Learning resource

Apply knowledge of electrical safety and safe working practices for electrical workers

Level 3 | Credits 6

Te Pūkenga

Contents

Health and safety at work Act

In New Zealand, work in the workplace is covered by the Health and Safety at Work Act (2015). It is the law about safety in the workplace.

One of the main purposes of the Health and Safety at Work Act (2015) is to ensure that people are protected against harm from workplace activities and that workplace health and safety will continuously improve over time.

The Act covers every business and every person in business including self-employed individuals who are carrying out work that may pose a risk to themselves or others.

There are some terms that are used in the Act that you will need to understand, if you are to be able to understand the Act. Below is a table of terms from the Act.

Term	Definition
PCBU	A person conducting a business or undertaking.
Officer	A person who holds a very senior leadership position and can influence the management of the business.
Worker	Can include an employee, a subcontractor, a volunteer, or an apprentice.
Workplace	A place where work is carried out. It can include a vehicle, ship, vessel, aircraft, or mobile structure.
Reasonably practicable	Do everything suitable in the circumstances to reduce risk.
Supply	Provision of a thing by way of sale, exchange, lease, hire or hire purchase.
Notifiable event	A death, injury or illness.
Notifiable incident	An unplanned situation that exposes people to a risk.
Notifiable injury or illness	Occurs as a result of something that happened at work.

Some other terms that are included in the HSW Act that you will need to be aware of are:

Term	Definition
Employee participation	Active involvement of an employee in the workplace health and safety system
Training	Official instruction in procedures, safe use and operation of tools, machinery and equipment.
Incident and hazard reporting	An effective and actively used system for communicating and recording incidents and hazards in the workplace
Hazard management procedures	A plan of action of how hazards are going to be dealt with to keep workers safe
Emergency procedures	An organised plan of action for when things go wrong in the workplace

According to the HSW Act, in the workplace, the people responsible for your safety as an electrical worker or trainee include:

- Your employer (PCBU -persons conducting a business or undertaking).
- You - the trainee.
- Your workmates.
- Your supervisor.

Everyone in a workplace needs to be doing their bit to work safely and look after other people around them.

As part of this system, employers (PCBUs) or officers in a workplace must:

- Keep up to date with the hazards and risks in their business.
- Have the gear to minimise or eliminate risks to health and safety.
- Have a system to deal with and record hazards, risks, and incidents.

You also have some things you must do. Employees or workers are responsible for:

- Looking after your own health and safety.
- Taking reasonable care that your actions, or lack of action, does not hurt (or potentially hurt) others.
- Co-operating with any reasonable health and safety instructions you are given by the boss

Energy Safety is part of Worksafe New Zealand. It is responsible for enforcing the Health and Safety at Work Act (2015) for electricity and gas. Some ways Energy Safety enforces the Act are:

- Issuing warning notices.
- Issuing infringement notices and fees.
- Issuing prohibitions or urgent instructions to address a serious safety risk.
- Prosecuting offenders who have breached the act.

Workplace hazards

A hazard is anything that can cause harm. A person's behaviour or their failure to take action can be a hazard.

Wherever possible hazards should be eliminated so that they no longer pose a threat, such as cleaning up a spill or removing the power supply from an appliance.

If this is not possible, then the hazard should be minimised. An example of isolating a hazard is to keep people away from it, i.e. using barriers around a hole in the ground, or preventing harm to workers with PPE and safety equipment.

There are a bunch of hazards that can be present in any workplace such as:

- Poor lighting.
- Manual handling.
- Slipping, tripping or falls.
- Fire.
- Electricity.
- Vehicles, machinery, cranes and diggers.
- Other trades working.

Obviously, this list can go on and on, and it depends on where you are working as to what the dangers and risks you face are.

