or give protection against all contaminants.
- Supplying the person with respirable air from a source independent from the working environment, conveying respirable air to the person via an airline or a self contained breathing apparatus.

The selection process for respiratory equipment should include:

- the nature, toxicity, physical form and concentration of the contaminant, whether particulate, gas or vapour, or a combination of these;
- whether failure of the respirator could result in immediate danger to life or health;
- the need to wear other personal protective equipment e.g. eye or skin protection against irritants;
- the adequacy of the exposure warning symptoms given by the contaminant;
- the possibility of the contaminated atmosphere being flammable or explosive; and
- the ability to effectively detect the contaminants likely to be present (e.g. availability of correct detection equipment).

It is essential when selecting a respirator to determine the reduction in exposure that different respirators can be expected to provide. Australian and New Zealand Standard *AS/NZS 1994 Selection use and maintenance of respiratory protective devices* (Tables 6.1 to 6.5) sets out respirator selection considerations for mechanically generated particulates, thermally generated particulates, gases and vapours and combined particulates and gases.

See Appendix 8 Other sources of information

Consult the supplier on suitability of equipment for the level of protection required. Insist that the supplier provides equipment complying with the relevant standard and all necessary information on correctly fitting, cleaning, maintaining and storing the equipment.

Skin protection

To protect employees from the effects of hazardous substances to the skin, consideration must be given to the selection of protective equipment such as gloves, aprons and chemical suits. When selecting gloves and clothing to help protect employees from the harmful effects of toxic, corrosive or hazardous chemicals, several performance factors have to be considered.

Penetration, degradation and ***permeation*** are key factors to be considered in the selection process.

- ***Penetration*** In selecting chemical resistant clothing it is important to select material that is designed to resist penetration of a hazardous substance through seams, pores, zippers and material imperfections.
- ***Degradation*** is the reduction in the physical properties of gloves and protective equipment whereby exposure to hazardous substances, heat and sunlight may cause the protective equipment to become brittle, weak, soft, swell, shrink or lose its permeation factor and thereby reduce the level of protection.
- ***Permeation*** is the process by which hazardous substances pass through gloves or clothing without going through pinholes, seams or other openings.

Before selecting gloves and protective clothing, the employer must consult with the supplier to ensure appropriate consideration is given to each of the above.

Table 5 summarises some of the risks associated with hazardous substances. It also indicates some of the occupations where persons are commonly exposed to the risks and refers to appropriate personal protective equipment designed to protect them, where other controls, e.g. design, substitution, redesign, etc. are not practicable.

See Appendix 6 Types of gloves

Appendix 6 covers the suitability of certain types of gloves for handling a range of hazardous substances.

Table 5 - Hazardous substances		
Area of Exposure	**Risks**	**Protection**
Head	Splashes, burns to the face	Face shields
Eyes	Burns, splashes, irritation	Face shields, goggles. Irritation to the eyes from harmful vapours may be effectively controlled by changing work methods to isolate harmful chemicals from workers.
Hands	Burns, dermatitis, absorption into body tissue and blood, defatting	Impervious safety gloves
Feet	Burns	Safety footwear, impervious footwear
Whole body	Respiratory vapours, inhalation, ingestion	Respirators, breathing apparatus
	Burns, absorption into body tissue and blood, defatting	Impervious, hazardous chemical suit
Persons who may be exposed to hazardous substances include: gardeners and groundkeepers, agricultural workers, laboratory technicians, storemen and packers, freight handlers, painters, labourers, maintenance workers, chemical process operators, emergency workers, firefighters, manufacturing workers, metal workers, paper workers, textile workers and plastics workers.		

3.5.5 Temperature extremes

Burns, scalds, spills or splashes

Foundry and furnace operations are examples where workers are exposed to heat for which protective suits, face masks and complete skin protection may be required. Plant and substances at cryogenic temperatures can also create the risk of burns. Fire fighters should have clothing that is both fire retardant and thermally insulating, for protection against burns.

Hazards in this category include spills or splashes of hot substances and contact with hot surfaces. These hazards may be found in foundries, galvanising works, welding workshops and a variety of other workplaces.

