Building and Construction

Work effectively and sustainably in the construction industry

Learner Guide

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Working in Construction [1]

The Construction industry employed 1.01 million people in 2011–12 (9% of the Australian workforce). Within this industry 73% of workers were classed as employees and were covered by workers' compensation. Employers in this industry paid 2.3% of payroll in 2011–12 to provide workers' compensation coverage for their employees.

Fatalities

Over the five years from 2007–08 to 2011–12,
211 Construction workers died from work-related injuries. The total number of deaths equates to 4.34 fatalities per 100 000 workers, which is nearly twice the national rate of 2.29.

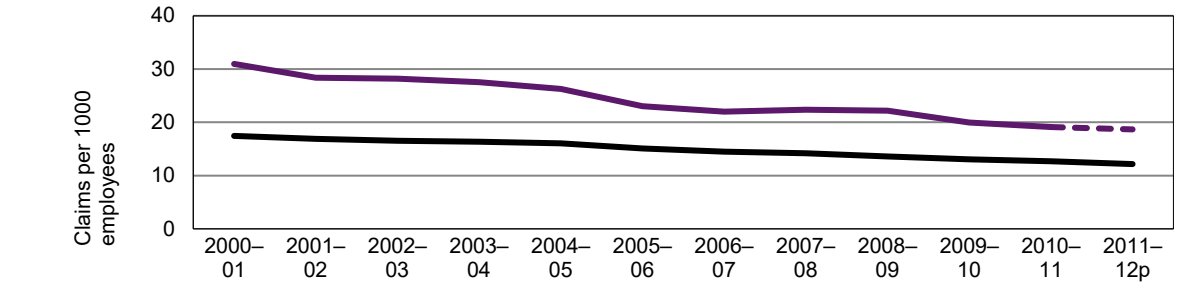
- *Falls from height* accounted for 51 fatalities. Of these, 18 involved falls from buildings, 15 involved ladders and 8 involved scaffolding.
- *Vehicle incident* resulted in 34 fatalities. In 21 of the incidents the worker was in a car and 10 were in a truck.
- *Being hit by moving objects* and *Being hit by falling objects* accounted for 29 deaths each. More than half of the deaths caused by *Being hit by moving objects* involved road transport (16).

Serious Claims

The preliminary data for 2011–12 show there were 13 735 successful workers' compensation claims for serious injury or illness in the Construction industry. Over the five years from 2007–08 to 2011–12, the Construction industry accounted for 11% of all serious workers' compensation claims. On average there were 39 claims each day from employees who required one or more weeks off work because of work-related injury or disease.

Figure 1 shows that the incidence rate of serious claims in this industry has fallen 38% from 31.0 claims per 1000 employees in 2000–01 to 19.1 in 2010–11. However, this rate remains higher than the rate for all industries (12.7) and was the fifth highest of all industries in 2010–11.

Figure 1: Serious claims: Incidence rates by year



	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11	2011–12p
Construction	31.0	28.4	28.2	27.5	26.3	23.0	22.0	22.4	22.2	19.9	19.1	18.7
All Industries	17.5	16.9	16.5	16.4	16.0	15.1	14.5	14.2	13.6	13.1	12.7	12.2

[1] Source: Safe Work Australia, as at http://www.safeworkaustralia.gov.au/sites/swa/about/publications/pages/fs2010constructioninformationsheet, as on 14th May, 2014.

Between 2007–08 and 2011–12:

- *Body stressing* accounted for 34% of claims—more than half of these were due to muscular stress while handling a range of materials, tools and other equipment.
- *Falls, trips and slips of a person* accounted for 26% of claims and almost all of these involved *Falls from height* or *Falls on same level*.
- *Being hit by moving objects* accounted for a further 16% of claims—many of these involved being hit by falling or moving materials and equipment.

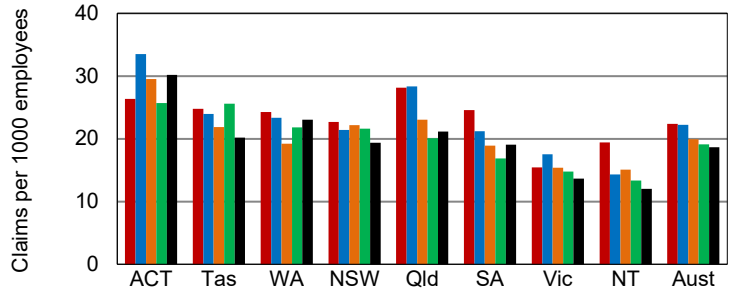
Serious claims by jurisdiction

Figure 2 shows the incidence rates of serious claims in the Construction industry by jurisdiction.

Over the period 2007–08 to 2010–11 all jurisdictions except Tasmania recorded decreases in incidence rates. The largest decreases were recorded by South Australia and the Northern Territory (both 31%) followed by Queensland (29%) and Western Australia (10%). Tasmania recorded a small increase (3%).

The preliminary data for 2011–12 show that incidence rates across Australia ranged from 12.0 claims per 1000 employees in the Northern Territory to 30.2 in the Australian Capital Territory.

Figure 2: Serious claims: Incidence rates by jurisdiction



	ACT	Tas	WA	NSW	Qld	SA	Vic	NT	Aust
2007–08	26.3	24.8	24.3	22.7	28.2	24.6	15.5	19.4	22.4
2008–09	33.5	24.0	23.4	21.4	28.4	21.2	17.5	14.3	22.2
2009–10	29.5	21.9	19.2	22.2	23.1	18.9	15.4	15.1	19.9
2010–11	25.7	25.6	21.8	21.6	20.1	16.9	14.8	13.4	19.1
2011–12p	30.2	20.2	23.0	19.4	21.1	19.1	13.6	12.0	18.7

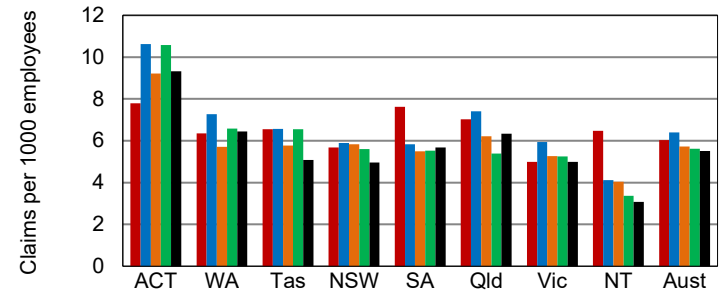
Claims involving 12 or more weeks time lost by jurisdiction

Figure 3 shows the incidence rates of claims involving 12 or more weeks off work by jurisdiction. Preliminary data for 2011–12 show 30% of serious claims had compensation paid for 12 or more weeks off work.

Over the period 2007–08 to 2010–11 the Northern Territory recorded the largest decrease in incidence rates of long term claims (48%) followed by South Australia (28%). The Australian Capital Territory recorded a 36% increase in the incidence rate of long term claims.

The preliminary data for 2011–12 show that the Australian Capital Territory recorded the highest incidence rate with 9.3 long term claims per 1000 employees.

Figure 3: Claims involving 12 or more weeks off work: Incidence rates by jurisdiction



	ACT	WA	Tas	NSW	SA	Qld	Vic	NT	Aust
2007–08	7.8	6.4	6.5	5.7	7.6	7.0	5.0	6.5	6.0
2008–09	10.6	7.3	6.6	5.9	5.8	7.4	5.9	4.1	6.4
2009–10	9.2	5.7	5.8	5.8	5.5	6.2	5.3	4.0	5.7
2010–11	10.6	6.6	6.6	5.6	5.5	5.4	5.2	3.4	5.6
2011–12p	9.3	6.4	5.1	5.0	5.7	6.3	5.0	3.1	5.5

Claims data were extracted from the National Data Set (NDS) for Compensation-based Statistics. The data presented here are restricted to accepted claims for serious injury and disease. Serious claims include fatalities, claims for permanent disability and claims for conditions that involve one or more weeks of time lost from work. Serious claims do not include those involving journeys to and from work. The 2011–12 data are preliminary and expected to rise. As such they have not been used to determine the percentage change in rates over time. More information on this industry can be found at swa.gov.au.

Information on fatalities is extracted from the Traumatic Injury Fatalities database. Annual fatalities reports can be found at swa.gov.au.

Construction industry white card

If you are interested in starting work in the construction industry, it is important that you obtain your white card. You must obtain your white card before commencing work on a construction site.

What is a White Card?

'White Card' is a term used to describe the plastic card issued by a Registered Training Organisation indicating that a person has undertaken general induction training for construction work, also known as 'White card training'. People who work on construction sites in Australia must undertake general induction training or 'White Card training' and have evidence of their attendance from the course before they are permitted to commence work on a construction site.

How do I get a White Card?

The training.gov.au website lists Registered Training Organisations that have approval to deliver white card training. The course is called “CPCCOHS1001A – Work safely in the construction industry”.

Construction work

Construction work has the potential to seriously injure or kill a person and therefore, it is important to manage risks associated with the construction work. Construction work includes any work on a structure involving:

- maintenance and repair
- alteration and renovation
- construction and commissioning
- conversion, refurbishment and fitting out
- decommissioning, demolition and dismantling.

In addition, the *Work Health and Safety Regulation 2011* (WHS Regulation) provides a special category for high risk construction work. This includes work involving a risk of falling more than two metres, asbestos, explosives, demolition, traffic, diving, extreme temperatures, contaminated or flammable atmospheres, energised electrical installations as well as work in confined spaces, shafts and trenches and work on gas, chemical, fuel or refrigerant lines. Refer to the WHS Regulation for more details on high risk construction work.

Safe work method statements (SWMS) must be prepared for high risk construction work and workers must comply with the SWMS when carrying out the work.

The WHS Regulation also sets out specific duties for the management of risks.

Person conducting a business or undertaking (PCBU)

A person conducting a business or undertaking (PCBU - the new term that includes employers) has a primary duty of care to ensure workers and others are not exposed to risks to their health and safety.

A PCBU with management or control of the workplace, must ensure so far as is reasonably practicable, that the workplace is secure from unauthorised access where construction work is being carried out.

A PCBU must also ensure that general construction induction training is provided to any workers they engage. Construction workers must be able to show their valid general construction induction training card or certificate (if they have recently completed the training) if requested.

Principal contractors

The principal contractor must ensure a WHS management plan is prepared before construction work begins on the project (where the cost of the construction work is $250,000 or more). Workers must be informed of the plan and it must be reviewed and revised as necessary to ensure it remains up to date.

Excavation work

There are also specific requirements for when excavation work is carried out, such as obtaining information on underground services and ensuring this information is made available to all workers.

Electrical equipment on construction and demolition sites

Electrical equipment and installations on construction and demolition sites must comply with Australian Standard AS/NZS 3012:2010 *Electrical installations - Construction and demolition sites*.

The *Electrical practices - construction and demolition site*s (http://www.workcover.nsw.gov.au/formspublications/publications/pages/Electrical-practices-construction-demo-sites.aspx) fact sheet provides more information.

Work on or near public roads

In recent times a number of incidents have been reported where workers have died or suffered serious injuries from being struck by motor vehicles and/or plant while performing construction or road work activities on or near public roads.

Working safely in Construction

Working safely seems like quite a sensible thing to do however many try to take short cuts in the hope of getting the job done quicker, can't be bothered doing it the correct way or they simply never found out the correct way to do a task correctly.

Unfortunately this method of working is not only very ineffective and usually costly (as jobs usually have to be done again) it is also very dangerous to all employees and visitors to the site.

The following information provides you with the basic information that you need to start working safely and to be aware of the dangerous environment that is around you every day.

Identifying Personal Development Needs

Identifying your own current and future skill development needs is an important step in progressing your career. Your skill development needs may be ***workplace specific***, such as 'how to operate the CNC machine'; or they may be ***general*** development skills such as 'improving your language and literacy skills'.

Knowing the level of your current skills can help you identify situations for further development.

IDENTIFYING THE SKILLS AND KNOWLEDGE NEEDED TO WORK IN THE CONSTRUCTION INDUSTRY

The construction industry is very diverse and requires many different specific skills. Individual workers need to identify the generic skills they need to work effectively, as well as the specific skills needed in each specialist area that they work in.

The table below lists the common generic skills needed in the construction industry:

GENERIC SKILL	EXAMPLE
Communication skills	Verbal communications; reading; writing; numeracy
Interpretation skills	Understanding plans, specifications, maps, diagrams, orders
Technological skills	Using mobile phones, two-way radios, fax machines, the internet
Interpersonal skills	The ability to work in a team, working with clients and other tradespeople
Organisational skills	Planning work, coordinating team members
Task specific skills	Glazing, joinery, carpentry, concreting, plumbing, electrical

Each individual has different methods of learning the skills and knowledge required for their particular area of the construction industry.
Some ways of accessing the required information could include:
 Speaking with your supervisor about the skills needed on site or in the workshop

 Reading building industry newsletters and bulletins (e.g. Supplier magazine; AWISA magazine; HIA publications etc.)
 Attending a local educational institute to be trained
 Talking to a mentor or co-worker
 Surfing websites related to the construction industry and specific skill areas

Specialist skills depend on your job role or occupation. There are many different jobs in the construction industry which require different skills, different qualifications and different amounts of
work experience. Some examples of construction industry jobs include:

- Aluminium Fabricator
- Architect
- Bricklayer
- Building Designer
- Building Industry IT Support
- Carpenter
- Concreter
- Construction Plant operator
- Cost planner
- Electrician
- Engineer
- Fencer
- Glazier
- Joiner
- Occupational Health and Safety officer
- Overseas aid construction
- Plumber
- Project Manager
- Shopfitter
- Site Foreman
- Site Manager
- Sign writer
- Stonemason
- Surveyor
- Tiler

IDENTIFYING YOUR OWN LEARNING NEEDS FOR FUTURE WORK REQUIREMENTS

Learning needs can vary from site to site due to the nature of the work. Identifying your own learning needs basically means:

- Identifying your current knowledge and skills
- Identifying future requirements such as 'what might I be doing in five years?'
- Determining what you need to learn to achieve the required goals
- Establishing how to get the skills you need

To help identify your skills and learning needs, you may need to consult with the right people in your workplace such as a supervisor, site manager, employer, safety officer or co-worker. These people may be able to help you identify the best way to develop your skills, and may suggest the following actions:

- Complete a brief assessment of your current skills
- Undergo recognition of prior learning
- Undertake on the job training or mentoring
- Organise for job rotation, task sharing or refresher training
- Enrol in formal vocational education and training such as TAFE
- Buddy up with a co-worker to gradually learn the new skills required

Working safely

Slips, trips and falls

We tend to think of the danger of falls being related to working at heights, but trips over cords or material lying in aisle ways, slipping on wet or greasy surfaces or tripping on stairs or uneven surfaces can also cause serious injuries. Most workplaces have some slipping and tripping hazards but they may go unnoticed because they have become too familiar.

Some simple practices can control and reduce the risk of a slip, trip or fall hazard:

- Work areas should be kept tidy and passages or aisle ways kept clear of obstructions.
- Spills should be cleaned up immediately.
- Rubbish should be disposed of in the appropriate place.
- Equipment should be stored in correct places.
- Drawers, cords and hand tools shouldn't be left open or where others can trip over them.
- Excavation works, trenches, holes, pits or lift wells should be clearly marked and roped off.
- Uneven or worn surfaces or mats should be reported and fixed.
- Equipment waiting for maintenance should be stored out of aisles and passages.
- Don't use chairs, stools or crates to reach high shelves or machinery.
- Footwear should be suitable to the type of work performed.