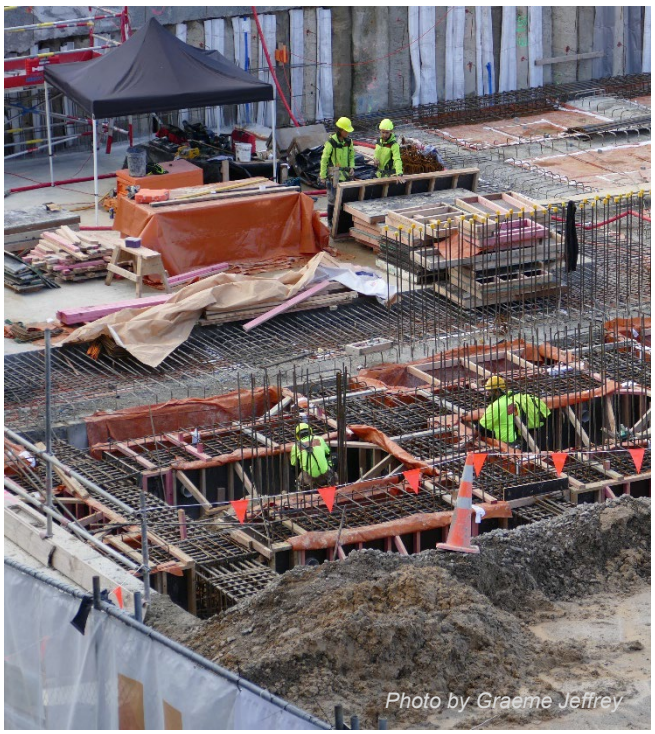


Photo by Graeme Jeffrey

Special hazards and hazardous materials

During your day-to-day work, you may occasionally come across special hazards that require specific precautions while working on or around them.

If you become aware of a special hazard during your work, you should stop work and inform your boss.

When working with any hazardous material, you must follow all relevant procedures regarding the hazard and use the correct safety equipment where needed.

Hazardous materials must be disposed of differently depending on the specific material.

Some requirements for correctly disposing of hazardous materials are:

- Hazardous material must be safely and competently removed from its current location.
- Correct disposal methods and procedures are to be used as appropriate to the hazard.
- Specialist hazardous material removal companies may need to be employed depending on the nature of the hazardous material.

The table below lists some special hazards, their effects and typical occurrences when the effects may occur.

Type of special hazard	Effects	Typical occurrences
Infrared	Damage to eyes and skin	Not wearing the appropriate personal protective equipment (PPE)
Ultraviolet	Sunburn, skin burn, arc eye	Not wearing sunscreen when working outside, exposure to welding arcs
Radio waves	Cancer, changes to DNA, increase in body temperature	Working near antennae
Microwaves	Cancer, increase in body temperature	Telecom industry, working near transmission equipment
Electrostatic and electromagnetic fields	Cancer, burns, electric shock, death	Power lines, lightening
Air quality	Breathing and lung problems	Pollen, gases, pollution, dust
Chemicals	Burns, poisoning, eczema	Unsafe working practices around treatment or cleaning facilities
Gases	Explosions, breathing and lung problems, poisoning, suffocation	Refrigeration plant, cutting through gas lines, cleaning and manufacturing processes, confined spaces
Dust	Stinging eyes, breathing issues, lung damage	Construction or demolition sites, cutting tiles and concrete, mills, sawdust, silos, digging and dirt
Asbestos	Cancer	Demolition of old buildings, work on and renovation of buildings, old pipe lagging and brake linings

Some examples of workplace behavioural hazards are:

- A worker forgets his safety glasses.
- An electrical apprentice uses a multimeter with a damaged lead.
- A contractor walks away from the ladder he is holding for a workmate.
- A worker claps two pieces of wood together behind another worker.
- A foreman hasn't had much sleep the night before doing a job.
- A trainee leans out to the side when working up a ladder instead of moving it.

The results of a hazard may be:

- Injury
- Illness
- Death

Ill health and injuries can potentially have a long-term impact on yourself, your family, and the wider community. Some examples of long-term effects are:

- Loss of social connections and function.
- Inability to participate in hobbies and interests.
- Depression.
- Lack of income.
- Permanent disability.

Dealing with Hazards

When dealing with Hazards, there are some actions that you need to take to identify and reduce the risk of hazards.

1. **Identify hazards**

   Firstly, you will need to have a system of looking for, and finding, things and actions that do or could result in harm. You will need to identify these things before you can do something about them.

