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Australasian Fire and Emergency Service Authorities Council

Department of
Environment and Conservation
Our environment, our future

Basic Wildfire Awareness

National Short Course 22023VIC 2010

DEC March 2011 – v1

Acknowledgements

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This Participant Manual and related training documentation was originally adapted from the original documentation produced by The Victorian Department of Sustainability and Environment (DSE) in November 2004. It has been adjusted to reflect the Western Australian Department of Environment and Conservation (DEC) terminology and procedures. DEC gratefully acknowledges the work of DSE in preparation of the original material.

The Victorian Registration and Qualifications Authority reviewed the accreditation of this course in 2009 for the period 1st January 2010 to 31st December 2013. DEC has reviewed and aligned it's material with the latest version to which the accreditation applies (version 2 December 2009).

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1 LEARNING OUTCOMES

Successful completion of this course gives credit for the nationally accredited short course "Course in Basic Wildfire Awareness" national code 22023VIC - 2010.

ELEMENT **Elements describe the essential outcomes of a unit of competency.**	**PERFORMANCE CRITERIA** Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold/italicised test is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.
1. Explain the three components required for a wildfire to burn and extinguishing techniques	1.1 Each of the components of the fire triangle required for a ***wildfire*** to burn and continue to burn is identified 1.2 Three common firefighting techniques used to attack and extinguish a fire are described 1.3 The three common firefighting techniques used to interrupt the fire triangle are outlined
2. Explain the parts of a wildfire	2. 1 Each of the main parts of a wildfire are identified 2.2 Terms 'head' and 'rear' or 'heel' of the fire are defined 2.3 Term 'spot fire' is described
3. Explain the three main factors affecting wildfire behaviour and wildfire development	3.1 Main weather factors that affect wildfire behaviour are identified 3.2 Main fuel factors that affect wildfire behaviour are outlined 3.3 Main topographic factors that affect wildfire behaviour are identified 3.4 Ground, surface and crown fires, and the typical conditions in which they occur are distinguished 3.5 Spotting, its causes and its effect on fire behaviour are assessed
4. Explain basic wildfire suppression strategies and tactics	4.1 Common ***strategies*** used at wildfires are identified and matched to the conditions in which they might be used 4. 2 Common ***tactics*** used to fight wildfires are described
5. Summarise the common risks of a (wildfire) fireground as a workplace and the normal precautions taken to reduce these risks	5.1 ***Risks*** associated with changes in fire behaviour and the precautions to be taken are outlined 5.2 Causes, prevention of and treatment of fatigue and heat illness are explained

	5.3 ***Hazards*** of fallen electrical wires, pole top fires and structural fires, and the precautions to be taken when in the vicinity of these hazards are identified 5.4 Risks of, and the precautions to take when working near heavy plant and machinery are determined 5.5 Risks of, and the precautions to be taken when working near a firebombing drop zone are identified 5.6 Precautions to take when working in the vicinity of chainsaw operations are ascertained 5.7 Risks associated with driving vehicles in the vicinity of a fire and the precautions to be taken are explained 5.8 Range of key risky scenarios, the reasons why these might pose a risk, and some suggested precautions to minimise these risks are identified 5.9 Risks associated with falling trees and the precautions to be taken when working in a forest area are identified
6. Explore a range of options (and their limitations) that could help to protect people from the *hazards of an approaching fire*	6.1 Purpose and limits of the effectiveness of ***personal protective clothing and equipment*** is confirmed 6.2 Range of possible ***places to seek refuge*** from a wildfire, and limitations associated with these places, is identified
7. Confirm the fire organisation and agency communication arrangements	7. 1 Each of the five key functions of the ***Australasian Inter-service Incident Management System (AIIMS)*** are described 7.2 Importance of a single ***Incident Action Plan*** and a single chain of command at a wildfire is explained 7.3 Importance of each person maintaining a two-way information flow with their fire supervisor is outlined 7.4 Agency's ***emergency warning protocols*** and the actions to take upon hearing these are established 7.5 Actions required to make an emergency call on the agency's radio system are outlined

Optional Exercise (recommended for DEC personnel who will work on or near firelines regularly eg Ground Support runners)

Demonstrate delivery of water from a knapsack spray unit.
Demonstrate construction of a mineral earth break with hand tools.