Working at heights

Falling from heights is a common cause of injury and death in workplaces. Workers have been injured and killed falling from portable and fixed ladders, roofs, scaffolding, mezzanine floors, platforms and elevated walkways. Most accidents that occur when working at heights can be prevented by:

- Thorough identification of all of the risks associated with the job.
- Assessing and controlling the risks before work commences.
- Undertake the work using a fall injury prevention system for example an elevating work platform such as a scissor lift or cherry picker.
- Ensuring safe access and protection from falls.
- Using the right equipment for the job and making sure it is correctly assembled and maintained.
- Good housekeeping, keeping the work area tidy and clear of obstacles.

Regulations require employers to identify all physical locations and tasks that might cause an employee or contractor to fall more than 2 metres. Where a task involving a fall hazard is identified, the employer must assess the risk of a fall occurring and put in place measures to control the risk. Where possible the risk should be eliminated, but if this is not possible, the risk must be reduced considering these controls:

- Undertake the work on the ground or a solid construction where this is possible
- Undertake the work using a passive fall prevention device for example a temporary work platform or scaffold
- Undertake the work using a fall injury prevention system for example an elevating work platform such as a scissor lift or cherry picker.

Not all work at heights will involve a fall hazard of more than 2 metres. But a fall from less than 2 metres can still cause serious injury. It is therefore suggested that even work at heights below 2 metres should be assessed for the risk of a fall occurring and the risks should have appropriate controls put in place to minimise the risk of injury.

Ladder control

When ladders are needed, it is important to:

- Choose the correct ladder for the job.
- Do not use metal ladders near electricity or power lines.
- Check the ladder is well maintained eg for damaged rungs or cracks.
- Cordon off the area if there are pedestrians or traffic nearby.
- Secure the head and base of the ladder – or ensure that someone is holding the base.
- Lock the spreaders on a step ladder into position.
- Make sure your footwear is suitable for climbing the ladder
- Use both hands to climb the ladder – tools can be passed up or carried in a belt.
- Make sure the stiles of the ladder extend at least 900 mm above the stepping off point and that there is a safe place to stand when stepping off the ladder

Scaffold controls

Where scaffolding is used, it is important that:

- It conforms to all regulations and standards in its construction and installation.
- If it is a mobile-type scaffold, that the wheels are locked prior to use.
- It is fitted with toe boards and hand rails and mid rails.
- Work platforms are level and kept clear of obstructions.
- Correct footwear is worn

Roofing controls

When working on roofs you can work safely by:

- Using fall protection systems such as safety mesh, safety nets, guardrails, or individual fall arrest systems, eg safety harnesses.
- Using safe access to the work area for yourself and your tools and equipment.
- Not working on fragile or asbestos cement roofs until a thorough risk assessment has been completed and safe work procedures put in place.
- Wearing suitable anti-slip footwear.

Working in confined spaces

Working in a confined space may present a major health and safety risk for those employees having to go in to them. Many ocur because the hazards of working in a confined space are either not identified or are under-estimated.

Tragically, many confined space accidents result in more than one fatality when attempted rescues of colleagues trapped in the confined space are unplanned and rescuers unprepared. Only persons who are appropriately trained & qualified must carry out work in confined spaces.

A confined space is a space of any volume which:

- Has limited or restricted means of entry and exit that makes it physically difficult for a person to enter or exit the space.
- May have inadequate ventilation and/or is an atmosphere which is contaminated or oxygen deficient.
- Is intended to be at normal atmospheric pressure at occupancy.
- Is not intended as a regular workplace, but may be entered by a person.

Being able to identify these hazards and plan appropriately for work in the confined space can mean the difference between a completed job and a disaster.

Planning confined space work includes carrying out a detailed risk assessment of the work to be undertaken – which means;

- identifying the hazards associated with performing the task,
- assessing the risk of these hazards causing harm and
- implementing suitable controls to eliminate or reduce the risk.

The hazards associated with working in confined spaces can include:

- The gases or fumes given off by by-products of previously stored materials or chemicals.
- Being trapped by fluids coming into the space such as in underground sewers and stormwater drains etc.
- Accidental leaks or spills which can contaminate the atmosphere of the space and add to slipping, tripping and falling hazards.
- Unexpected or continued operation of the plant, which leads to the worker being trapped or crushed by rotating or moving parts.
- Suffocation or engulfment by solids.
- Oxygen being used up by machinery or contamination by exhaust gases.
- Chemical reactions that could lead to explosion or a contaminated atmosphere.
- Extremes of temperature causing heat exhaustion or hypothermia".
- Noise which may effect hearing but also prohibit or limit communication with those outside the confined space.
- Manual handling injuries caused from working in cramped or awkward positions.

Risk

Risk management

Risk management is all about identifying hazards and minimising or controlling the risk of them causing an illness or injury.

The most effective way to identify risks and decide on what action that should be taken is to carry out a risk assessment, using the following three steps:

1. identify the hazards
2. assess the risks
3. control the risks.

Employers have a legal responsibility to identify, assess and control risks whenever:

- a new worksite is being set up

- work processes are being planned
- plant or equipment is being installed or used for the first time
- changes are made to the workplace, systems of work, equipment used or materials handed
- new information regarding work processes, equipment used or materials being handled becomes available

So...what is risk?

Risk is the probability of injury or loss upon a worker and the workplace.

Risk management is the process of identifying workplace hazards, assessing the risks level of impact and probability and eliminating or minimising the effect that the risk will have upon the workers.

Risk

Definitions

Before you can identify risks you need to be able to identify what a workplace hazard actually is.

Hazard definition

A hazard is a source of danger that could result in an accident if undue care is not exercised. Unfortunately, when not rectified, hazards put all workers at risk.

Summary

- Therefore a **risk** is the probability of injury or loss upon a worker and the workplace and a **hazard** is the source that causes the risk

Hazards

There are about 400-450 deaths each year in Australia from accidents at work. A further 80-120 people die as a result of work associated transport accidents. There are also approximately 200,000 workplace injuries and disease each year that require more than five days away from work.

One of your workplace obligations is to identify hazards and either removing them or report them to the correct people. Minimising their impact can seriously reduce the number of workplace accidents that can occur on a worksite.

Definition of hazard

A hazard is identified as some threat which has the ability to cause injury or even death to workers. At the very least the hazard could interrupt the flow of work and cost a great deal in productivity loss. A hazard can be either;

- chemical - explosiveness, flammability, corrosion, oxidation, poisoning, toxicity, carcinogenicity
- physical - electrical,noise, radiation, heat, cold, vibration and pressure
- biological - infection or allergic reaction from hazards such as viruses, bacteria, fungi
- ergonomic - from poor work design, layout or activity - manual handling, workplace layout and task design.
- psychological - stress, violence at work, long working hours

Hazards cannot always be entirely eliminated however if they are controlled effectively they may not become a risk to any workers i.e. not all hazards are dangerous all of the time.

Workers may be exposed to hazards or risks as part of their normal day to day work activities. In some cases, such exposure may be so low as to be considered acceptable; in others, exposure to hazards may be unacceptable, as it can be, or is, a risk to health and safety. It is the responsibility of the employer, and the task of the workplace health and safety professional, to identify and evaluate the risks from exposure to workplace hazards, and to control risks to acceptable levels.

The concepts of hazard identification and risk management are fundamental to controlling workplace hazards. Therefore, it is important to understand what hazards are, what the possible risks to exposed workers is likely to be, and how the hazards should be controlled.

Hazardous substances

There are over 35,000 different types of chemicals are used today in our places of work. Approximately 200 new chemicals are introduced into Australia each year. Many of these chemicals that are used on an every day basis may be hamrful to your health.

Exposure to chemicals commonly used in workplaces can lead to a variety of short and long term health effects such as poisoning, skin rashes and disorders of the lung, kidney and liver.

They come in the form of:

- solid materials
- liquids and mists
- gases and vapours
- toxic chemicals

Chemicals can include but are not limited to:

- Industrial chemicals such as solvents, cleaners or degreasers
- Paints
- Pesticides
- Drugs and medicines

Manufacturers and importers of hazardous substances are legally obliged to include warning labels and Material Safety Data Sheets (MSDS) with their products. This information offers advice on safe handling practices

Asbestos

What is asbestos?

Asbestos is a natural mineral that has been mined for many years. It is a crystal that is made up of many long thin fibres.

Asbestos falls into two main groups;

1. Serpentine
2. Amphibole

Asbestos in the Serpentine group is found widely and accounts for about 95% of all asbestos found in commercial buildings and households. Whereas asbestos from the amphibole group is primarily used in thermal insulation products and ceiling tiles.

Up until the mid 1970's asbestos was used widely in the manufacture of many products. Asbestos has been widely used in the past for such things as:

- construction materials such as asbestos-cement (AC) sheeting in construction work, gaskets for automotive engines, vinyl floor coverings, roof shingles, wall claddings
- asbestos cement lining and ceiling sheets
- asbestos cement drain and conduit pipes
- roof sheeting and guttering
- thermal insulation (lagging) on steam pipes, boilers, furnaces, ducts in buildings, plant, ships and furnaces
- fire retardant in high rise buildings, between floors or fire-doors
- compressed asbestos in vehicle brake linings, clutch plates
- acoustic insulation in false ceilings, especially in schools, hospitals and public areas;
- heat resistant such as cloth, padding, blankets
- electrical switchboard panels (Zelemite)

If inhaled, the asbestos fibre or dust, can cause lung cancer, (bronchial cancer), asbestosis (scarring of the lungs) or mesothelioma (cancer of the lining of the lungs).

Although the manufacture of asbestos based products is prohibited we are left with the legacy of having to deal with the removal or demolition of the materials, as the need occurs.

Presentation

Watch the following video to learn more about the properties of Asbestos:
http://www.youtube.com/watch?v=v3UMvf9kcMg&feature=player_embedded

Types of asbestos

Friable asbestos can be reduced to powder when squeezed. It is often found as insulation (also known as lagging) which was wound around old water pipes and steam pipes or in fibrous board. This type requires a Class A licence to remove the asbestos if the amount exceeds 10 square metres. An experienced tradesperson can remove asbestos if there is less than 10 square metres in fibrous board.

- (Note: In its raw state, asbestos is friable,which means it can be easily broken into tiny microscopic fibers and inhaled.Individual asbestos fibers are smaller than a human hair, and some are so small as to be invisible to the human eye. *Source: http://www.asbestos-mesothelioma.com/asbestos-fibers.html*)

Non-friable asbestos does not become powdery under pressure. It is found in bonded asbestos cement (AC) sheet, eaves lining, some floor finishes and vinyl tiles and has a low risk of releasing fibres. A Class B licence is required to remove this asbestos in AC sheet.

- (Note: Asbestos is not friable when it is embedded in ceiling tiles or pipe coverings; the potential for dangerous asbestos exposure occurs when asbestos products are broken, cut, or sanded. *Source: http://www.asbestos-mesothelioma.com/asbestos-fibers.html*)

If specialist contractors are required, they will need to carry out their work to stringent standards which may include:

- a report of the air quality in the immediate area
- the provision of full protective clothing and respirator to all staff
- the neat stacking and wrapping of the removed asbestos in plastic sheeting which must then be securely sealed and bound
- the disposal of the asbestos at a licensed disposal area
- a full report which establishes air readings before removal commences, progressively as the work is being done and at the completion of the removal.

In many cases, exhaust fans and other mechanical means are used to assist in maintaining the air quality of the immediate area and also the neighbouring area.

Note: In commercial projects the cutting, handling and installation of medium density fibreboard (MDF) is being treated with as much caution and respect as asbestos. This is due to the urea/formaldehyde resin which results in exposure to both wood dust and formaldehyde vapour.

The state safety authorities have further information on the health hazards of wood dust.

Precautions when working with asbestos cement products

Minimise generation of dust and spread of dust;

- use non-powered hand tools such as hand-saws;
- wetting down material will further reduce the generation of dust when cutting but high pressure jets must not be used;
- power tools (unless special approval obtained from the State Government) shall not be used for sanding, cutting, etc
- work in open, ventilated areas;
- use plastic “drop sheets” to collect off-cuts and coarse dust, vacuum fine dust or wet and sweep if necessary; and
- use appropriate respirator particularly in confined space

Precautions for removing fibro sheeting (these sheets are not to be reused)

- area adjacent to the site should be roped off and all remaining doors, windows etc closed;
- asbestos sheeting should be wetted with water (unless this increases risk of slipping of a roof etc.) or sealed. High pressure shall not be used;
- workers should wear disposable coveralls and approved respirators;
- only Government approved power tools shall be used;
- sheets should be removed with minimal breakage or lowered to the ground, not dropped;
- removed sheets should be stacked on a ground sheet and not allowed to be damaged by traffic;
- all waste to be kept wet, wrapped in plastic or sealed and removed in appropriate manner; the waste must be disposed of in a manner approved by the State Government; and

- any asbestos cement residue remaining in the roof space or around the removal area should be removed by vacuuming (with approved machine) if necessary

Chemical hazards

Chemicals are all around us both at work and in the home. Some of the dangers associated with chemicals are:

- Posionous corrosive
- Flammable
- Explosive
- Toxic

Classes of chemical hazards

Class 1 explosives

Materials that can react violently if subjected to impact or friction or explode or burn rapidly if subjected to heat

Examples: Gunpowder, gelignite, fireworks, fuses, detonators

Class 2 gases

Compressed gases such as compressed air, liquefied gases such as LPG, or a solution of a gas in a liquid such as acetylene. The major hazard of gases is that they can expand explosively if heated or mishandled. Gases can also be flammable or toxic.

Class 3 flammable liquids

Liquids that are able to catch fire at low temperatures and continue to burn

Examples: Petrol, Kerosene

Class 4 flammable solids and reactive substances

Solids that can easily catch on fire or may contribute to a fire, or are likely to spontaneously catch on fire in the air or if they come into contact with water

Class 5 oxidizing agents and oxidizing peroxides

Materials that can help other substances burn by supplying oxygen to them

Class 6 toxic and infectious substances

Substances which if they enter the body can cause severe injury, illness or even death

Class 7 radioactive substances

Any substance that produces a given level of radiation as part of nuclear reaction.

Examples: Uranium, Plutonium, Radio Isotopes

Class 8 corrosive substances

Chemically react to living tissue or their packaging or surrounding materials causing sever e damage or injury. Special protective equipment needs to be worn when handling these materials.

Examples: Hydrochloric acid, sodium hydroxide

Class 9 Miscellaneous Dangerous goods

Materials that can be dangerous when stored or transported but are not covered by the other classes

Examples: Aerosols, Dry Ice, Asbestos

Classes of chemical hazards

Chemicals can be classified into one of nine hazard classes. Each hazard class has a number and a symbol so you can recognise the hazard

Chemicals can get into our bodies several ways

Inhalation

Poisonous gases, dusts and powders can enter into our lungs and become absorbed into the blood.

It can be very dangerous because we cannot stop breathing and airborne dangerous substances can easily enter out bodies through our lungs.

Ingestion

Many materials are very dangerous if they are swallowed. They can get into your mouth if you put your hands in your mouth or smoke after handling a dangerous substance without washing your hands.

It is possible for food to become contaminated if it is kept near dangerous substances. You should not eat or store food near dangerous substances.

Skin Absorption

Many dangerous materials are easily absorbed through the skin into the blood stream. Materials can also enter through cuts and breaks in the skin.

Understanding MSDS

Material Safety Data Sheets (MSDS) are an important part in the correct handling, transporting, storage and application of hazardous goods and substances.

The MSDS lists all the relevant safety details that might affect:

- the user
- future processes
- the materials themselves, or
- other goods, substances and/or materials that the referenced materials are likely to come in contact with.

OHS legislation requires the manufacturers or suppliers of workplace substances to provide Material Safety Data Sheets (MSDS). The MSDS is usually supplied with their first delivery of the hazardous substance. MSDS provide relevant information on hazardous chemicals and substances.

All MSDS are produced in a standard format and are divided into six major sections.