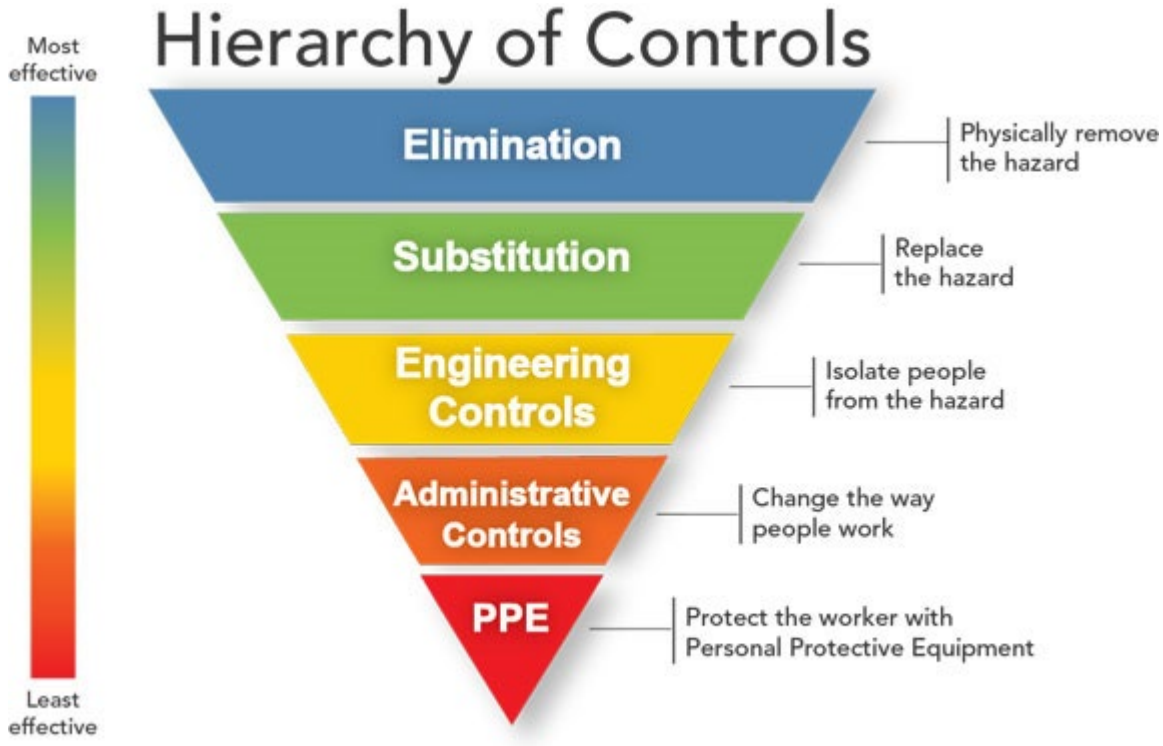
2. **Assess the risk and prioritise your response**

   Next, you will need to judge the harm that may come from a hazardous situation and decide how likely it is to happen. You need to act and start planning the appropriate safety action by:

   1. Physically inspecting the workplace.
   2. Working through and planning tasks or processes to identify hazards.
   3. Analysing previous accidents and accidents that have nearly happened.

3. **Apply control measures**

   The next and most important step is to actually put the control measures of the safety plan into action - in how you actually do the job, being trained properly for the job and using the proper gear.



Hazard controls for electrical work

Some examples of control methods are listed in the table below.

Control measures	High current		High voltage		Low voltage	
	Minimises hazard	Eliminates hazard	Minimises hazard	Eliminates hazard	Minimises hazard	Eliminates hazard
Safety distances	✓		✓		✓	
Personal training	✓		✓		✓	
Switching off	✓		✓		✓	
Isolating, locking and tagging supply		✓		✓		✓

You will notice that some control methods eliminate the hazard completely and should be the first choice, others just minimise the hazard and so some risk to workers remains.

Some very easy standard workplace hazard control measures are shown below.

Hazard Control	Explanation
Clean up the dust after cutting the slot in the concrete floor	Reducing dust and debris on the site reduces the possibility of long-term health effects caused by dust being stirred up into the air you are breathing.
Running the extension lead where it is out of the way and not laid across access ways	This removes a trip hazard and prevents possible damage to the extension lead which may give rise to an electric shock.
Storing the drums of cable in a place out of the walkways	Keeping exits and routes to exits clear helps a workplace be more efficient and allows a quick clear way out if something goes badly wrong.
Putting the pile of down light packaging and boxes in the dumpster	Everything on the floor is a danger to health from tripping and also makes life on site less comfortable. Clearing out unnecessary clutter improves the health and safety of any site.
Using a longer auger in the drill so that you can reach the top plate without the use of a ladder	Being able to drill for a prewire from the ground may not only make the job faster but eliminates the use of a ladder and therefore potential falls.
Removing objects off the floor around the base of a ladder before climbing it	There is a high chance if you don’t, you will forget it is there and when you back down it would be easy to twist your ankle or fall over it.
Have and refer to material data sheets to make sure you are handling substances safely	Material data sheets are designed to help protect the health and safety of people in the workplace. They provide information on the hazards of particular substances and how to safely use, store, transport and dispose of them.
Only use currently tested and tagged power tools on site and inspect before use	Testing and tagging verifies that the equipment is safe at the time of testing. Untagged tools may not have been tested and may be faulty. Inspecting the tool before use will show any damage that might have occurred since the tool was tested.