In addition to the provision of personal protective equipment against burns, consideration must be given to the design of such protective clothing so that it does not present a hazard in itself. Fire proof clothing, for example, worn by a worker who is very active may lead to an increase in metabolic heat to dangerous levels, thereby contributing to a secondary effect of temperature hazard.

Table 6 summarises some of the hazards and risks associated with heat. It also indicates some of the occupations that are commonly exposed to these hazards and risks, and appropriate personal protective equipment designed to protect against them and where the other controls, e.g. design, substitution, redesign, etc. are not practicable.

Table 6 - Burns, scalds, splashes

Area of Exposure	Risks	Protection
Head	Burns, scalding, splashes, contact with heat	Face masks, fire protective clothing, protective headwear
Eyes	Splashes, sparks, burns	Eye protectors, protective eyewear
Hands	Burns, scalding, splashes, contact with heat, spills	Protective gloves
Feet	Burns, scalding, splashes, contact with heat, spills	Protective footwear, gaiters
Whole body	Burns, scalding, splashes, contact with heat, spills	Respiratory equipment, fire protective clothing including aprons

Persons who may receive burns or be scalded include: welders, foundry workers, mechanics, metal process workers, chemical process operators, agricultural workers, labourers, glass and ceramic workers, boilermakers, chefs and cooks, train drivers and engineers, and firefighters, plumbers and maintenance workers, boiler attendants, engineering workshops, auto and heavy equipment mechanics using steam cleaners etc.

Excessive heat or cold

Extremes of heat and cold can create direct hazards to workers in the form of heat exhaustion, heat stress, hypothermia and frostbite. Indirect hazards may be created by continuous and energetic activity by a worker in an environment of high ambient temperature.

Foundry and furnace operations and boiler rooms are examples where workers are exposed to extreme heat for which protective suits, hooded respiratory equipment and complete skin protection may be required.

Workplaces where hazards in this category exist include those in which mechanical equipment generates heat by its operation, or where the ambient temperature is typically high or low. These hazards may be found in a variety of workplaces, from bakeries to boiler rooms to cold stores.

Table 7 summarises some of the hazards and risks associated with extremes of temperature. It also indicates some of the occupations commonly exposed to these hazards and risks and appropriate personal protective equipment designed to protect against them, where the other controls, e.g. design, substitution, redesign, etc. are not practicable.

Table 7 - Extremes of temperature hazards

Area of Exposure	Risks	Protection
Whole body	Heat exhaustion, heat stress, burns, scalding, contact with hot surfaces	Respiratory equipment, fire protective clothing, gloves
	Contact with cold surfaces, frostbite, hypothermia	Thermal clothing, footwear, headwear, gloves
Persons who may be exposed to extremes of temperature include: welders, foundry workers, electricians, mechanics, metal workers, chemical process operators, agricultural workers, machine operators, labourers, transport drivers, glass and ceramic workers, boilermakers, chefs and cooks, train drivers and engineers, drycleaners, firefighters, cold store workers, mechanical services plumbers, and all persons working in high or low ambient temperatures.		

3.5.6 Radiation hazards

Electromagnetic radiation includes ultraviolet radiation, lasers and microwaves. A range of risks are associated with electromagnetic radiation including cancer, skin burns, reproductive toxicity, and changes to the nervous or cardiovascular systems. Radiation can lead to long term health problems.

Due to the wide range of the spectrum of electromagnetic radiation, the risk assessment must identify the type of radiation that workers are exposed to and the risks presented by that exposure. Various types of shields, aprons and masks are available where it is not practicable to protect workers from radiation by other means.

It is often possible, and always preferable, to isolate workers from radiation through controls other than personal protective equipment. For example, medical workers have adopted the simple procedure of leaving the room where a patient is undergoing an X-ray.

See Appendix 8 Other sources of information

Ultra violet radiation from the sun is recognised as a hazard to the health of outdoor workers. The risk of exposure to sunlight should preferably be reduced by providing shade or scheduling outdoor work to hours other than the middle of the day.