1. Introduction - *company name, address, telephone number*
2. Identification - *product name, associated numbers and codes, physical and chemical descriptions*
3. Health hazard information - *health effects, first aid recommendations for various entry routes, advice to doctor.*
4. Precautions for use - *exposure limits, engineering controls, personal protection – including personal protective equipment (PPE), level of flammability*
5. Safe handling information - *control of spills and safe disposal, fire explosion hazard information, other information*
6. Toxicological data - *toxicity information*

MSDS are designed to provide information to doctors, engineers, OHS representatives, managers, emergency service persons, employers and employees.

The most important sections the employee must be familiar with are:

- identification
- health hazard information
- precautions for use
- safe handling information.

If you have difficulty understanding any of the information on the MSDS, the national code of practice for the preparation of Material Safety Data Sheets NOHSC:2011 provides a definition for each of the recommended information categories.

Risk assessment

Now that you know how to identify hazards in the workplace you need to learn how to assess the type of risk that might occur from those hazards.

Purpose of a risk assessment

The purpose of a risk assessment is to determine the risks of the identified hazards and to use appropriate control measures to reduce the level of risks and enable the work to be performed safely.

How is a risk assessment conducted?

Once a hazard has been identified it is then assessed to determine the severity of the injury that the hazard would cause or how it will effect people and the workplace (consequence). Then it is assessed for how likely it is to occur (probability). Once these have been determined the response to the hazard can be determined.

Response to risk = Severity + Probability

When must a risk assessments be done?

In theory a risk assessment can be undertaken at anytime however this may not lead to the most effective use of time and resources. The following list provides an idea of when risk assessments should be undertaken or reviewed at work.

- When a job is first undertaken

- Immediately prior to using premises for the first time as a place of work
- When a new piece of equipment is installed
- When new or relevant information regarding health and safety becomes available from an authoritative source e.g. WorkCover
- When substantial changes are made to a system of work
- When there has been an injury to a person undertaking a job or to a person near where a job is being performed
- Following an accident that did not result in an injury or damage
- When there is evidence to suggest that a current risk assessment is no longer valid
- When hazardous substances and/or dangerous goods are introduced into the workplace
- As part of the design and construction of a new facility
- Prior to conducting an experiment
- As part of developing and designing a new subject, unit or course outline

Employees role in conducting a risk assessment?

Employees play a vital role because it is often the case that an employee will know most about their work and the hazards/risks inherent in the work.

At work it is expected that employees will take a proactive role in the risk assessment process by offering constructive information and feedback.

Risk assessment

Once the hazards have been identified, they can be given a risk rating depending on how urgently they need to be addressed.

Below is a typical risk assessment table used to rate the likelihood of an accident occurring and the severity of the injury that might result. This allows you to put a priority rating to each of the hazards identified, so that the most serious ones can be dealt with first.

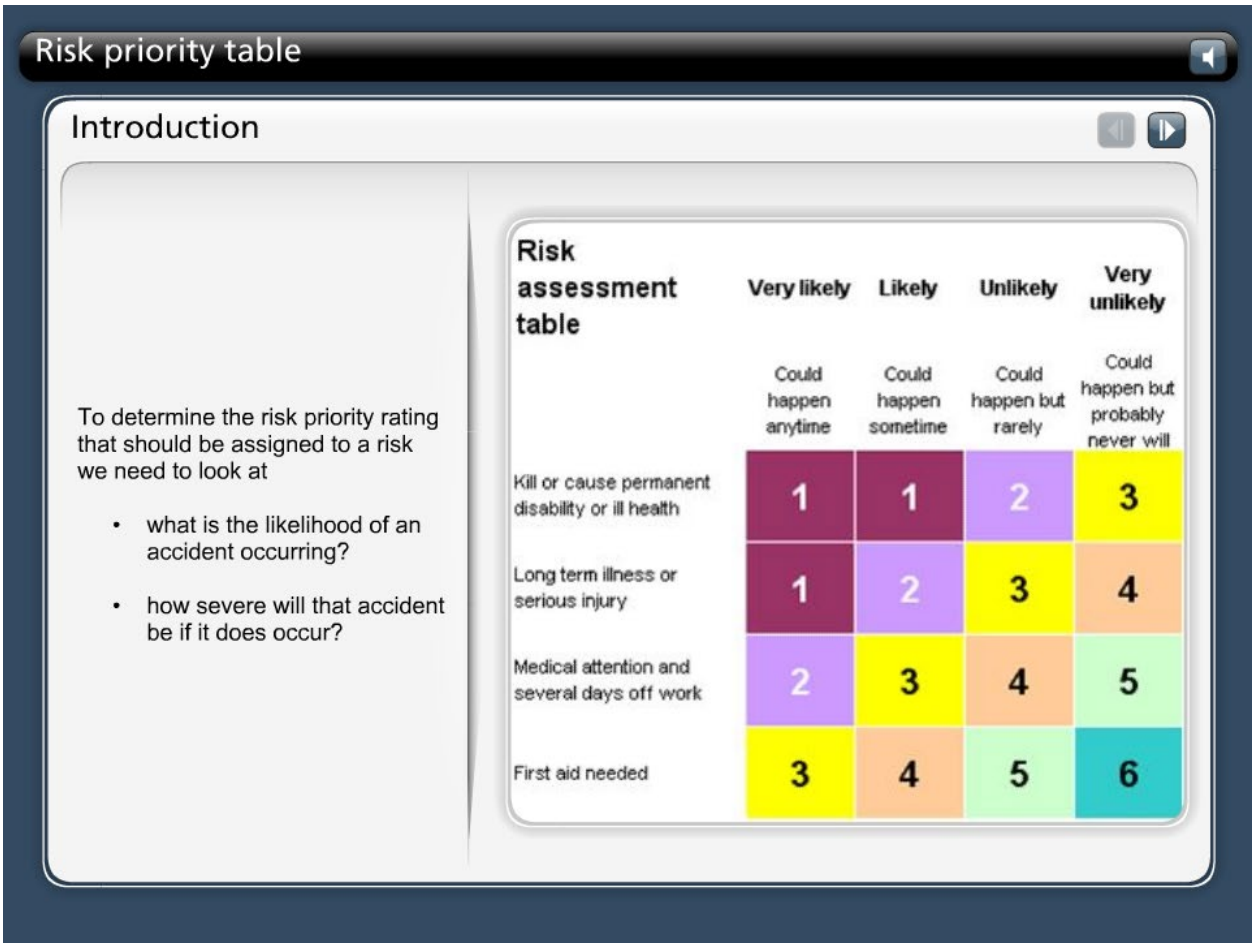
Risk priority table

Introduction

To determine the risk priority rating that should be assigned to a risk we need to look at

- what is the likelihood of an accident occurring?

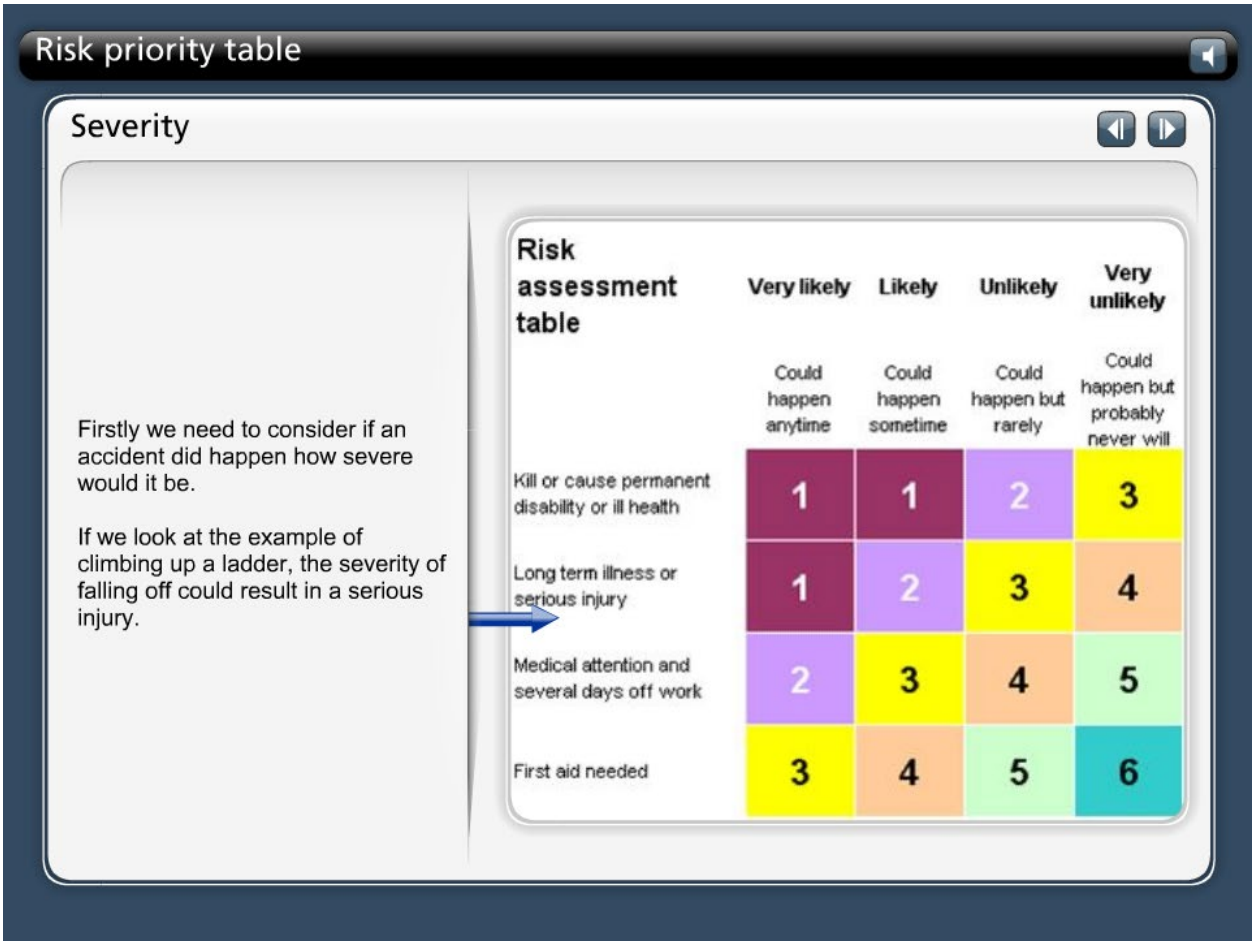
- how severe will that accident be if it does occur?


Risk priority table
Introduction
To determine the risk priority rating that should be assigned to a risk we need to look at
• what is the likelihood of an accident occurring?
• how severe will that accident be if it does occur?
Risk assessment table
Very likely
Likely
Unlikely
Very unlikely
Could happen anytime
Could happen sometime
Could happen but rarely
Could happen but probably never will
Kill or cause permanent disability or ill health
1 1 2 3
Long term illness or serious injury
1 2 3 4
Medical attention and several days off work
2 3 4 5
First aid needed
3 4 5 6

Severity

Firstly we need to consider if an accident did happen how severe would it be.

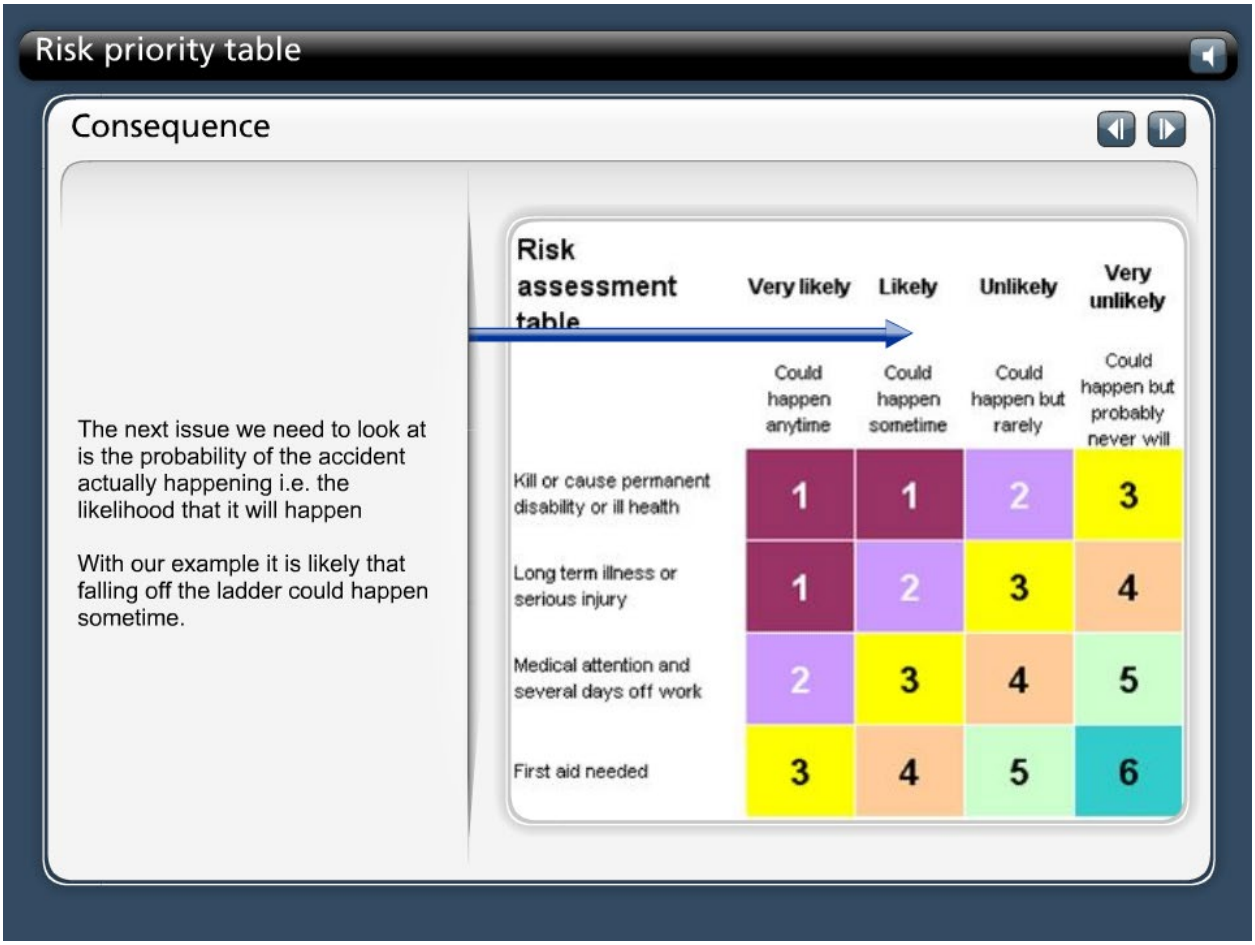
If we look at the example of climbing up a ladder, the severity of falling off could result in a serious injury.