Working with other trades

There are health and safety considerations and responsibilities you should think about when working with other trades, things like:

- Having a hazard ID board to ensure everyone is aware of hazards or changes in hazards.
- Attending site toolbox meetings to be up to date with what other trades are doing (for example, cranes operating overhead).
- Caring about how your work affects the other trades, being involved as a working community, letting others know about any specific hazards you might create.


Photo by Graeme Jeffrey

Being part of the good safety culture on a site with other trades will help ensure it is a good place to work, mean that other workers around you will feel safe, and it is more likely that you will be recommended for more work in the future.

If you are a danger onsite, the contractor will quickly get rid of you and find some other company that will not cause him safety concerns.

Holding a toolbox meeting

Toolbox meetings are usually held on a worksite at the beginning of work, to discuss the days activities on site and highlight any possible hazards that may result from what is happening that day.

Toolbox meetings allow workers to play a part in worksite health and safety and give their input into how health and safety should be approached.

Some things that could be covered in a toolbox meeting are:

- New contractors/workers on site.
- Recognition of previous good health and safety by workers.
- Ongoing activities on site.
- The activities happening today and any new health and safety actions.
- Any particularly special health and safety risks as a result of the day's activities.
- Incidents/ accidents from yesterday.
- Risks from changing seasons/weather or other influences.
- A reminder of a (randomly) chosen health and safety point.

A toolbox meeting should not be a lecture style meeting, rather a discussion where everyone is encouraged and free to participate.

A record of the meeting, what was covered and who was in attendance should be kept as part of the company health and safety records.

Electric shock

Working in the electrical industry, obviously, one of the main hazards is electricity and getting a shock.

Dangers of Electric Shock

Since the human body is a conductor of electricity, a current will flow through your body tissue when contact is made simultaneously with two objects that are at different voltage potentials.

Photo by Graeme Jeffrey

Voltages below 32 volts AC are virtually harmless to humans under normal circumstances, but records show that electric shocks can be fatal when the AC voltage has been as low as 40 volts.

Unfortunately, our electrical supply systems are at 230 volts single phase to earth, 400 volts phase to phase, and so can easily be lethal if you get a shock.

Electrical shock is the effect produced on the body, in particular the nervous system, by an electric current passing through it.

An electrical shock occurs when a current flows through the human body. This happens when contact is made simultaneously with two objects that are at different voltage potentials.

Electrons are forced to move through the body, in somewhere and out somewhere else. As they do, they cause damage. Heat is generated and the body is “cooked” from the inside.

Our muscles are operated by electrical signals from the brain and getting a shock interferes with that system.

The shock may cause muscles to contract and your hand may grab on harder without your permission, even if you try to let go.

If the current crosses through the heart, ventricular fibrillation may occur. The heart will vibrate in a random way and reversion to normal rhythm rarely occurs by itself - which could be fatal because the heart is not effectively pumping blood.

100mA is the approximate level of current at which organic tissue damage can start to occur - if you are getting shocked. As with any dangerous level of current, the longer the current flows, the more damage is done.

Here is a table that compares the possible results with the length of time the current flows.

The current value and contact times are given as general examples only. The effects listed are those likely to occur in a person of average good health and condition.

Current in milliamps	Contact time in milliseconds	Effect
1mA		Threshold of sensation
10mA	10-10,000 ms	Mild to painful sensation
50mA	10-200 ms	Usually no danger
50mA	200-4000 ms	Temporary muscular paralysis likely
50mA	Over 4000 ms	Ventricular fibrillation possible
100mA	10-100 ms	Usually not dangerous
100mA	100-600 ms	Temporary muscular paralysis possible
100mA	600-10,000 ms	Ventricular fibrillation possible
100mA	Over 10,000 ms	Ventricular fibrillation probable
500mA	10-40 ms	Danger unlikely
500mA	40-500 ms	Ventricular fibrillation possible
500mA	Over 500 ms	Ventricular fibrillation probable

These times are pretty quick, and the higher the current flow and frequency, the more damage is done faster.

Atmospheric humidity or skin moisture will also increase the severity of the electric shock.

The effects of electric shock are:

- Effect on heart rate and beat
- Muscular paralysis
- Effect on breathing

Overloads and short circuits

When equipment develops a fault, one of the possible outcomes is for excess current faults to occur. These faults can become safety issues.