Where this is not practicable, personal protection should be provided by protective clothing (e.g. broad brimmed hat, long sleeve shirt) and sunscreen lotion (SPF 15+) in accordance with *AS/NZS 2604 Sunscreen products - Evaluation and classification*.

Light may present a hazard whether it originates from natural or artificial sources. Continuous exposure to glare from the sun reflecting off surfaces may cause irritation and swelling of the eyes. It can also lead to accidents resulting from poor vision. Sunglasses can reduce the risk to the eyes.

Intense forms of light from welding operations are another source of hazard. Electric arc welding flash can cause damage to the eyes so welding operations should be shielded by suitable flash-resistant screens to protect workers other than the welder. The welder will require a welder's helmet or other appropriate shield to protect the eyes.

Table 8 summarises some of the risks associated with radiation hazards. It also indicates some of the occupations commonly exposed to these risks and appropriate personal protective equipment designed to protect against them, where the other controls, e.g. design, substitution, redesign, etc. are not practicable.

Table 8 - Radiation hazards

Area of Exposure	Risks	Protection
Head	Cancer, skin burns	Face shields, protective headwear (wide brims)
Eyes	Optical radiation, glare, corneal damage, cataracts	Eye filters, protective eyewear
Hands	Cancer, skin burns	Protective gloves
Feet	Cancer, skin burns	Protective footwear
Whole body	Cancer, skin burns, reproductive toxicity, damage to nervous or cardio-vascular system	Shields, aprons, protective clothing, sunscreen lotions
Persons who may be exposed to radiation include: welders and foundry workers, electricians, medical staff, health workers, glass and ceramic workers, agricultural workers, laboratory technicians, luminous paint workers, electronic equipment workers, transport drivers, outdoor workers, machine operators, metal workers, illuminating engineers and electrical engineers.		

3.5.7 Noise

Many workplaces generate noise. In some, this will be to a level of noise leading to hearing loss and tinnitus. A risk assessment should identify sources of noise, assess noise exposure levels and evaluate the risk to exposed workers. The WorkSafe Western Australia Commission *Code of Practice – Managing Noise at Workplaces* should be referred to for further information relating to noise control and hearing protection. Noise can lead to long term hearing problems, and a variety of hearing protectors are available where exposure cannot be controlled by other means.

Personal hearing protectors should be selected in accordance with Australian and New Zealand Standard AS/NZS *1269.3 Occupational noise management – Hearing Protection Program.*

When selecting suitable hearing protectors the following should be considered:

- *type of working environment* - for example, ear muffs can be more uncomfortable than ear plugs in hot environments or, alternatively, ear plugs can be difficult to keep clean in situations where they are inserted or adjusted with dirty hands;
- *comfort, weight and clamping force* - a hearing protector with unnecessarily high attenuation sound reduction may cause communication difficulties and ultimately be rejected by the wearer on the grounds of discomfort and inconvenience. High values of sound reduction are generally achieved at the expense of wearer comfort, for example, by increasing the clamping force of earmuffs;
- *combination with other items of personal protective equipment* (e.g. safety glasses, hard hats, etc.) - these may affect the performance of the protector;
- *safety of the wearer* - hearing protectors should not mask or hide warning sounds. Visible warning devices (such as flashing lights) may also need to be considered in situations where hearing protection is required; and
- *opportunity for individual choice* - a selection of two or three hearing protectors should be provided where possible, provided the choices available are suitable to the protection required.

See Appendix 8 Other sources of information

Table 9 summarises some of the risks associated with noise. It also indicates some of the occupations commonly exposed to these risks and appropriate personal protective equipment designed to protect against them, where the other controls, e.g. design, substitution, redesign, etc. are not practicable.

Table 9 - Noise

Area of Exposure	Risks	Protection
Ears	Over exposure to noise (hearing damage, loss)	Personal hearing protectors
Persons who may be exposed to noise hazards include: construction and building workers, demolition workers, explosives workers, miners, heavy machinery operators, agricultural workers, process workers, sanding and grinding machine operators, timber and logging workers, jackhammer operators, excavation equipment operators, transport drivers, metal workers, sawmillers, carpenters, assemblers, maintenance workers, labourers, lathe and press operators and music concert technicians.		