Consequence

The next issue we need to look at is the probability of the accident actually happening i.e. the likelihood that it will happen

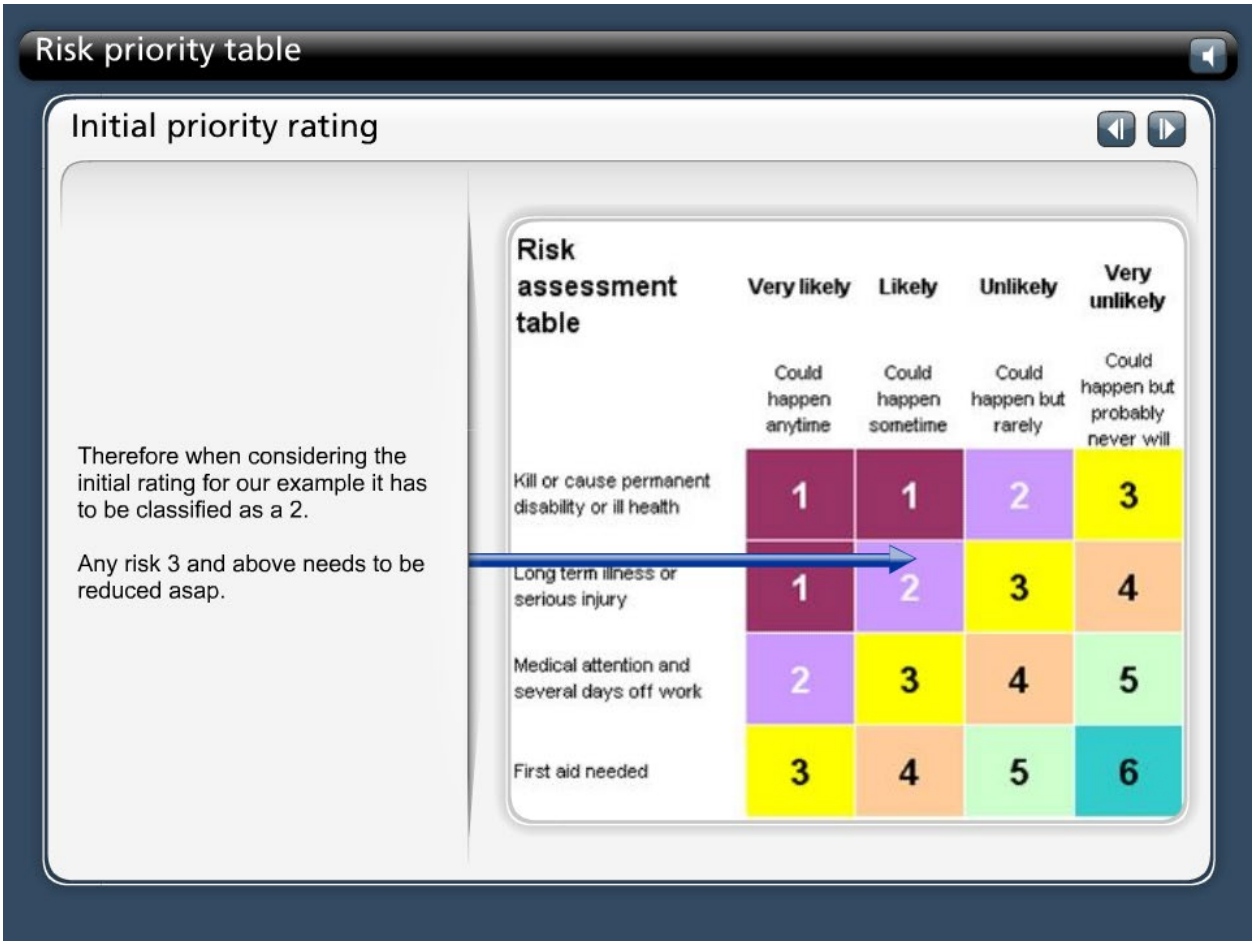
With our example it is likely that falling off the ladder could happen sometime.



Initial priority rating

Therefore when considering the initial rating for our example it has to be classified as a 2.

Any risk 3 and above needs to be reduced asap.



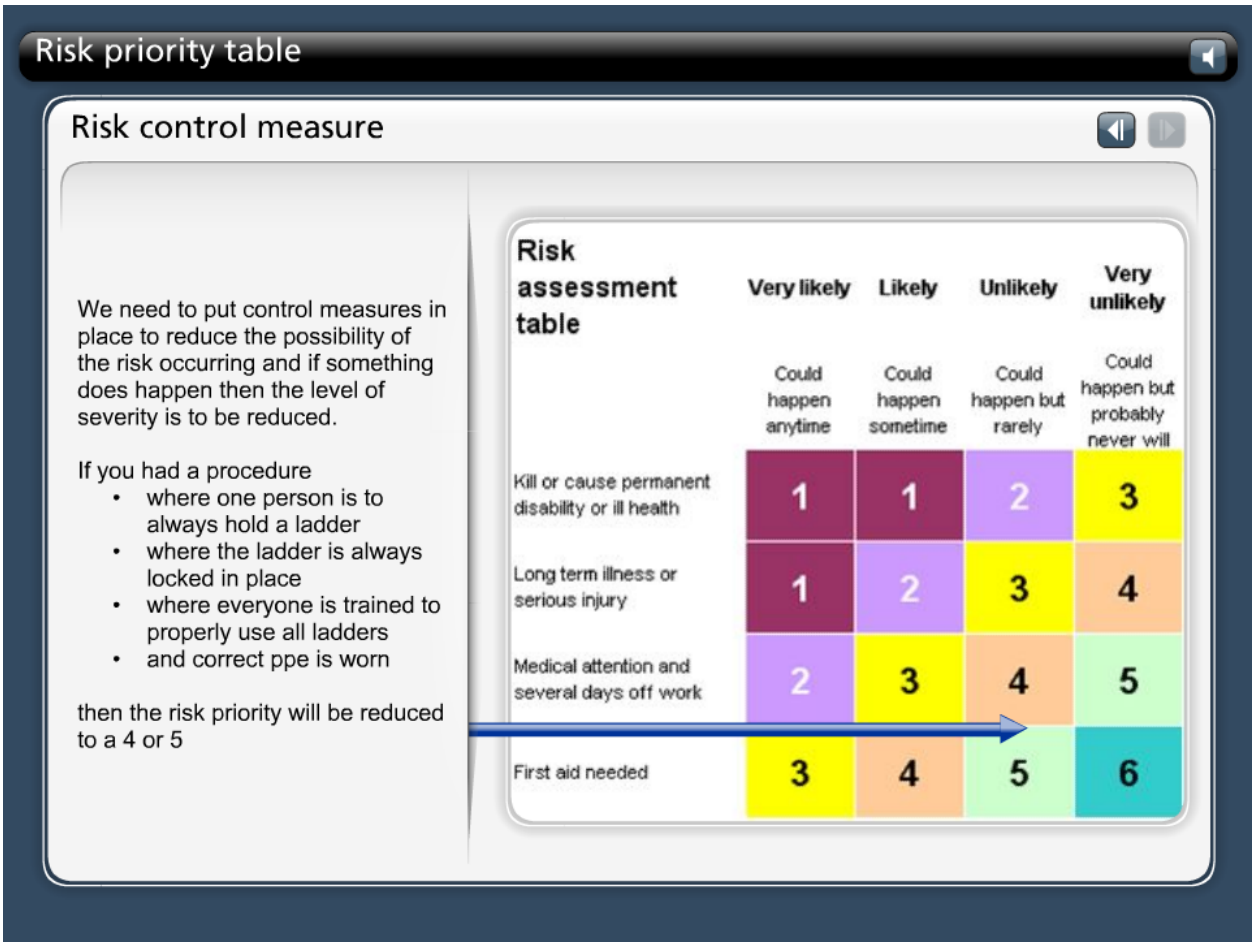
Risk control measure

We need to put control measures in place to reduce the possibility of the risk occurring and if something does happen then the level of severity is to be reduced.

If you had a procedure

- where one person is to always hold a ladder
- where the ladder is always locked in place
- where everyone is trained to properly use all ladders
- and correct PPE is worn

then the risk priority will be reduced to a 4 or 5



Hierarchy of control

Hazards lead to accidents. To reduce the risk of an accident, rectify or minimise hazards wherever possible. Not all hazards can be removed from the workplace. However, their effect can be reduced.

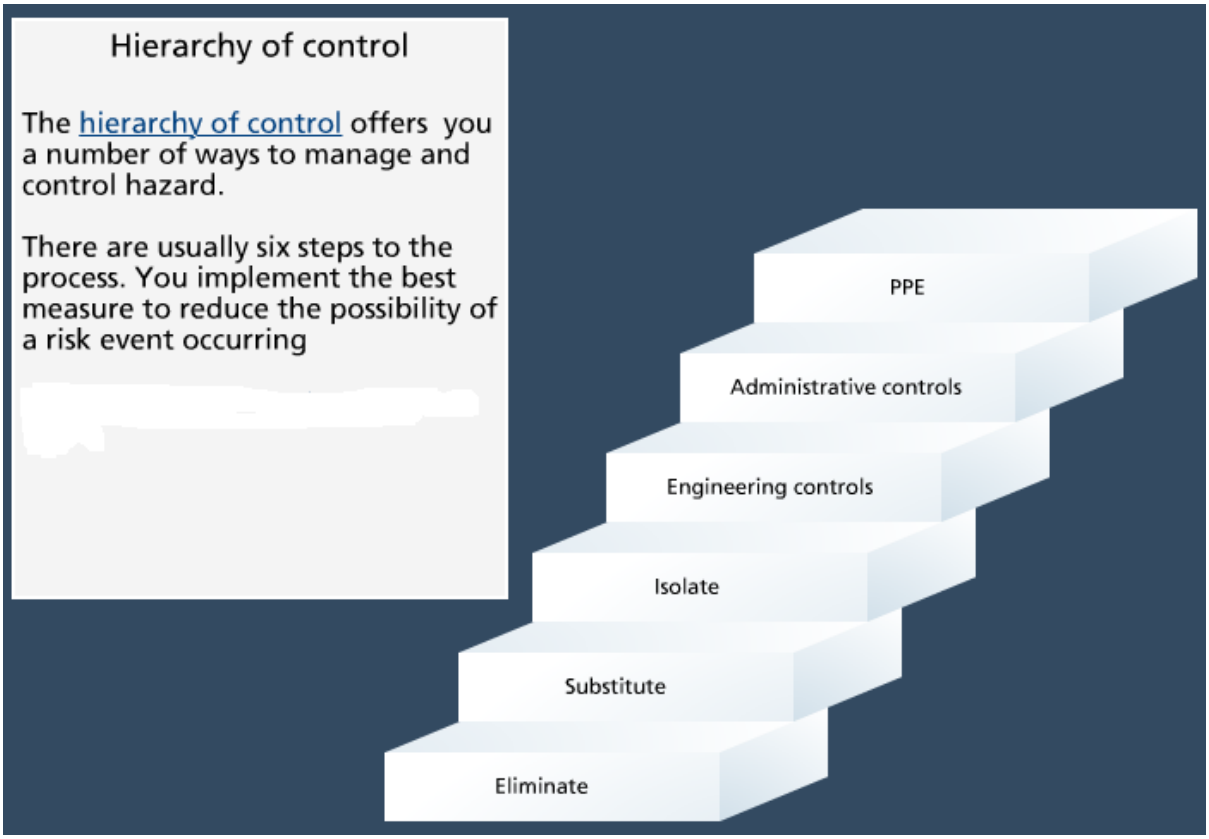
There is a preferred order of control measures for OHS risks. This is called the 'hierarchy of control'.

So the most practical process for deciding on how to address a hazard is to go through the hierarchy of controls, starting with the most effective solution -- removing the hazard from the workplace -- and working progressively to the least preferred option -- accepting that the hazard must remain and providing personal protective equipment to workers who are at risk.

Hierarchy of control

The hierarchy of control offers you a number of ways to manage and control hazards.

There are usually six steps to the process. You implement the best measure to reduce the possibility of a risk event occurring



Eliminate
Eliminate the hazard

Where possible you eliminate or remove the hazard from the workplace. For example: remove faulty electrical equipment

Substitute
Substitute the hazard

If you are not able to remove the hazard from the workplace are you able to substitute it or replace it with a lesser risk. For example use less toxic materials to complete the job.

Isolate
Isolate the hazard

If it is not possible to either eliminate or substitute the hazard then isolate it by placing in either an enclosed or restricted environment. For example create a specific area for grinding.

Engineering controls
Use engineering control measures

This involves using special equipment to assist with managing the risk. For example installing safety switches to protect socket outlets or to use dust extraction fans to reduce the level of dust.

Whilst there is still a hazard - the probability of risk actually occurring is minimised significantly.

Administrative controls
Use administrative controls

Administrative controls should always be in place on a worksite. This step involves;

- regular testing & inspection of equipment

- conducting training
- rotating staff to reduce risk of fatigue
- generally implementing safe working practices

PPE

Use personal protective equipment

PPE should be used in conjunction with the previous steps. It involves items such as protective clothing, gloves, masks, safety glasses, face shields, safety helmets, steel capped boots, non-slip mats etc.

Just wearing PPE is not sufficient enough to reduce many workplace hazards.

For example wearing insulated gloves will not protect other workers from an electrical shock.

Risk management

Who is responsible for risk management?

The employer is legally obliged to have a risk management plan in place i.e. identify the foreseeable hazards in the workplace and apply appropriate control measures. This is called conducting a risk assessment. This process is carried out in consultation with employees.

The basic principles of risk management include:

- Identification of the hazards associated with the working environment.
- Assessment of the risk so as to determine the amount of impact it will have and the probability that it will occur.
- Reducing the risk to an acceptable level using required controls, as assessed.

These controls could be accomplished by:

- Improving the design of equipment or changing its location.
- Eliminating the risk by not continuing with the activity until other controls can be put in place.
- Substituting - by using equipment or plant tests that present a lower, more acceptable level of risk.
- Separation - by the use of isolating barriers or insulating mats.
- Administration - by rescheduling the activity, providing adequate training or using appropriate warning signs.
- Wearing personal protective equipment, for example, in the form of insulating gloves, protective clothing, face shields, safety footwear, etc.

Documentation

To conduct an effective and efficient risk management process you need to

1. Identify all the hazards that the job entails
2. Complete a risk assessment - determine the risk priority (severity + probability)
3. Determine the risk control - use the hierrachy of control

It is imperative that this process be documented, followed and filed for future reference. All jobs should have a risk assessment form completed before work begins.

Managing hazards and risks

Order these four steps for managing hazards and risks from most important to least important:

- Monitor and review the control measures to ensure continual safety
- Put appropriate control measures in place to eliminate or reduce the risks
- Identify the hazards
- Assess the risks arising from the hazard

When you think you have these in the correct order, check your answer against the one shown below:

- Identify the hazards.
- Assess the risks arising from the hazard.
- Put appropriate control measures in place to eliminate or reduce the risks.
- Monitor and review the control measures to ensure continual safety.

This hazard and risk identification process and subsequent control measures should be a process in which every person on-site is involved. This process should be documented.

Safe Work Method Statement

The Safe Work Method Statement (SWMS), also known as the Job Safety Analysis (JSA), provides an easily understood way to encourage contractors to become actively involved in the prevention of accidents.

Each sub-contractor coming on-site must prepare an SWMS that clearly indicates to the site management how the sub-contractors will carry out their particular area of work.

This must be completed and signed off by both parties (sub-contractor and manager) before any work commences. A copy of the document must be kept in the site files so that the sub-contractor's progress can be constantly checked against the document.

The benefits of the SWMS to contractors are as follows:

- fewer health and safety incidents
- better communication with sub-contractors
- a transportable planning tool which only requires site specific updating
- helps them to meet basic health and safety responsibilities.

Storage of hazardous materials

In the workplace, there are many various substances that can cause you and the environment harm if you don't handle and store them properly in particular;

- fuels, such as petrol, diesel and LP gas
- solvents, such as paint thinners, metholated spirits and turps
- poisons, such as pesticides and herbicides
- acids, such as battery acid, or brick-cleaning hydrochloric acid
- preservative treatment chemicals, particularly in mills involved in the pressure treatment of timber.

Guidelines to follow

Here's some guidelines to follow on the handling and storage of hazardous materials:

- Store chemicals in a designated area, away from stormwater drains.
- Provide bunding around the storage area.
- Clearly label each container with the name of the chemical it contains.

- Don't store incompatible chemicals with each other.
- Dispose of hazardous wastes in accordance with the EPAs requirements for waste tracking, using a licensed contractor and a licensed waste disposal facility.
- Check your work areas regularly to identify any problems that might result in a spillage.
- In particular, make sure that drums or containers aren't placed where they can be knocked over by forklifts or reversing trucks.
- Never allow hazardous liquids or other chemicals to soak into the ground. Chemicals can accumulate in the soil and seep into the ground water, causing water and land contamination.
- If chemicals spill onto unsealed areas of your property, you'll need to take special care to remove the contamination. Contact your local council or the EPA if your land has areas where chemicals have soaked into the soil.