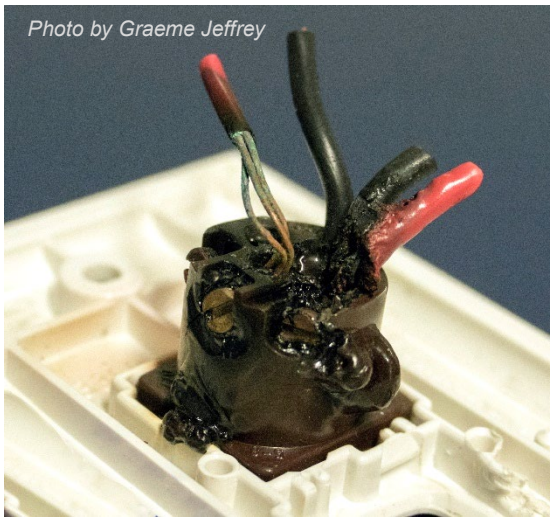


Photo by Graeme Jeffrey

Excess current faults fall into two categories, namely:

- Overloads
  - A circuit that has too much load connected to it will result in a current flow that is higher than the rated current carrying capacity of the circuit.
- Short circuits
  - Occurs when a path with low resistance/impedance allows current to bypass (take a short circuit) around a load and very high current flows as a result, i.e. phase comes into contact with neutral.

Short circuits and uncontrolled faults are dangerous as high current can flow which poses serious risk to people and property.

Risks of short circuits or out of control current to people and property:

- Fire.
- Damaged cables and equipment.
- Damage to property.
- Electrocution.

Protective devices such as fuses, circuit breakers, and overload relays are wired into circuits to reduce the potential for harm from overloads and short circuits.

This may not seem to be a health and safety issue as such, but if you do not correctly protect electrical circuits then the results can be very hazardous.

Personal training

One control measure is personal training - official instruction in procedures, safe use and operation of tools, machinery and equipment.

To ensure that electrical work is carried out safely and to a high standard, the current regulations and standards require all prescribed electrical work to be carried out by a person who is fully competent to carry out the required work.

Obviously, electrical work is dangerous, and some types of electrical work are more dangerous than others.

Operating and working on high voltage equipment (over 11kV) is an example of very dangerous work where the consequences of something going wrong are significantly bad.

Anyone working on high voltage equipment must:

- Be competent to do the work.
- Have the correct permission to carry out the work.
- Follow correct isolation procedures during the work.
- Be aware of the minimum safe approach distances for working on and around high voltage equipment.
- Have ensured that his PPE equipment is checked, tested and correctly rated for the job.

According to the Electrical Workers Registration Board's document - Supervision Procedures for Trainees, the supervisor of apprentices and trainees must take responsibility for ensuring that:

- The trainee uses appropriate safety practices and equipment and is supervised if they do not yet have adequate skills for the task.
- The trainee is not allowed to work outside of their supervisor's limits.
- The work is completed competently.
- The work complies with the Electricity (Safety) Regulations.

While trainees need to be supervised, they also need to take initiative themselves to work safely and make sure others are safe too. Some important behaviours for a trainee to have are:

- Using equipment and tools correctly in accordance with manufacturers' instructions.
- Use the right personal protective equipment (PPE) at all times when needed.
- If in doubt, asking for help, advice or information.
- Follow instructions given to them by their supervisor.

Legally, if a worker or trainee has been asked to stop working dangerously, his/her supervisor is required to report their behaviour to the site foreman and/or their employer.

Workplace accident, incident and emergency reporting.

Every workplace will have slightly different procedures for accident and incident reporting.

Everyone in the workplace must report any accidents or incidents to their employer or boss. This may be done verbally or using the documentation provided such as accident/incident reports.

In an emergency, everyone in the workplace should be able to identify the location to evacuate to during or after an emergency. Workers should also be able to identify who they report to in an emergency.

A workplace emergency procedure may include calling emergency services, providing first aid, and warning others about the emergency.

Investigating incidents and accidents

To improve future health and safety, incidents and accidents must be carefully and deliberately investigated to find the true actions or circumstances that caused the accident.

Three things that help focus an investigation, and help identify the root cause of an incident are identifying:

- The immediate cause of the accident i.e. ladder slipped, hand touched, blade cut.
- The fundamental error that led to the accident happening i.e. on unstable ground, failed to isolate, removed machine guard.
- The extent and nature of the damage that occurred i.e. paintwork damaged, concussion, electric shock, finger cut off.

Tools

Tools should only be used by people trained and competent to use them. In some cases, the person must also be certified.

Tools should also only be used for their proper purpose and should be inspected for damage before use.

Photo by Graeme Jeffrey

Keeping your tools in good condition is part of health and safety. Tools and instruments that are damaged or not in good condition are simply more dangerous to use.

Taking good care of your tools and equipment is important. For example, if your test meter saves your life by indicating when a circuit is live, then it is not appropriate to hiff it into the back of the work truck between drums of cable, it should be treated carefully and stored where it will not become damaged.