3.5.8 Biological hazards

Biological hazards that can occur in workplaces, are predominantly infectious agents or micro-organisms such as viruses and bacteria. Such infections may be transmitted through exposure to human or animal secretions, blood, body fluids or waste matter.

Persons who may be exposed to biological hazards include doctors, nurses, ambulance workers, dentists, other health workers, prison officers, abattoir workers, stock handlers, farmers, shearers, butchers, veterinarians, laboratory technicians, sanitation and sewerage workers.

Health care workers may be at risk from hepatitis, HIV/AIDS and tuberculosis (TB). Routes of transmission may be faecal-oral (e.g. Hepatitis A), blood-borne (e.g. HIV/AIDS, Hepatitis B and C), or air-borne (aerosol) (e.g. TB). Meat industry workers are at risk of acquiring diseases from animals, e.g. Q fever, through inhalation of infected aerosols or dust; leptospirosis by entry through open wounds. Penetrating wounds also present an opportunity for entry of bacteria that cause tetanus.

Prevention of infectious diseases is not reliant on personal protective equipment, as the higher level controls, elimination, substitution, isolation, engineering and administrative controls, are more effective. These include vaccination and immunisation, standard precautions and personal hygiene which are covered in the WorkSafe Western Australia Commission *Code of Practice on the Management of HIV/AIDS and Hepatitis at Workplaces, 2000*. Table 10 summarises some of the associated risks and personal protective equipment that may be used where higher level controls are not practicable or where there is a need to increase the level of protection.

Table 10 - Biological hazards

Area of Exposure	Risks	Protection
Head	Inhalation, ingestion, irritation, needlestick, absorption through cuts, open sores, skin pores	Masks, shields, protective head coverings
Eyes	Splashes, squirts, irritation	Protective eyewear
Hands	Absorption, irritation, needlestick, absorption through cuts, open sores, skin pores	Protective gloves, protective barrier substance (cream, lotion)
Feet	Irritation, needlestick, absorption through cuts, open sores, skin pores	Protective footwear
Whole body	Inhalation, ingestion, irritation, needlestick, absorption through cuts, open sores, skin pores	Protective clothing, aprons, gaiters
Persons who may be exposed to biological hazards include: doctors, nurses, ambulance workers, health workers, dentists, abattoir workers, stock handlers, animal waste handlers, butchers, veterinarians, laboratory technicians, prison officers, cleaners, sanitation workers and sewer workers.		

See Appendix 8 Other sources of information

3.5.9 Electricity

Electricity can result in burns, shocks and electrocutions. Proper maintenance of equipment and training in the proper use of tools will substantially reduce risks from electricity.

Risks from electricity are present in all workplaces where electrical equipment is used, and in workplaces where contact with overhead or buried conductors may occur. Apart from obvious risks at workplaces where electricity is generated, electrical hazards are present at any workplace where portable or semi-portable electrical equipment is used. All electrical equipment must be isolated or de-energised for repair and repaired only by authorised personnel.

Electrical hazards pose common risks where power tools are subject to rough handling and used at various locations of a workplace.

Protective footwear may provide some protection against electric shock. In situations where contact with overhead wires is possible, for example by a linesman, head protection is available that provides protection, from electric shock and burns. When selecting head protection, knowledge of potential electrical hazards is important as different helmets provide different levels of protection.

See Appendix 8 Other sources of information

An important way of preventing injuries from electricity is to ensure electrical equipment is properly insulated. *AS/NZS 3100 Approval and test specification - General requirements for electrical equipment* specifies approval and test specification, definitions and general requirements for electrical materials and equipment.

Table 11 summarises some of the risks associated with electricity. It also indicates some of the occupations commonly exposed to these risks and appropriate personal protective equipment designed to protect against them, where the other controls, e.g. design, substitution, redesign, etc. are not practicable.