Read MSDS for storage and spillage instructions

You should always follow the instructions put out by the manufacturer when you're handling a hazardous substance. The label will give you basic information, but for a complete rundown on how to store and what to do in the event of a spillage, or how to dispose of the product safely, you'll need to read the material safety data sheet (MSDS).

Hazchem placards

You may have seen HAZCHEM placards located at the entrance to a building, or on the rear of a truck body. These placards help authorities identify what hazardous goods or dangerous substances are present.

A HAZCHEM code is used to detail information about the hazard; this information can then assist authorities in the case of an emergency such as a fire or a spill. An example of a hazard placard is shown below.

Where dangerous goods are stored in large amounts (according to Dangerous Goods Safety Management Regulation 2001), placarding must be erected. An outer warning placard stating 'HAZCHEM', as shown below, must be visible from every entrance to the premises.

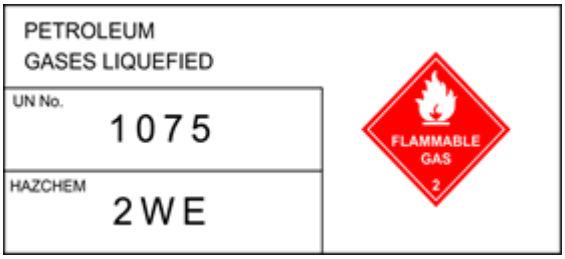
Note: *Placarding is not required where the only gas present is liquified petroleum gas in cylinders outside a building, connected to appliances by piping.*

Information placards must be placed at the following locations where gases are stored in excess of the placarding quantity:

- the main point of entry into a building
- at either the main point of entry to a room or enclosure or other area
- adjacent to where the gas cylinders are being stored.

Information placards may take two forms:

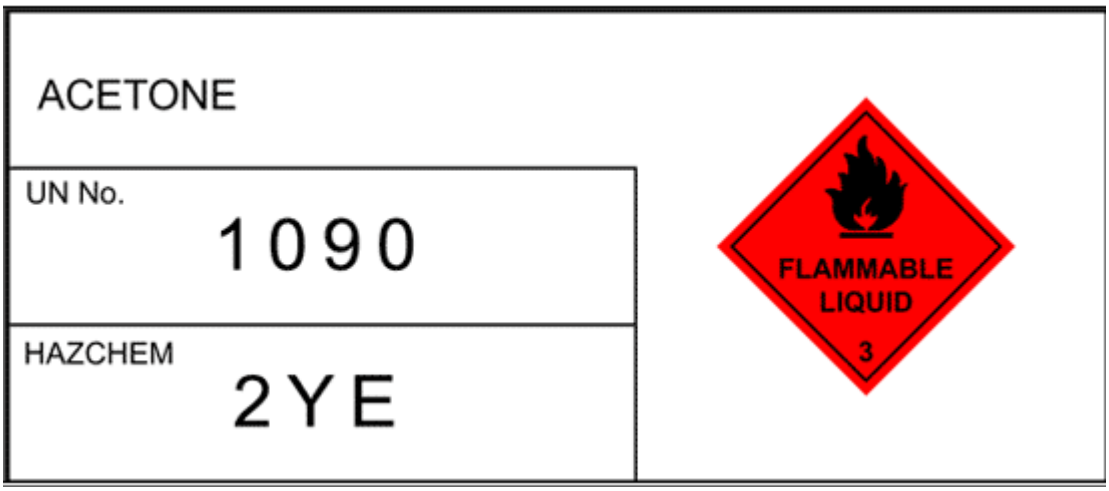
- those for tanks (gas cylinders that have a water capacity of 500L or more) need to be in the format shown below displaying the proper shipping name, UN number, class diamond label and haz-chem code



- for package stores, the placard consists of the class diamond for each class of gas stored in excess of the placarding quantity. The class diamonds must be at least 100 mm in diameter and not confused or obstructed by other signs or objects. (Note: Packages are cylinders that are less than 500 litres water capacity.)

Reading Hazchem placards

Imagine you need to fight a fire in the workshop, where the following hazchem placard exists. What information does the placard hold which might be of assistance?



Interpreting a HAZCHEM sign

ACETONE		This is the name of the hazardous substance. In this example it is acetone. Acetone is commonly used in paints and adhesives.
No	1090	This area shows the UN number. This number should be given to emergency services if an emergency arises involving this product.
HAZCHEM substance.	2YE	The **2** represents the suitable fire fighting agent for this 1=Water jet 2= Water fog 3= Foam 4= Dry agent The **Y** represents the appropriate precaution to be taken in the event of fire or spillage. Refer to the table on the following page to determine the precautions The E represents the evacuation of people should be considered.

P	V	Full	Dilute	
R		Full	Dilute	
S	V	BA	Dilute	
[redacted]	V	BA for Fire only		Dilute
T		BA	Dilute	
T		BA for Fire only		Dilute
W	V	Full	Contain	
X		Full	Contain	
Y	V	BA	Contain	
[redacted]	V	BA for Fire only		Contain
Z		BA	Contain	
[redacted]		BA for Fire only		Contain

V = can be violently or even explosively reactive

BA = Use breathing apparatus plus protective gloves

FULL = Use full body protective clothing with breathing apparatus

DILUTE = Wash to drain with large quantities of water

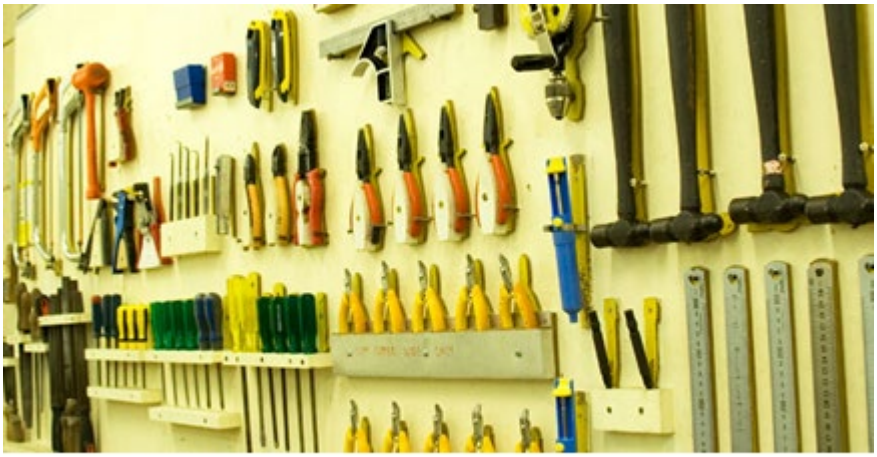
CONTAIN = Prevent spillage from entering drains or watercourses

General housekeeping

Good housekeeping and maintenance are the essential routine supports of industrial safety and health. They are complementary and, on some points, it may be difficult to draw a line between them, but a general distinction may be made.

Maintenance covers the work done to keep building, plant, equipment and machinery in safe and efficient working order and in good repair; the upkeep of all sanitary and welfare facilities; and the regular painting and cleaning of walls, ceilings and fixtures.

Good housekeeping includes day-to-day cleanliness, tidiness and good order in all parts of the undertaking. Good housekeeping is almost impossible without good maintenance of machinery and equipment; for example it is difficult to keep a badly-worn floor clean or to keep it dry if there is leakage from a broken roof or some ill-maintained piece of plant. On the other hand, good day-by-day housekeeping will considerably cut down the amount of maintenance work required.



Many accidents can be attributed, in the first place, to defective maintenance, for example:

- Falls on broken floors or worn-down steps or stairs;
- Falls off or from defective ladders, stools or chairs;
- Access to dangerous parts of machinery through broken or badly fixed guards; and
- Scalds from leaking steam pipes or burns from unlagged hot pipes.

A very large number and a very wide range of accidents may be caused in part at least, by bad housekeeping, for example:

- Falls on floors left slippery, greasy, or damp;

- Striking against or falling over machine parts, material or other obstructions left lying in passageways;
- Cuts from objects left protruding from benches; and,
- Punctures by nails protruding from wood, especially on construction sites

Risks from internal transport are intensified if passageways are not kept clear or stacking of materials restricts your vision. Badly-stacked materials may fall and cause serious injury.

Fires may be started if combustible waste is not regularly removed or if excessive quantities of flammable materials are kept in workshops. Health risks from dangerous dusts and chemicals are greatly increased unless all working surfaces and surroundings are kept clean.

Good housekeeping cannot be left to the unplanned activities of persons employed but is, in its broad outlines, a responsibility of management. The undertaking should be laid out in such a way that it is easy for order and cleanliness to be observed. Aisles, walkways, traffic areas and exits should be properly marked and defined.

Special areas should be set aside for storage of raw materials, finished work, tools and accessories. Racks for hand tools or implements above workbenches and an underbench slot or other simple provision for storage of small personal possessions will keep working areas clear. Adequate receptacles for waste and debris should be conveniently placed.

Floors and workbenches should be constructed of materials suitable for the work done and also be easy to clean; non-slip surfaces allied with non-slip polishing methods will obviate the risk of slipping which sometimes occurs in public offices.

Many machines are liable to eject quantities of oil, swarf or water but much can be done by screening and simple physical devices to prevent deposit on the surrounding floors. Wet processes or plant should be provided with drainage channels and sometimes isolated by curbs.

Each type of industry has its particular housekeeping problems, from large steel works to a small dressmaker's workroom. Construction sites present serious difficulties: only the most rigorous supervision and the co-operation of all employees can keep the site, work platforms, etc., free from tools, bolts, planks, (including upturned nails) and other objects likely to cause serious accidents.

Emergency procedures

Fire safety

Fires at work can result in serious injury or loss of life. It could also cause serious interruption to production due to the loss of buildings, equipment, stores, and records.It is a fact that most fires that occur are preventable. Typically, fires are caused by any one of the following:

- Open flames coming in contact with rubbish
- Faulty electrical equipment
- Incorrect use or storage of chemicals
- Portable heaters being faulty or left on
- Gas welding and cutting
- Smoking
- Static electricity
- Hot surfaces
- Sparks from machinery or mechanical processes

To have the best chance of preventing fire, pre-planning is vital. Areas and processes that could be a fire risk in a workplace should be identified and systems put in place to prevent fires from arising. Areas of risk to consider are:The type of building construction

- Processes and manufacturing operations
- Maintenance operations
- Storage and handling of chemicals and materials

Some fire prevention strategies are:

- Good housekeeping – making sure work areas are regularly cleaned and rubbish is disposed.
- Following safe working practices when using chemicals or other flammable items.
- Correct storage of all chemicals and substances
- Regular inspection, testing and tagging of electrical equipment
- Correct disposal of waste
- Strict control of tasks involving ‘hot work’
- Easy accessibility to all fire equipment
- Regular inspections by qualified fire safety personnel

The prevention of fire is everyone’s business. There are many simple things every employee can do to minimise the risk:

- Looking after work areas and making sure they are kept clean and free from waste
- Checking that electrical wiring and appliances are safe, and tested and tagged if necessary
- Correctly disposing of flammable materials such as cleaning fluids, photocopier inks and oily or solvent soaked rags
- Always following safe work procedures

Where **NO SMOKING** signs are posted, they are there for a reason. Smoking in these areas has been identified as either a fire or an explosion risk.

Fire protection should be provided such as fire extinguishers, fire hoses, smoke detectors and in some cases sprinkler systems. The correct access to these areas should be free of equipment and materials. A fire team may be trained in the use of this equipment but every individual should also be aware of where the fire fighting items are located and who the warden for the area is. Every employee should know what to do in case of a fire but most importantly the fire evacuation routes and assembly areas.

On site fires

Combustible and flammable materials are present in every workplace in the construction industry. No matter where you work you are surrounded by potential fuels. Quite apart from the timber stock itself, which of course is very flammable, these fuels could include:

- sawdust, shavings and wood chips
- timber offcuts and edgings
- timber framing and cladding in buildings
- petrol and diesel
- gas
- solvents and other chemicals stored on-site.

There will also be various 'ignition' sources that may set these fuels alight under the right conditions, such as:

- electrical sparks from faulty machinery or loose wiring
- sparks from welding activities
- naked flames from matches or cigarette lighters
- smouldering cigarette butts.

Prevention

The two most important prevention measures you can take to avoid the possibility of a fire are:

1. maintain good housekeeping
2. keep potential ignition sources away from flammable and combustible materials.

This means that you should always try to keep the workplace clean, especially at the end of the day before you knock off, and always make sure that any activities that may cause sparks or flames are carried out well away from fuel storage areas. The most obvious example of this is to avoid smoking near gas, petrol or diesel storage tanks or refuelling areas.

Fire fighting equipment

Fire extinguishers and hose reels are the most common equipment kept to fight fires on-site. Fire extinguishers are colour coded and labelled according to their contents. It's very important to match the correct extinguisher to the type or class of fire. The contents of

some extinguishers may be unsuitable — or even dangerous — if used on the wrong type of fire.

Fire classes are categorised according to the type of material that is burning. They range from Class A to Class F, and cover solids, liquids, gases and electrical currents.

Classes of fire

Class A - Ordinary combustible solids

Includes: wood, paper, cloth, plastics, rubber, coal

Class B - Flammable and combustible liquids

Includes: petrol, oil, paint, thinners, kerosene, alcohol

Class C - Flammable gases

Includes: LPG, butane, acetylene, hydrogen, natural gas

Class D - Combustible metals

Includes: magnesium, aluminium, sodium or potassium

Class E - Electrical fires

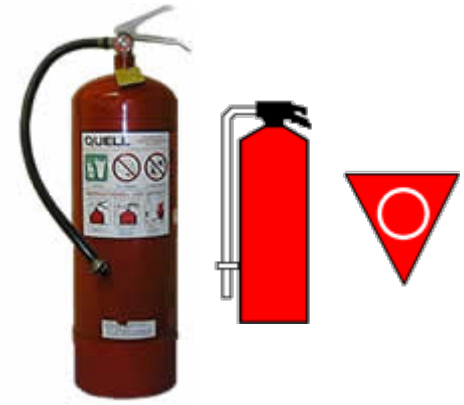
Includes: computers, switchboards, power-boards

Class F - Cooking oils and fats

Includes: cooking oils and fats usually found in industrial kitchens

Types of fire extinguishers

The water extinguisher

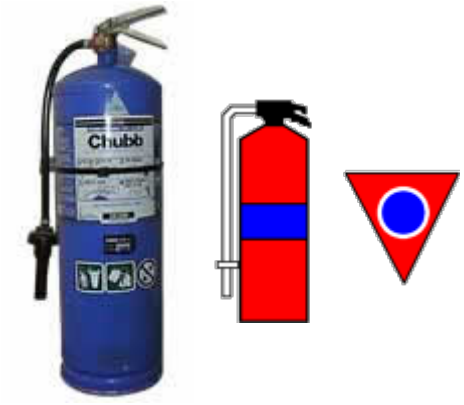


Direct the stream of water at the base of the fire. Move the stream of water around the fire and then over the fire. The water both cools and smothers the fire.

- Colour: Solid red.
- Contents: Water
- Label: **Class A fires** paper, wood, cardboard.
  Dangerous if used on cooking oils, fats, electrical fires.

If you use a water extinguisher on an oil fire the oil may explode and fire spread by floating on the water

Foam extinguisher



Place a layer of foam in front of the burning liquid. Next direct the foam behind the fire and then up and over the fire. The burning liquid is trapped between the front and back layers of foam and it is then smothered. The foam both cools and smothers the fire.

- Colour: Red with a blue band or Blue
- Contents: Foam
- Label: **Class A and B fires** paper, wood, cardboard, and flammable and combustible liquids, e.g. methylated spirits.

Dangerous if used on electrical fires.