Here are some examples of damage or defects in tools and equipment that can make them more difficult or dangerous to use:

- Insulation damaged or missing from insulated hand tools.
- Insulation on meter test leads damaged.
- Blunt cutting tools.
- Cracked multimeter body.
- Protection guards missing.
- Meters out of calibration.
- Blunt rounded off screwdrivers.
- Rusted seized pliers.

Photo by Graeme Jeffrey

Electrical tools and test equipment.

Portable electrical tools and appliances used on the job need to be regularly inspected and tested against the standard AS/NZS 3760 to detect damage, wear or anything else that makes it unsafe.

Periodic tests are necessary to measure earth continuity, insulation and polarity. After passing the tests, a piece of equipment has a tag placed on it to verify that it is safe for use.

Electrical test equipment should be checked before use to ensure it has the correct ratings and features for the intended use (for example, if it is being used on live circuits).

Meters and test equipment should also have a current calibration label showing that they have passed a calibration test.

Personal protective equipment

Personal protective equipment (PPE) is there for your protection and needs to not only be cared for, but actually used and used appropriately for the situation.

There is a lot of different PPE you will come across on the job and you need to have proper training on how to use it. A few examples of PPE are shown here.

Personal Protective Equipment (PPE)	Name of PPE	Function of PPE
	Hard hat	Protect the head from falling objects
	Steel-capped boots	Protect the feet from crush injuries
	Ear muffs	Provide protection from loud noises
	High vis vest	Increase the visibility of the wearer

The table below describes a few examples of the correct checks for use and maintenance of PPE.

PPE	Correct checks for use	Maintenance
Safety glasses	Safety glasses must be correctly fitted for the individual. The choice of safety glass material (for example, mesh, plastic) should provide appropriate protection for the specific task.	Clean with appropriate materials to guard against damage or scratching.
Hard hat	Adjust the headband to fit snugly on your head. Check that it is not out of date. Check for cracks or other damage that may weaken the helmet. If required, check and use the chin strap to prevent the hat from falling off.	Do not paint or draw on a hard hat with marker pen as the chemicals may weaken the plastic. Store out of the light and where it will not get damaged by equipment around it.
Insulating gloves	Inspect and air test before each use to ensure there is no damage. The gloves must be rated for the voltage that the worker will be exposed to.	Store without folding and without exposure to any potentially damaging chemical or substance. Must be kept away from high temperatures, sunlight or humidity.
Flame-retardant clothing (arc rated)	The clothing must be of appropriate size and fit. It should be made from non-synthetic materials such as cotton and have the correct calorie rating for the situation.	Wash according to manufacturer instructions, without bleach, fabric softener or using a dryer. Replace when the item is sufficiently worn that the protection is reduced.

Working at height

Ladders

Ladders are allowed to be used for short duration work but they must be appropriate for the type of work being done and rated to industrial strength for use on worksites.

Metal ladders may not be used for live electrical work because they are conductive and can contribute to the user getting an electric shock.

Ladders must be checked to make sure that there are no defects and are in good condition before use. They must be placed on a firm footing, use a 4 to 1 ratio when setting up a ladder, i.e. 1 metre out for each 4 metres up.

Don’t over-reach when working on ladders, this is the cause of many ladder accidents. Move the ladder closer to what you are doing.

Elevated Work Platforms (EWPs)

If workers are using an Elevated Work Platform (EWP), it should have been serviced within the last 6 months and should be checked before each use.

The user of the EWP should be trained and competent to operate it.

Some EWPs require the use of harnesses during use and workers using harnesses must also be trained in the use of them.

Photo by Graeme Jeffrey

Harnesses

Harnesses should be relied on as a last resort for fall prevention. They should be stored dry and protected from damage when not in use.

Harnesses and equipment that are out of date must not be used and got rid of.

Any worker required to use a harness must have had specific training on the use of harnesses.

Scaffolding

Scaffolding must have a current safety certificate (displayed) on it and must not be used if it doesn't.

The certificate indicates that it is finished, checked and ready for use.

There will be a date of when the certificate expires and if it has, the scaffolder must recheck the scaffold and issue a current certificate before the scaffold is used.

Photo by Graeme Jeffrey

Confined spaces

According to WorkSafe's standard Safe Working in a Confined Space, a confined space is any area not intended for human occupancy, that has limited entries and exits and may potentially contain a dangerous atmosphere.

Confined spaces are very dangerous because they can:

- Contain product that can engulf you.
- Have gasses or an atmosphere that can kill you.
- Be spaces that can trap you and make rescuing you very difficult.