Table 11 - Electricity

Area of Exposure	Risks	Protection
Head	Burns, electric shock	Protective headwear
Eyes	Sparks, glare	Eye protectors
Hands	Burns, electric shock	Safety gloves
Feet	Burns, electric shock	Protective footwear
Whole body	Burns, electric shock	Protective clothing

Persons who may be exposed to electrical hazards include: electricians, linesmen, welders, machine operators, lathe and press operators, labourers, electric equipment operators, electrical engineers, maintenance workers, illuminating engineers and agricultural workers.

3.5.10 Vibration

Reduction of vibration through personal protective equipment is limited to localised body parts, such as the hands. Continuous vibration of the hands can cause *white finger* or Raynaud's Syndrome. Gloves designed to minimise the transmission of vibration to the hands are available. Most are not very effective over the whole range of damaging frequencies, and their bulkiness can reduce manipulative efficiency.

Their main advantage appears to be in maintaining normal hand temperature which in itself appears to reduce the risk from Raynaud's syndrome.

Whole body vibration can lead to long term health problems. Equipment re-design can eliminate or reduce the risk of whole body vibration.

Table 12 summarises some of the risks associated with vibration. It also indicates some of the occupations commonly exposed to these risks and appropriate personal protective equipment designed to protect against them, where the other controls, e.g. design, substitution, redesign, job rotation, work-rest regimes are not practicable.

Table 12 - Vibration

Area of Exposure	Risks	Protection
Hands	Raynaud's Syndrome (from continuous vibration)	Protective gloves (anti-vibration)
Whole body	Spine disorders, gastro-intestinal disturbance, circulation, muscle and joint disorders	Redesign of work process, equipment, work practices
Persons who may be exposed to vibration hazards include: jackhammer operator, timber and logging workers, machine operators, heavy equipment operators, transport drivers, agricultural workers, sanding and grinding machine operators and metal workers.		

3.6 Design and manufacture of personal protective equipment

3.6.1 Design and construction

A person who designs, manufactures, imports or supplies personal protective equipment for use at a workplace has a duty of care to ensure that the equipment is so designed and constructed as to be safe and without risk to safety or health when used properly. Personal protective equipment is "used properly" when it is used in accordance with the manufacturer's instructions, provided such instructions contain adequate information about conditions for which the equipment is designed and has been tested and examined, as well as any other information necessary to ensure that the equipment is without risks to safety or health of any person.

3.6.2 Information

A person who designs, manufactures, imports or supplies personal protective equipment has a duty to ensure the availability of adequate information about the use for which the equipment is designed and manufactured and has been tested and examined, as well as any other information necessary to ensure that the equipment may be used without risks to safety or health of any person.

3.6.3 Testing and examination

A person who designs, manufactures, imports or supplies personal protective equipment has a duty to ensure that the appropriate tests and examinations have been carried out on the equipment.

3.6.4 Applicable standards

Items of personal protective equipment should be manufactured, selected and used according to an appropriate Australian or equivalent overseas standard. Relevant Australian Standards covering the selection and manufacture of personal protective equipment include:

AS 1067	*Sunglasses and fashion spectacles*
AS/NZS 1269	*Occupational noise management*
AS/NZS 1270	*Acoustics - Hearing protectors*
AS 1319	*Safety signs for the occupational environment*
AS/NZS 1336	*Recommended practices for occupational eye protection*
AS/NZS 1337	*Eye protectors for industrial applications*
AS/NZS 1338	*Filters for eye protectors*
AS 1558	*Protective clothing for welders (Incorporating Amendment 1)*
AS/NZS 1715	*Selection, use and maintenance of respiratory protective devices*
AS/NZS 1716	*Respiratory protective devices*
AS/NZS 1800	*Occupational protective helmets - Selection, care and use*
AS/NZS 1801	*Occupational protective helmets*
AS/NZS 1891	*Industrial fall arrest systems and devices*
AS/NZS 2161	*Occupational protective gloves*
AS/NZS 2210	*Occupational protective footwear*
AS 2225	*Insulating gloves for electrical purposes*
AS 2375	*Guide to the selection, care and use of clothing for protection against heat and fire*
AS/NZS 2604	*Sunscreen products - Evaluation and classification*