Dry Chemical

Apply the jet of powder to the base of the fire in a side-to-side sweeping action. Cover all of the burning material. The dry chemical does not spread out like water or foam. It also does not cool the burning material and there is a chance of re-ignition.

When the jet of powder first hits the fire it may draw in air that will cause the fire to flare up.

- Colour: Red with a white band.
- Contents: Dry chemical or powder.
- Label: **Class A, B, C and E fires** most fires except for oils and fats.

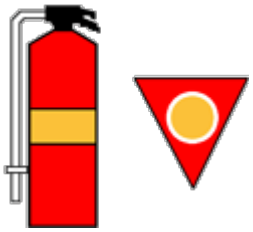
Carbon Dioxide

Pull the trigger on the extinguisher and direct the carbon dioxide fog at the near edge of the fire. Move the stream up and over the fire in a sweeping motion. Carbon dioxide does not cool the fire and it may re-ignite. The force of the carbon dioxide may cause the burning material to be splashed or scattered.

Carbon dioxide displaces oxygen and, in a confined space, this may create problems with breathing.

- Colour: Red with a black band.
- Contents: Carbon dioxide.
- Label: **Class E fires** electrical.

Wet chemical



- Colour: Red with an oatmeal band.
- Contents: Wet chemical.
- Label: **Class F fires** cooking oils and fats also paper and wood. Dangerous if used on electrical fires.

How to use fire fighting equipment

Fire extinguisher

To use a fire extinguisher:

- pull out the pin
- squeeze the handle while aiming the hose at the fire
- use a sweeping action to spray the substance back and forth across the fire, from front to back and from side to side.

Hose reels

Hose reels use water, and are only designed for Class A fires, that is, fires involving materials such as paper, wood and cardboard. They must never be used on fires involving fats or electrical equipment. To use a hose reel:

- turn the water on at the reel *before* unrolling the hose
- unroll the hose, with the assistance of another person if required

- turn the water on at the nozzle.

Fire blankets

Fire blankets are useful for smothering small fires associated with cooking stoves or other high-risk electrical appliances.

To use a fire blanket:

1. pull the tabs downwards to remove the blanket
2. shake the blanket open, holding onto the tags
3. hold the blanket in front of the body to form a heat shield
4. if an appliance is on fire - place the blanket over the fire and turn off the source of the flame
5. if a person's clothes are on fire - wrap the blanket around the person and roll them on the ground.

Evacuation procedures

There are many different reasons why a workplace may have to be evacuated. These may include fire, explosion, major chemical spill, gas leak, major accident, violence, bomb threat and siege.

The evacuation may involve only an individual work area, or may affect the whole work place. In either case it is important that employees are able to act in a way that is going to save their own lives and not put others at risk.

All workplaces should have procedures in place to deal with a potential site emergency. Employees need to know the procedures so they can be followed calmly and confidently if an emergency does occur.

An evacuation plan will contain instructions for dealing with the various emergencies that could occur at the particular workplace including the various responsibilities assigned to personnel within your workplace.

The plan may describe roles for:

wardens	The wardens are usually identified in an emergency by the colour of the helmet they wear, an identification card, an armband or high visibility vest. The warden is to account for the number of people in their area and to communicate the evacuation area to employees
the incident controller	The incident controller, person in charge or manager is someone on site will be nominated to take control in an emergency. It will be their responsibility to decide on the appropriate action and when it is safe to return to work. It is important that you know who this person is and to follow their instructions.
fire fighting teams	Fire fighting teams are employees who are trained to fight a fire or to clean up spills or contain leaks. They will usually be identified by the colour of their overalls or protective clothing
first aiders	Most workplaces have trained first aid staff who can provide support until medical attention arrives. They can also assist employees who have minor injuries or illnesses at work. Often they will be identified by a badge or their photos may be displayed on a notice board in your workplace.

The evacuation plan is usually displayed on the notice board or wall in each work area and contains vital information for employees, contractors and visitors. It highlights:

- Exits
- Assembly areas or muster points
- Location of fire extinguishers
- Instructions to follow if alarm is activated
- Emergency services phone numbers
- Emergency contact number for the site

The important points to remember in an emergency are to:

- Remain calm
- Follow the instructions of the warden(s)
- Proceed calmly to the designated assembly area

When employees start in a new workplace or work area, they need to be informed of:

- Who the area warden and incident controllers are
- What the evacuation plan includes and where it is displayed

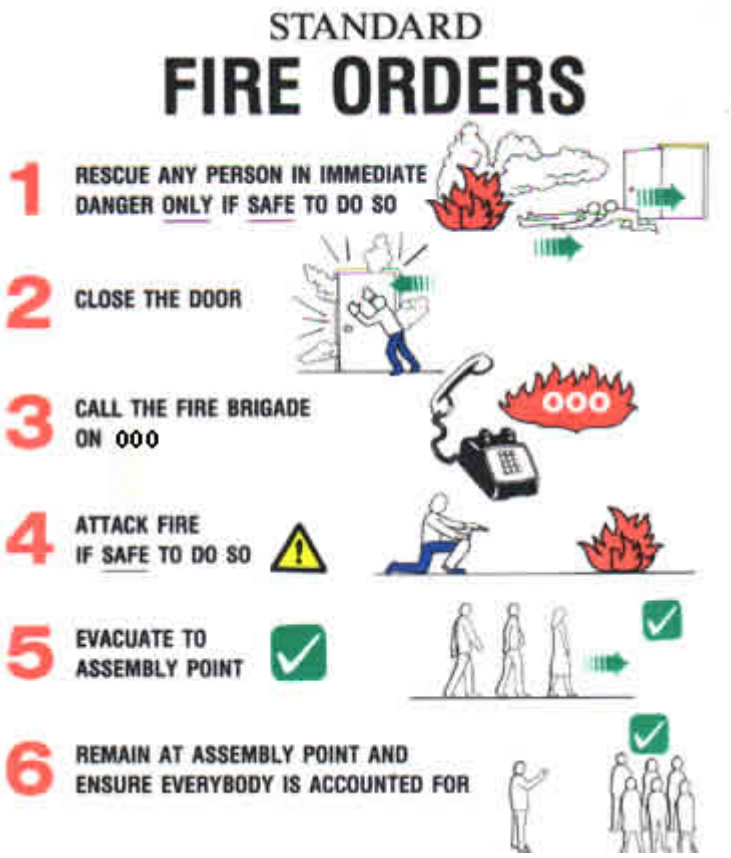
- Where first aid kits and facilities are located and who the first aider for the work area is
- How often emergency drills occur
- What the emergency contact number is for the site.

The evacuation plan

In an emergency you may need to evacuate the building where you are working. This may in response to:

- a fire
- a spill or leak of toxic materials
- a bomb threat

Your workplace should have an emergency response plan. This will detail the steps you need to take if an emergency occurs. You must become familiar with this plan so you know what to do in an emergency.



Contact emergency services

It is the responsibility of the Chief warden to get in contact with the emergency services. It is best to phone "000".

The following information will be required:

- The address of the place where the emergency is located
- The nature of the emergency. Eg fire, bomb threat, etc
- The number of people who are involved
- If any people have been injured
- Your contact details so the emergency services can get back to you if needed

Assembly area

All people should be directed to an approved assembly area. Once in the assembly area check that all of the people are present. It is a good idea to have a list of all the people who are meant to be in the area as well as a register of any visitor who may be in the building.

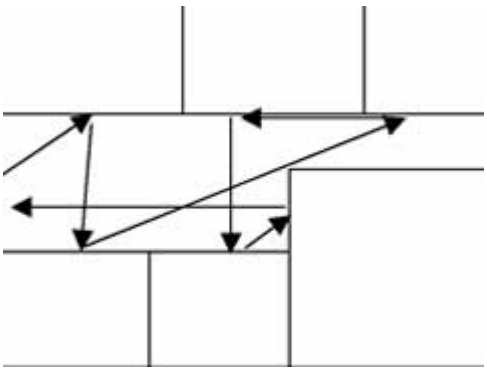
Checking and securing the building

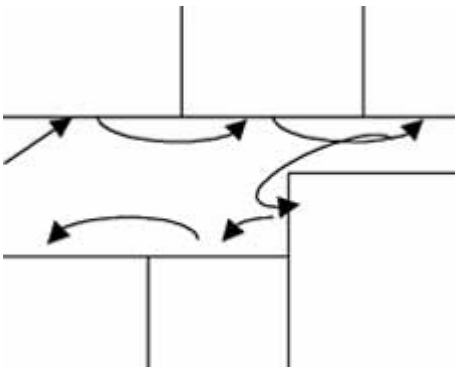
Wardens should make a check of the building or area to make sure all people have been evacuated. As they do this they should also secure the building.

Checking for people

It is important that the warden carries out an efficient and effective check for all people. In an emergency people may do unexpected things like hide in cupboards.

The route followed when checking the area should be efficient. The warden should not have to continually go back over areas already searched.





The warden needs to make sure that any smaller rooms inside larger rooms, such as toilets and offices, are also checked.

Securing the building

As each area is checked it should be secured by closing the doors and windows. This is to make sure that people do not re-enter the room once it has been checked.

If there are gas cylinders or gas lines in the area these should be turned off to reduce the risk of a gas leak or an explosion.

Roles in an evacuation

Wardens

The chief warden

The chief warden wears a white helmet.

Chief warden's role:

- Find out the nature of the emergency.
- Makes sure that that the appropriate emergency services are notified.
- Let the floor or area wardens know the nature of the emergency.
- Start the evacuation procedures if necessary.
- Record the progress of the evacuation and the actions taken in the incident log.
- When the emergency services turn up let them know the nature and location of the emergency.

The floor or area warden

The floor or area warden wears a yellow helmet.

Floor/area warden's role:

- Start the emergency procedures for the floor or area.
- Make sure the emergency services have been notified.
- Direct wardens to check the floor or area for any situations that are not normal.
- Start the evacuation procedures if needed.
- Get in touch with the Chief warden and act on any instructions that are given.
- Let the Chief Warden know as soon as possible of the situation in the area and what is being done.
- Check that all of the actions that the wardens are responsible for have been carried out. Let the Chief Warden know if these actions have been undertaken.

The warden

The warden wears a red helmet.

Warden's role:

- Operate the intercommunications systems.
- Make sure that all smoke and fire doors are closed.
- Search the area to make sure all the people have been evacuated from the area.
- Make sure that the evacuation is carried out in an orderly manner. This may involve controlling traffic in stairwells or crossing roads.
- Assist anybody that has a disability or other problems in leaving the building.
- Lead groups of people to the designated assembly areas.
- Report to the floor or area warden once the area has been evacuated and secured.
- If the fire is small and can be controlled, the

warden may use an extinguisher to put out the fire. Under no circumstance should the warden fight a fire that is in danger of spreading or increasing in size in an uncontrolled way.

The first aider

First aider wears a green helmet.

The first aider's role:

- Provide first aid to any person who needs assistance

Emergency procedures and first aid

Treatment while awaiting medical assistance

A victim suffering from airway burns should be kept under observation and transported to hospital without delay - preferably by ambulance. Resuscitation should be commenced if necessary.

Major burns are managed by the application of special dressings once resuscitation is effected or in progress and the victim’s location is no longer hazardous.

The only effective management of flash burns to the eyes is to close both eyes of the victim and cover with pads if readily available.

Note: Flash burns to the eyes result from the effect of heat and light waves on the superficial layers of the cornea and do not involve deeper layers so there is no permanent scarring but the pain is severe and frightening for the victim.

Airway burns

Burns to the face and upper trunk may indicate that the victim has sustained airway burns and the resultant swelling may cause airway obstruction.

- Keep victim under constant observation.
- Transport to hospital without delay, preferably by ambulance.
- Be prepared to commence resuscitation if necessary.

Burns - general

- Flood burnt area with cold water (if available).
- Gently remove any rings (if possible), watches, belts or tight clothing from burnt area before it starts to swell.
- Unwrap sterile non-stick burns dressing.
- Avoid touching or contaminating any part of the dressing that will come in contact with the burnt area.
- Avoid skin-to-skin contact with the victim's burnt areas.
- Cover the burnt area with sterile non-stick burns dressing.
- Continue to use cold water to irrigate the dressing and the burnt areas, and monitor the victim's skin temperature to avoid overcooling the patient.
- Do not break blisters.
- Do not remove loose skin.
- Do not attempt to remove clothing or melted synthetic material which is sticking to the skin.
- Do not apply burns cream or any other preparations to the burnt area.

Flash burns to eyes

- Close both eyes of the victim.
- Cover both eyes with pads and bandage if readily available.

Control severe bleeding

- When attending to any wound precautions must be taken to avoid direct contact with blood and any body fluids.
- Apply pressure over the wound with a hand or squeeze the edges of the wound together.
- Keep pressure on the wound with a thick pad, covering the entire wound, bandaged firmly in place.
- Elevate the injured part, but do not apply a tourniquet.
- Loosen bandage if the victim's fingers or toes feel numb, tingling or painful.
- If bleeding continues, apply a further pad and bandage over the first pad.

Seek medical assistance

Basic procedure should be:

- Ensure victim is breathing, place in the recovery position, monitor vital signs.
- Stop any bleeding.

- Keep the victim calm and make comfortable, monitor for the onset of shock.
- Await medical aid.

CPR

Determine a casualty's level of consciousness via a gentle touching and loud talking. Do not shake the casualty. Casualty examination for first aid follows a plan which is known by the acronym **'COWS'**.

This is used to remind first aid providers of some simple steps that will help to determine a casualty's ability to respond. These steps are:

- **C**an you hear me?
- **O**pen your eyes
- **W**hat's your name?
- **S**queeze my hand

If the casualty is conscious and they express no pain, observe their behaviour for any distress, unusual position or posture and any body-swelling.

Where there is more than one casualty, always give priority to the unconscious casualty.

If unconscious perform **'SRABC'**:

- **S**afety - yourself, bystanders and casualty
- **R**esponse - does the casualty respond to your voice and touch? Call 000
- **A**irways - should be open and clear
- **B**reathing - look, listen, and feel for breathing
- **C**irculation - signs of life, breathing, coughing and movement
- **S**evere bleeding - check for life-threatening bleeding.

Checking vital signs

If a person is unconscious, the first step is

- to check their mouth for any item blocking the airway - these items could include their tongue, food or vomit. If blockages are found, gently roll the person onto their side, into the recovery position.
- Clear any blockages using your fingers, then check for breathing.
- If no blockages are found, roll the person onto their back and check for breathing.
- Listen for the sound of the breath, look for the movements of the chest or feel for the breath on your cheek.

When there are no signs of life present, then you should commence cardiopulmonary resuscitation (CPR).

When engaging in chest compressions:

- interruptions to compressions should be minimised
- compressions should be fast and hard
- over-ventilation should be avoided.

The compressions ventilation ratio is 30:2 (30 compressions to 2 breaths) for infants, children and adults.

Locate centre of chest

Locating centre of chest

- Find the lower half of the sternum.
- You should visualise the 'centre of the chest' and compress at that point.
- Position the heel of your hands in the centre of the person's chest, interlace your fingers and lift them off the chest.
- Using the heel of the hand, give 30 compressions.

Performing compressions

Performing compressions

- Each compression should depress the chest by about one third.
- After 30 compressions take a deep breath, seal your mouth over the person's mouth, pinch their nose, and give two firm breaths.
- Thirty compressions and two breaths should be continued till either first aid arrives or the person's pulse returns. It can be carried out by either one or two people.

Treating shock

A person who has lost a lot of blood may go into shock. Shock occurs because not enough oxygen is being carried by the blood to the brain and vital organs of the body.

The signs of shock are:

- Rapid breathing.
- Weak and rapid pulse.
- Pale, cold and clammy skin.
- Faintness or dizziness.
- Nausea or vomiting.

If a person is in shock, things might get worse. You need to look after them.

To treat shock follow these procedures:

Reassure the casualty.

Lie the casualty down and raise their legs above the level of the heart.