You must be very careful that your safety is covered while working in a confined space and have a rescue plan carefully worked. This is because if you do come to grief, health and safety may prevent someone else coming into the space to get you out.

Before working in a confined space, some actions that should be taken are:

- Carry out a risk assessment.
- Be trained and competent to work in a confined space.
- Ensure you have emergency procedures organised and ready.

Fire

The Chemistry of Fire

Fire is a “redox” (oxidation-reduction) chemical process. Fire involves the rapid oxidation of a fuel source at a high temperature. Fire is an exothermic reaction, which means that the process releases energy as heat and light. Gaseous by-products are also produced.

The combustion process begins when a fuel source is heated beyond its ignition temperature in the presence of an oxidiser.

Oxygen in the air is the “oxidiser”. This is because it provides the oxygen to the fuel in the redox reaction. The oxidiser loses oxygen to the reaction and this process is called “reduction”.

The fuel for a fire is called the “reducing agent”. It gains oxygen during the reaction (reducing the other substance) and in doing so gets oxidised (gains oxygen) rapidly.

As the fuel burns, a self-sustaining chemical reaction has begun as the energy it produces is greater than or equal to the energy needed for continued burning.

The fire triangle

The fire triangle describes the three elements that must exist in the right proportions in order for a fire to happen.

The first element in the triangle is heat. Without enough heat, a fire cannot ignite or grow.

The second element is fuel (the reducing agent). Fuel provides the energy for the fire to burn.

The third element is oxygen (the oxidiser). Oxygen is needed in sufficient amounts for a fire to start and continue burning.

Fire extinguishers

There are currently 6 classes for fire (before 1999 there were only 4 classes so you may find extinguishers that are still be labelled to the old system):

- Class A (Flammable solids i.e. wood, paper, plastics)
- Class B (flammable & combustible liquids i.e. petrol, paint, propane)
- Class C (flammable gases i.e. propane, butane and methane)
- Class D (fires involving combustible metals i.e. potassium, sodium, aluminium, magnesium)
- Class E (electrically energised equipment i.e. motors, transformers, appliances)
- Class F (cooking oils and fats i.e. animal fats, vegetable fats)

There are many different types of fire extinguishers available, such as:

- Water
- Foam
- Wet chemical
- Dry powder
- Carbon dioxide
- Vaporising liquid
- Specialised materials for Class D

Photo by Graeme Jeffrey

An electrical fire may be intensified by the use of the wrong extinguisher.

The type of fire extinguisher you need will depend on the class of fire you are most likely to experience. For example, where you may experience a cooking oil fire you will need a wet chemical fire extinguisher rather than a water extinguisher.

Electrical fires require an extinguisher labelled Class E - Dry Powder and Carbon Dioxide are the two main types.

Ensure you only use the right extinguisher for electrical fires as any that have water in them are unsuitable and dangerous. The water can carry current resulting in electric shock or cause a flashover causing burns or serious injury.

Portable Fire Extinguisher Guide

Two colour schemes for fire extinguishers exist		EXTINGUISHANT	CLASS A	CLASS B	CLASS C	CLASS D	CLASS E	CLASS F	COMMENTS
PRE 1999	FROM 1999		Wood Paper Plastics	Flammable & Combustible Liquids	Flammable Gases	For fire involving combustible metals	Electrically Energised Equipment	Cooking Oils and Fats	
		WATER	YES	NO	NO	Use only special purpose extinguishers and seek expert advice	NO	NO	Dangerous if used on flammable liquid, energised electrical equipment and cooking oils/fat fires
		WET CHEMICAL	YES	NO	NO		NO	YES	Dangerous if used on energised electrical equipment
		FOAM	YES	YES	NO		NO	LIMITED	Dangerous if used on energised electrical equipment
		DRY CHEMICAL (Dry Powder)	YES (ABE) / NO (BE)	YES (ABE) / YES (BE)	YES (ABE) / YES (BE)		YES (ABE) / YES (BE)	NO (ABE) / LIMITED (BE)	Look carefully at the extinguisher to determine if it is an BE or ABE unit as the capability is different
		CARBON DIOXIDE	LIMITED	LIMITED	LIMITED		YES	LIMITED	Not suitable for outdoor use
		VAPORISING LIQUID	YES	LIMITED	LIMITED		YES	NO	Check the characterisitics of the specific extinguishing agent

LIMITED indicates that the extinguishant is not the agent of choice for the class of fire, but that it may have a limited extinguishing capability
Solvents such as alcohol or acetone mix with water and therefore require special foam
Green text indicates the class or classes in which agent is most effective

Fire Fighting

It is not your job to fight fires, it is your job to escape fire. Leave the firefighting to the professionals.