Maintain the casualty's body temperature. If it is a cold day cover the person or if it is a hot day try and keep them cool.

DO NOT give the casualty anything to eat or drink by mouth. If the casualty is thirsty you can moisten their lips.

Monitor the casualty's level of consciousness, breathing and pulse.

Reporting accidents

It is important that every work injury or work based illness is recorded and dealt with accordingly. The workplace health and safety regulation 1997 - part 7 -states that the employer is to inform Workplace Health and Safety Queensland as soon as possible in the case of serious bodily injury or a work-caused illness or a dangerous event.

It is necessary for any incident that occurs at a construction workplace for the principal contractor to complete, keep and, where required, lodge an incident form. This form is to be kept for a minimum of 12 months. This is also the case with any incident that involves a serious electrical incident or dangerous electrical event however they are also to inform the electrical safety office (ESO).

A work injury is any injury to a person that requires first aid or medical treatment provided that the injury was caused by work, a workplace, a workplace activity or specified high risk plant. The employer is to submit the incident report within 24 hours however in the event of a death they are to inform earlier if that is at all possible.

Always remember to ensure that an incident report is completed any time you encounter a serious work injury. You may find that whilst the pain might be bearable today, it might not be in two weeks time. If you haven't submitted an incident report there is a strong possibility that you would not be able to claim WorkCover for the time that you are away from work.

Sustainability

Caring for the environment

It's easy to forget about where the stormwater is going once it disappears down the drain. But you need to remind yourself that eventually it will rejoin an ecosystem that supports a whole network of plants and animals.

When stormwater runs off roofs and driveways, it generally travels via gutters and drains to the local creek. From there, it eventually it ends up in a river or coastal waterway.

If stormwater is contaminated with litter, wastes, grease, oil or other chemicals it can kill fish and other water life, and seriously pollute the environment.

That's why it's an offence to allow stormwater to become polluted. This includes placing substances in a position where they can fall or be blown into a drain, gutter or local waterway.

Keeping stormwater clean

Here's some simple things you can do to stop the rainwater running off your premises from becoming polluted before it goes into the stormwater drains:

- keep driveways and yard areas free of litter
- sweep up rubbish and put it in waste bins, don't hose it into the gutter or drain
- provide containers for cigarette butts
- keep drains clear, so that muck isn't allowed to build up over time and stop the free flow of water when it rains.

One example of a treatment process is an oil water separator. This unit directs the wastewater into a tank, where it skims off the oil, which is pumped out separately, and then discharges the treated water into the sewer.

Dealing with trade wastewater

Trade wastewater is any wastewater produced by a commercial or industrial activity. It includes the runoff from industrial sprays and cooling systems, especially when it contains contaminants like cutting compounds from grinders, tannins from logs, and oil or grease from the workshop floor.

Before you let wastewater go into the sewerage system, you need to remove the contaminants, and your company needs to get a wastewater permit from the local water authority. This permit will specify the treatment process required and any other standards that may apply.

Not all businesses need to put their wastewater into the sewerage system. Some companies recycle the wastewater on-site, and treat it so it can be used in other production processes, or for watering the garden. Other companies collect the wastewater in drums, and have it taken to a waste disposal station.

Remember that if you're sending wastewater to a waste facility, the transporting must always be done by a licensed contractor.

This on-site diesel tank has a concrete bund around its base and a corrugated iron roof to keep the rainwater out.

Bunding

One of the best ways of stopping hazardous substances from escaping and getting into the stormwater system is to use *bunding*. A bund is a barrier, like a low wall, built to contain spills or leaks.

Where possible, storage bays should also have a roof overhead to stop rainwater from filling up the bunded area and also from rusting the drums. However, if there are hazardous chemicals involved, there may be special WorkCover requirements to comply with when the roof is installed.

Bunding and a roof covering is also a good idea around plant and machinery that's housed outside the factory walls, such as compressors, generators and oil-water separators.

Waste disposal

If you're disposing of waste or storing it on-site while its waiting to be picked up, you need to make sure that its managed correctly. There will be different requirements for different materials, depending on their make-up. For example, copper chrome arsenate (CCA) treated timber must only be disposed of in certain landfills, approved by the EPA.

If you don't store waste securely prior to being collected, it may escape, particularly into the storm water system, and your company could face a fine. You must not bury waste on-site either - this constitutes a landfill activity and is illegal unless your company has an EPA waste licence.

Don't put liquid wastes into the waste bin. Materials in the waste bin generally go to landfill, so it should only ever be used for dry, solid wastes. Always drain and clean anything containing leftover fluid before you put it in the bin. Depending on the type of liquid it is, you can then either recycle it on-site, treat it and discharge it, if your company has a permit, or put it aside for removal by a waste disposal contractor.

CCA treated pine typically has a greenish colour. It needs to be kept separate from other timber offcuts, so that it doesn't accidentally get included in firewood or used for other purposes that may be hazardous.

CCA treated timber should never be burnt, because the arsenic is not only given off in the smoke, it also concentrates in the ashes.

Reduce

- Reducing the level of waste you generate in the first place is the best way to deal with it.
- Always try to use raw materials as efficiently as you can, and minimise the amount of reject stock you produce.

This frame and truss component cutter is monitoring the lengths of the off-cuts, so that only the shortest pieces go to waste.

Reuse

- Reusing waste is another way of minimising the amount that needs to be thrown away.

- Ask your suppliers whether products can be delivered in returnable packaging, such as crates, pallets, and containers. Their delivery trucks may be able to pick up these items when they drop off your next order.

Recycle

Source: Safety and environment toolbox
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Recycling waste products is now a very organised business.

Recycling companies offer commercial services for many different products, including:

- glass
- aluminium
- steel
- plastic
- paper and cardboard
- toner cartridges.

Timber shavings and sawdust are also often collected by composting operations, pet shops, or horse stables.

Waste minimisation strategies[2]

Approximately 32.4 million tonnes of solid waste was generated in Australia in 2002–03, an estimated 42% of which was building waste (Productivity Commission 2006). Minimising and recycling this waste can have significant social, economic and environmental benefits.

A number of states, including Victoria, South Australia and Western Australia, have 'towards zero' waste strategy documents. The strategies set state-wide targets for waste reduction, resource recovery and littering, and specific targets and actions for the municipal and business sectors to deliver more sustainable use of resources. See for example Victoria's *Sustainability in action — towards zero waste strategy* or *South Australia's waste strategy 2011–2015*.

The three Rs of waste minimisation: reduce, reuse, recycle.

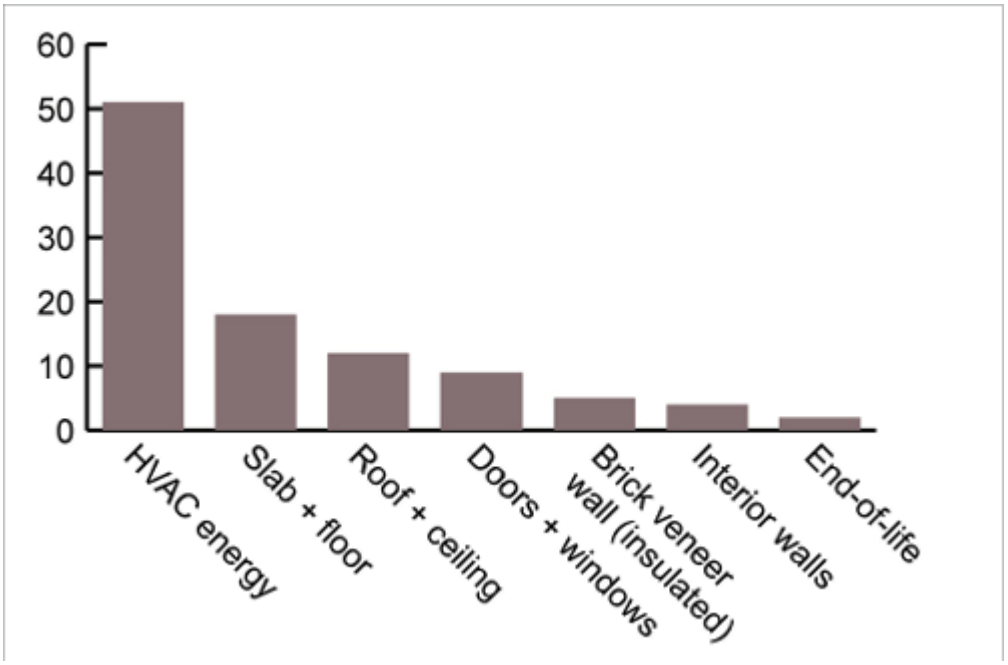
Reduce consumption of resources by building smaller houses that are better designed for your needs. This is the most effective way to conserve precious resources for use by future generations and reduce waste. It also lowers costs.

Improve the accuracy of your ordering so that materials are not wasted nor sit around a site for long periods where they can become damaged.

Reuse existing buildings and materials in order to reduce demand for resources, lower waste volumes and save money. A lot of energy and resources go into the materials used to construct a home and due to the mixed nature of these materials most end up in landfill. The following graph shows that the emissions from the energy of the materials required to construct a typical house are nearly equal to the emissions from the energy required to heat or cool that house over a typical 50 year life. Consider renovating an existing house, rather than demolishing the old and building from scratch as very little of the demolished house is recycled or reused.

Recycle resources that are left over or have reached the end of their useful life. This reduces demand for new materials and lowers the volume of waste going to landfill. Use materials with high recycled content to create a market for recycled resources. It raises the price paid by recyclers for recovered resources and increases the viability of recycling.

[2] Source: Your Home, as at http://www.yourhome.gov.au/materials/waste-minimisation, as on 14th May, 2014; https://nationalvetcontent.edu.au/alfresco/d/d/workspace/SpacesStore/46533bf3-db71-4495-a6e6-38ff09372e2d/ims/content_sections/cpccbc4021a_minimise_waste/01_plan/003.htm, as at 14th May, 2014.



Source: Rouwette 2010

Emissions from typical brick veneer house over 50 year life.

Sending building materials to landfill is like throwing money away. You have already paid for the material, paid someone to deliver it and then paid someone to collect it and throw it away.

Landfill

Our traditional means of waste disposal to landfill is uneconomic. Costs to communities for operating and maintaining landfill sites are high and the availability of suitable land is limited. Reuse options for landfill sites are limited due to potential health hazards. Remedial action is often prohibitively expensive. Emissions and leachate from landfill sites can be

highly toxic due to concentrations of heavy metals and toxic chemicals. These toxins find their way into the watertable or waterways, often with disastrous consequences.

Tipping fees are increasing rapidly to reflect the true cost of disposal. This increases the cost competitiveness of recycling options and rewards waste minimisation efforts.

What is building waste?

Percentage weight of typical building waste materials	
Waste description	**Waste quantity (% of total weight)**
Source: Extrapolated from NSW EPA Waste Census Data 1997	
Paper/cardboard	1
Garden/vegetation	3
Wood/timber	10
Textiles/rags	1
Hard plastic	1
Ferrous	2
Soil rubble (<150mm)	34
Soil rubble (>150mm)	2
Concrete-based masonry	16

Clay-based (e.g. bricks, tiles)	16
Plasterboard	2
Other/unknown	11
Total	**100**

Life cycle and waste

Life cycle assessment of waste streams indicates that significant energy savings can be achieved at little or no cost by considered construction and demolition waste management and planned recycling.

Materials with high embodied energy (e.g. metals, especially aluminium) or with high environmental cost in extraction can have their life cycle impact reduced by end use recycling. The environmental impact of most materials can be substantially reduced with each reuse.

Recycling — who to contact

- local councils
- regional waste authorities
- local waste station or landfill operator
- waste recycling contractors (see www.recyclingnearyou.com.au for a list of recyclers searchable by location or product)

What can be recycled?

Most materials can be recycled. The following list demonstrates some reuse options. There are many more and the list is growing rapidly.

Steel — Electric arc furnaces produce reinforcing bar, mesh and sections from 100% steel scrap. Conventional blast furnaces can incorporate up to 30% steel scrap. Recycling steel reduces embodied energy by 72%.

Aluminium — Aluminium is 100% recyclable; recycling aluminium reduces embodied energy by 95%.

Gypsum plasterboard — CSR recycles clean plasterboard offcuts from material ordered from them; other companies are considering doing so. Check with your supplier to see if they offer this service. Plasterboard disposed of in landfill produces poisonous hydrogen sulphide, which has a foul odour.

Timber — Most timber (except treated timber) can be reprocessed into horticultural mulch. A particleboard manufacturer in Australia is developing a recycling facility that requires little or no pretreatment of the waste.

Concrete — Un-set concrete can be ‘washed’ out at the plant to remove cement. Sand and stone can be reused. Set concrete can be crushed and recycled as aggregate for new

concrete or road base and fill. Rapidly developing markets for this product mean the material is now in demand and disposal costs are significantly reduced.

Glass — Most glass can be recycled. Construction glass must be separated from other glass such as drink bottles. Glass may be cut and reused or recycled as aggregate for concrete. Some patterned glass incorporates all types of recycled building glass. Recycling glass reduces embodied energy by 20%.

Carpet — In good condition, carpet can be sold and reused. It can also be recycled into secondary carpets. Some manufacturers offer a recycling or take-back service on their products. Some carpet can be recycled as a weed barrier or a covering and food for worm farms.

Bricks and tiles — These materials can be reused where appropriate or crushed on site for backfill, aggregate and gravel with portable crushing plants.

Plastics — Many plastics can be granulated and reused to make new plastic products and include:

- high density polyethylene (HDPE): rubbish bins, buckets and traffic cones
- low density polyethylene (LDPE): shrink wrap and bubble wrap
- polystyrene containers, insulation, PVC pipes, fittings, and vinyl flooring.

Making it happen

To be cost effective, waste minimisation strategies must be agreed to and implemented by all parties involved in building the home at the design, construction and operation stages.

A team approach by the owner, builder and designer is the most effective way to reduce waste.

Research has shown that opportunities for cost effective inclusion of sustainable features decline exponentially throughout the design process. Up to 90% of critical decisions, including waste minimisation, are made during the design stage. Many good household recycling and waste minimisation guides are available. Consult your local council.

The design stage

Plan ways to reduce waste before you start the job.

Designers are responsible for introducing and planning waste minimisation strategies from the earliest stages of design through to completion. This includes deciding what to build, whether to demolish, what materials to use and how they might be recycled.

The initial consultation

- Lasting decisions about whether to renovate or demolish are often made at this stage.
- Consider waste streams and life cycle benefits.

A commitment to reducing waste at the initial consultation is more likely to endure throughout the project.

Concept design

- Choose construction to minimise cut and fill.
- Plan for end use and deconstruction.
- Select building systems with low waste rates.
- Choose prefabricated products.
- Identify recycled materials that can be used.
- Source recycled materials.

  Early decisions have a major impact on waste stream quantity and quality.

Design development

- Dimension to suit standard modular construction sizes and minimise waste — and create fewer plasterboard and wall lining offcuts.
- Select materials with known minimum waste rates; consider manufacturers' waste recycling schemes and recycled content or other life cycle benefits.
- Engage like-minded design professionals (e.g. engineer, interior designer).
- State and agree key waste goals before engagement (team building).

Working drawings and detailing

- Design operational waste handling facilities.
- Select energy efficient appliances (washing machine, refrigerator, dishwasher).
- Plan for waste separation and sorting on site during construction.
- Prepare accurate working drawings and nominate waste-wise fabricators.

  Off-site fabrication can reduce waste, facilitate separation of waste streams and improve recovery rates.

Specification

Specify:

- materials with known minimum wastage rates, e.g. plywood, finger-jointed timber
- materials with known recycled content, e.g. paper and polyester insulation
- durable materials and finishes
- waste handling and recycling contractors
- waste streams to be recycled.

Contract documentation

- Prepare a waste minimisation plan. Identify the possible types of waste produced (e.g. bricks, timber, plasterboard), potential recyclers and methods to reduce or avoid the waste before you begin. An example of a waste minimisation plan can be found at www.mbav.com.au
- Agree which party or parties receive financial benefits of recycling.
- Provide economic incentives for recycling.
- Include waste minimisation and recycling performance clauses in the contract.

Tendering period

- Promote the economic benefits of waste minimisation and recycling to tenderers.
- Familiarise tenderers with recycling, waste management and waste minimisation strategies.
- Answer questions and allay concerns (costs).
- Engender a spirit of cooperation to achieve waste minimisation objectives (team building).

The construction stage

Site operations generally

- Plan locations for depositing and stacking of materials before delivery.
- Separate waste for recycling wherever possible. Provide recycling skips and ensure compliance with waste stream sorting by all trades.
- Where this is not possible engage a reputable waste disposal contractor who will take mixed waste bins, sort it on their site and provide you with a report.
- Form a compound to contain plastic film, cardboard, glue and paint tins.
- Use bins with lids to reduce windblown litter.
- Use reputable waste service providers.
- Negotiate recycling paybacks with local resource recovery firms.
- Use waste aware subcontractors.
- Use written contracts with all trades including clauses requiring waste minimisation practice.
- Require trades to dispose of their own waste.
- Back charge for sorting of waste streams not sorted by each subcontractor.
- Colour code or label waste skips and protect them from contamination, rain and wind.
- Provide regular waste bins for food scraps and household waste during construction.
- Lock special skips at night and weekends to prevent others dumping rubbish in them.
- Tidy up the site often. This encourages your trades to do the same and reduces the potential for windblown litter and safety hazards on site.

Supervision

- Monitor recycling rates and on-site sorting and storage of various waste streams.
- Verify contractor performance or certification.

Materials storage and handling

- Minimise the time between delivery and installation to reduce the risk of damage or theft.
- Does packaging adequately protect goods? Is there too much? Can you eliminate some?
- Ask suppliers to collect or recycle packaging.
- Have fragile materials and fixtures delivered and installed close to completion date.
- Use prefabricated framing and trusses to reduce time on site before installation.

- Check quantity, condition and quality of goods on delivery. Report discrepancies immediately.
- Reject inferior goods or materials if their quality will result in additional waste.
- Refuse oversupply as compensation for inferior quality or condition.
- Report careless delivery staff to the supplier.

Concreting

- Use concrete with recycled aggregate in all viable applications.
- Use reinforcement made from recycled steel.
- Form up accurately and fine-tune estimating to minimise waste. Up to 10% is often wasted.
- Return surplus to the plant for recycling.
- Buy from plants that wash out cement to allow recycling of sand and aggregate.
- Break remnants into small pieces before final set to allow later use as backfill or recycling.
- Always form up a small area of path or low grade slab ready to accept remnants.

Carpentry and joinery

- Use engineered timber products that make efficient use of materials where possible.
- Use sustainably sourced timber.
- Encourage your supplier to find sustainable sources.
- Prepare accurate cutting lists before ordering.
- Give joiners a copy of the cutting list.
- Ensure that carpenters have a complete cutting list to allow efficient timber use.
- Use joinery profiles that can be easily and invisibly joined to reduce offcuts.
- Use offcuts wherever possible.

Measure it twice — cut it once.

Bricklaying

- Have bricks delivered around the perimeter to minimise the chance of damage from subsequent movement to place of use.
- Use mortar to produce masonry of appropriate strength and durability as required by AS 3700-2001, Masonry structures. Mortars with lower cement content are usually softer, thus helping in recycling as well as saving on cement.

Electrical services

- Use sub-boards and plan wiring to reduce wiring distances, quantities, waste and cost.
- Recycle offcuts. Strip insulation from copper.
- Consider pulse switching and intelligent controls to reduce cabling and energy use.

- Use cable products that are highly recyclable and be aware that some PVC coatings used to contain heavy metals.

Plastering

- Buy plasterboard from suppliers who recycle.
- Sort offcuts and store on site for return to recycler. Keep offcuts clean and dry.
- Carry useful sized offcuts to the next job.

Glazing

- Separate construction glass from other glass such as drink bottles. Most glass can be melted down and recycled but requires sorting.
- Glass can also be recycled as aggregate.

Waste management plans

Many local councils require waste management plans before granting development consent. They usually require the builder or designer to estimate the total waste stream volumes from both demolition and construction and nominate the means of disposal including the recycling contractor, recycling waste station or landfill site.

The site plan is often required to show waste storage facilities on site during construction and provide a schedule for delivery or pickup.

The time and cost of waste plan preparation is usually recouped through reductions in waste disposal costs or dividends from the sale of salvaged resources. If this is not possible (low tipping fee areas), charge a fee for the service to ensure that plans are properly prepared.

Calculating the relative costs and savings of your waste minimisation strategy is an important part of the planning process. You can calculate your relative costs and savings by

comparing the cost of an **existing work practice** against an **alternative sustainable work practice**.

The new strategy specifies the purchase of building materials with minimal or no packaging. As part of your research into the new purchasing strategy, you will need to compare the cost of the building material with minimal packaging against the cost of disposing of the packaging waste to landfill. For example, your organisation is planning to introduce a new strategy to minimise waste on the construction site.

Once you have calculated the relative costs and savings of your proposed waste minimisation strategy, you will be able to demonstrate the economic and environmental benefits of your strategy to your client.

It is important that you involve other building and construction industry professionals during the planning stages of your waste minimisation strategy. Their involvement will help you to calculate material reuse costs, identify and specify building materials based on Australian Standard sizes in your plans and specifications. This will help you to reduce project costs and minimise waste. Involving other building and construction industry professionals may be more common on large commercial projects, but it's one example of how waste minimisation can be integrated into the planning stage of the construction process.

How to calculate the costs and savings of waste minimisation strategies

Calculate the cost of your existing work practice

You need to calculate the cost of your existing work practice, before you can determine the costs and savings of your waste minimisation strategies. Once you know the cost of your existing work practice, you can compare this against the cost of alternative work practices. Consider the following building and construction problem:

A subcontractor has finished planning a demolition project. The contractor determined the demolition will generate **5 tonnes of brick and concrete waste.** The subcontractor's existing work practice is to dispose of brick and concrete waste to landfill.

The local landfill charges **$150** for a truck to **dispose of 1 tonne** of acceptable general rubbish. Acceptable general rubbish includes building materials such as brick and concrete waste.

You can **calculate the cost** of disposing of brick and concrete waste to landfill by multiplying the **quantity of building waste** by the **cost per tonne**.

For this example, it will cost the subcontractor **$750 to dispose of 5 tonnes of brick and concrete waste** to the local landfill. Regardless of the work practice, the calculation method is the same. **Multiply the quantity** by the **cost per unit.**

Types of waste minimisation strategies

Once you have calculated the cost of your existing work practice, you can identify a strategy that will minimise waste generated by your current work practice. Some strategies you could implement to minimise waste on your work site are:

- **purchasing materials in standard sizes** – companies manufacture building materials in standard sizes; by purchasing and building to these sizes you can minimise building material waste
- **green purchasing strategies** – specify that suppliers deliver building materials with minimal packaging or packaging that can be recycled or reused
- **deconstruction practices** – that combine hand and machine can be used to increase the recovery of building materials for reuse and minimise on-site waste
- **litter reduction or prevention** – site fencing and litter bins can be installed on site to reduce litter or prevent it from being released into the work site, landfill or the environment
- **storage and separation** – recycling bins can be installed on site to store and separate building material waste.

Identify a waste minimisation strategy

Consider how the subcontractor could apply a waste minimisation strategy to their existing work practice of disposing of brick and concrete to landfill. The contractor could specify that brick and concrete waste be **separated and stored in on-site storage bins or skips**. Once the on-site storage bins or skips are full, they would be collected by a recycling company for recycling or resale.

This kind of strategy would minimise the amount of brick and concrete waste disposed of to landfill and create a potential revenue stream, through the sale of second-hand bricks.

You can communicate your waste minimisation strategies to your subcontractors by including them in the initial design stage of the project. This increases their awareness of the goals of your strategy and encourages them to identify opportunities to save resources and minimise waste.

Calculate the costs and savings of your strategy

Once you have identified your strategy, you can calculate the costs and savings. You can do this by **multiplying the quantity of waste** by the **cost of the waste minimisation strategy** and then **subtracting the result** from the **cost of the existing work practice.** Consider how the subcontractor could calculate the costs and savings of their waste minimisation strategy.

The subcontractor has determined that hiring **on-site recycling bins** from a local recycling company is the best way for them to minimise building waste. The recycling company charges customers a **flat rate of $420 to collect recycling bins** from a construction site. The subcontractor can now calculate the savings of their waste minimisation strategy. The subcontractor has already determined that the cost of **disposing of building waste to landfill will be $750**. The subcontractor will need to subtract the **recycling bin charges of $420** from the **landfill fee of $750** to calculate the savings of the waste minimisation strategy. The subcontractor **saved $330** by hiring recycling bins for their construction site.

Remember, the costs and savings of your strategy will be determined by your project.

Negotiate costs and savings with your client

Once you have calculated the costs and savings of your waste minimisation strategy, you can record your calculations on your waste minimisation plan. You can then use the plan to show your client the financial benefits of implementing a waste management strategy.

Sometimes your strategies may cost more than the existing work practice. This is where you need to demonstrate how your strategies will benefit your client. For example, your strategy may specify that recycling bins be installed on site. The bins are used to prepare bricks for recycling. The cost of the bins is more than the cost of disposing the bricks to landfill.

You can demonstrate to the client how the cost of the bins can be offset by the reuse of the bricks in another stage of construction. The bricks could be used in the construction of the garage. The client may no longer need to purchase new bricks and could make a saving.

This waste minimisation plan shows the cost of the subcontractor's waste minimisation technique, the cost of their existing work practice and savings generated from their waste minimisation strategy.

Waste minimisation plan

Building materials	Cost of existing work practice	Waste reduction technique	Cost of waste reduction technique	Savings
Bricks	Landfill charges $750	Bricks are to be sorted and separated into on-site bins and then sent to a recycling company	Hire of on-site recycling bins $420	$330

Communication strategies

You can communicate your waste minimisation strategies with project stakeholders through your project plans and waste minimisation plan.

These documents usually describe the materials to be used and the type and quantity of waste materials to be generated. These documents can also describe waste reduction techniques to be followed during the project or how waste is to be reused or disposed of to landfill.

You could also develop a building material reuse strategy for deconstruction projects. The strategy estimates the amount of materials that can be salvaged and how long it would take to prepare the materials for reuse in the construction of a new building. You would then compare the cost of preparing the materials against the cost of purchasing new materials.

This strategy is useful for commercial building developers who are applying for Leadership in Energy and Environmental Design (LEED) certification through the Green Building Council of Australia (GBCA).

That completes our demonstration of how to calculate the cost of waste minimisation strategies.

Sustainable Construction[3]

In the past decade the awareness of the importance of ecology and environment protection has risen to a very high level. People are being educated more on the environment protection and are always trying, together with experts, to find new ways of being green. With that in mind sustainable construction has been invented.

Basics

Green building (also known as green construction or sustainable building) refers to a structure and using process that is environmentally responsible and resource-efficient throughout a building's life-cycle: from siting to design, construction, operation, maintenance, renovation, and demolition. This practice expands and complements the classical building design concerns of economy, utility, durability, and comfort.

While standard building practices are guided by short term economic considerations, sustainable construction is based on best practices which emphasize long term affordability, quality and efficiency. At each stage of the life cycle of the building, it increases comfort and quality of life, while decreasing negative environmental impacts and increasing the economic sustainability of the project. A building designed and constructed in a sustainable way minimizes the use of water, raw materials, energy, land … over the whole life cycle of the building.

The evolution of the concept of sustainable development is used as a basis for advancing understanding of sustainable construction. Principles of sustainable construction are developed and divided into four 'pillars' – social, economic, biophysical and technical – with a set of over-arching, process-oriented principles, to be used as a checklist in practice. A multi-stage framework is proposed which requires the application of Environmental Assessment and Environmental Management Systems for construction projects.

Sustainable or "green" construction is a type of construction which is concerned with environmental impacts in addition to the creation of a usable structure. When people build sustainably, it means that they are building in a way which is considered sustainable, meaning that the building practices used can be utilized in the long term without causing damage to the environment. There are a number of aspects to sustainable construction, and such construction is often overseen by a firm which specializes in sustainable construction and is familiar with the complexities of this type of work.

Sustainability is a complex issue. One critical facet is environmental sustainability, but it can also include social and economic sustainability. Good sustainable construction thinks about the environmental impacts of construction and long term building use, in addition to considering whether or not a structure is economically sensible to build and maintain, and whether or not a structure fits sustainably into the social structure in the area where it is being built.

[3] Source: Australian Science, as at http://www.australianscience.com.au/industry/sustainable-construction/, as on 15th May, 2014.

Construction has been accused of causing environmental problems ranging from excessive consumption of global resources both in terms of construction and building operation to the pollution of the surrounding environment, and research on green building design and using building materials to minimise environmental impact is already underway. However, relying on the design of a project to achieve the goal of sustainable development, or to minimise impacts through appropriate management on site, is not sufficient to handle the current problem. The aim for sustainability assessment goes even further than at the design stage of a project to consider its importance at an early stage, before any detailed design or even before a commitment is made to go ahead with a development. However, little or no concern has been given to the importance of selecting more environmentally friendly designs during the project appraisal stage; the stage when environmental matters are best incorporated. The main objectives of this paper are to examine the development, role and limitations of current environmental building assessment methods in ascertaining building sustainability used in different countries which leads to discuss the concept of developing a. sustainability model for project appraisal based on a multi-dimensional approach, that will allow alternatives to be ranked is discussed in detail in the paper.

Sustainable construction faces economic challenges at different levels. On the macroeconomic level, the goals of sustainable construction are being implemented most actively in industrial countries in which the share of construction output is decreasing. However in both less developed and newly industrialized countries, the share of construction output is increasing, but the goals of sustainable construction are more difficult to implement. On the mesoeconomic level, the construction sector depends on the implementation of the goals of sustainable development across the national economy as a whole. Supply chains feeding the construction sector are long and intertwined, making it difficult to assess the effect of different materials, components and procedures. On the microeconomic level, buildings are created with shorter time horizons in response to being a demand-derived commodity and increasingly dominated by mechanical, electrical and electronic equipment. Their finance is being adjusted to the short and medium term which is in conflict with sustainable construction, whose goals rely upon the long term. Two broad approaches for meeting the economic challenges of sustainable construction are considered: governance through standards, legal and regulatory practices; market-oriented policies which influence the costs of particular forms of construction. Both approaches have a role, but it is argued that the market-oriented measures will be more effective at the strategic level.

The construction industry makes a vital contribution to the social and economic development of every country, but, at the same time, its building sector has major impacts on the environment. Construction is a major consumer of non-renewable resources (energy in particular), a substantial source of waste, a polluter of air and water and an important contributor to land dereliction. This paper focuses specifically on the growing lack of focus on construction sustainability in the Southern Africa Development Community (SADC) public building sector. It indicates some salient issues on sustainable construction and the need for appropriate procurement systems, using the Botswana public building sector as a case study. It addresses two propositions. First that lack of appropriate focus on sustainable construction is primarily due to an inappropriate project organizational structure. Second that a default traditional construction procurement system (TCPS) provides a poor

relationship management system incapable of dealing with sustainability parameters. Information is obtained through questionnaires on the dominant procurement system used. The primary conclusion is that the building procurement system apparently in use in the SADC public building sector differs significantly from that recommended in the theory, resulting in insignificant focus on construction sustainability. Salient steps are proposed with a proviso that the SADC public building sector should establish appropriate methods of selecting building procurement systems and formulate appropriate project organizational structures that will embrace an environmental management system.