Only use fire extinguishers to make an escape path for yourself, or to extinguish very small fires.

Attempting to put out a fire

It is only safe to try and use fire extinguishers when:

- The fire service has been called and all people are safe.
- The fire isn't going to explode i.e. gas bottles, petrol, paint etc.
- The fire is small and reasonably contained.
- You can safety access and retreat from the fire.

Remember, life is more important than property — don't put yourself or others at risk.

Operating a fire extinguisher

If it is safe to try and put a fire out and a fire extinguisher is on hand, get it and check that it is suitable for the type of fire.

When operating a fire extinguisher remember PASS:

- **P**ull the safety pin or remove the clip.
- **A**im the nozzle at the base of the fire from a safe distance. Most extinguishers are designed to be operated from about 2 - 3 metres away.
- **S**queeze the handle/trigger.
- **S**weep the extinguisher from side to side while aiming at the base of the fire.

Photo by Graeme Jeffrey

Automatic fire extinguisher systems

Many buildings have active fire protection systems, such as sprinklers, which operate to extinguish an outbreak of fire.

There are many different automatic fire extinguisher systems that you may come across in industry. Four common systems are listed with brief explanations below.

Fire sprinkler systems

Fire sprinkler systems rapidly deal with fires in buildings that have a high level of risk and are storing large volumes of flammable material.

The sprinkler system's sensors detect heat as a fire increases in intensity, and then the system automatically turns on and distributes water onto the fire.

Photo by Graeme Jeffrey

Dry-chemical extinguishing systems

Dry-chemical extinguishing systems release dry chemicals to extinguish fires detected in things like energised electrical equipment, gases, liquids, grease, wood, and paper.

When the fire reaches a specified temperature, the system automatically releases chemicals onto the source of the fire. The choice of chemicals depends on what likely fire hazards are identified.

Wet-chemical extinguishing systems

Wet-chemical extinguishing systems release wet chemicals to extinguish fires in areas such as commercial cooking kitchens.

When the system is triggered, it releases a liquid spray. This reacts with the oils or fats to create a foam that reduces heat to stop the fire from burning.

Carbon dioxide extinguishing systems

Carbon dioxide extinguishing systems lower the level of oxygen by releasing an inert gas. This stops the fire from burning without causing significant damage to property.

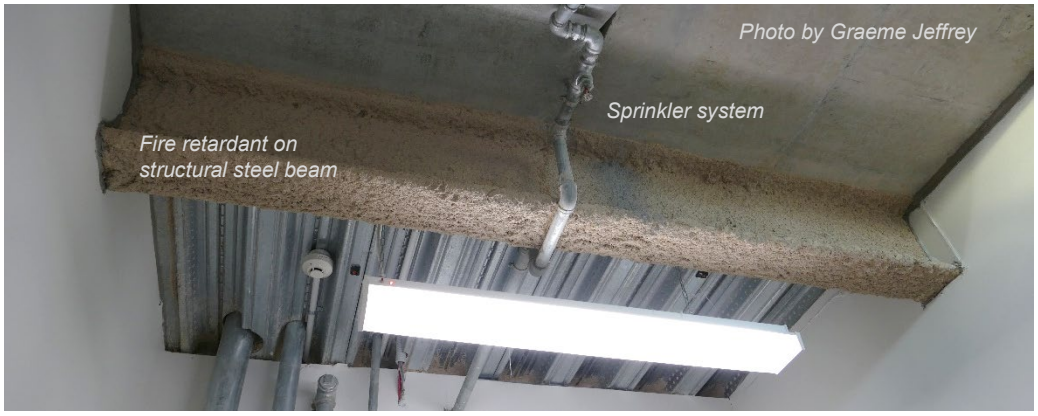
Depending on the system, the gas may flood the area or be used locally. It must be used in areas unlikely to be occupied by people, particularly when the system is triggered.

Systems may have built in alarms and time delays to ensure people are evacuated before it operates.

Fire cells

A building structure can have passive fire protection built into it, for the purpose of slowing or containing the progression of fire and smoke through the structure.

Special fire-resistant walls and doors which are designed to resist fire for a period of time (to allow time for people to get out of a building and fire fighters to get in), are an integral part of modern building design.



A fire cell is an area in a building that is designed to withstand fire for a definite period of time and reduce the spread of fire so that any occupants can safely evacuate.

Floors and wall linings with no penetrations help contain fire.

Fire cells include the use of fire rated materials such as wall linings, paint and construction materials and sealing of cable penetrations with fire retardant materials.

If electrical or communication cables are installed through a fire wall or floor, steps must be taken to maintain the fire rating of the structure

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