2 INTRODUCTION

This course is designed to provide non-firefighting personnel who work under supervision at bushfires with knowledge and information about the risks and hazards of bushfire fighting, prevention and precautionary measures to take to avoid or reduce risks, fire behaviour, fire suppression and how fire fighting is organised. Personnel who receive this training will be able to work on the fire ground but not in active firefighting roles eg pump operator on a fire tanker.

3 INTRODUCTION TO FIRES

3.1 What is fire?

Combustion to produce a fire involves the combination of three elements to sustain it. These three elements are fuel, oxygen and heat and are commonly represented in the fire triangle:

Fuel – something to burn.
Oxygen – all materials require oxygen to burn (or oxidise)
Heat – materials need heat to reach a minimum temperature in order to burn. This is often referred to as the heat of combustion. Once they start to burn they gradually produce enough heat to sustain the fire.

The Fire Triangle

The absence of any factor will stop the fire. Reducing any factor will weaken the fire triangle, reduce fire intensity and alter fire behaviour.

Heat can be reduced by applying water or foam. This is because the water absorbs heat to become steam.

Oxygen can be reduced by smothering fuels with earth, or applying foam or chemical retardants. The oxygen is eliminated (or at least restricted from being in the combustion process).

Fuel can be physically removed by constructing a fire break with hand tools or machinery, to break its continuity. Alternatively, fuel can be removed by backburning.

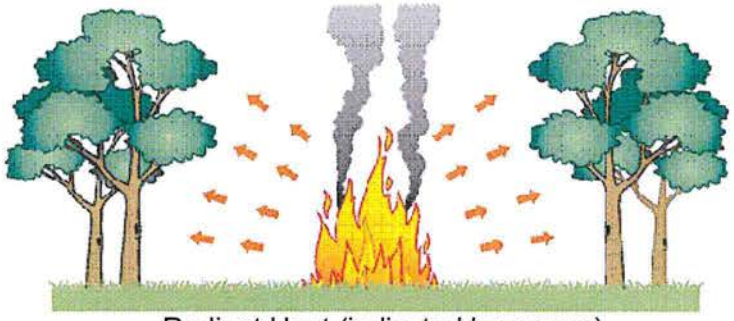
3.2 Heat transfer

Heat is important;

1. To sustain burning
2. It is hazardous to people and
3. It can influence the way a fire burns

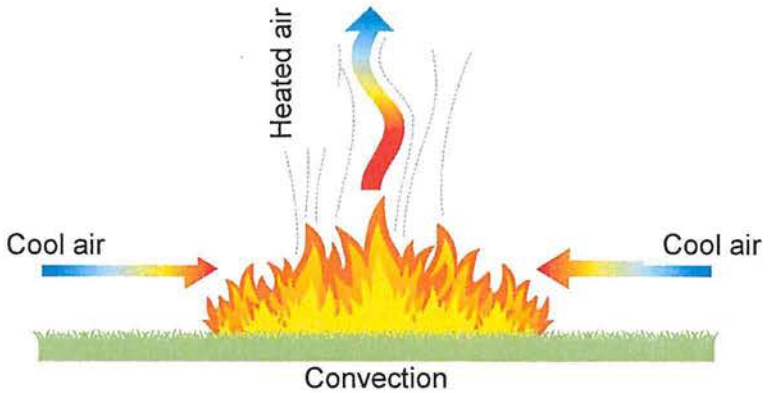
Generally the heat required to sustain a fire comes from actual burning materials (embers) or flame to provide enough heat to spread a bushfire. Alternatively there are three ways in which heat can be transferred:

Radiation – this is where the heat output from the fire travels in straight lines, like the heat from the sun. Radiant heat is the main killer at fires. It is important to protect oneself from the radiant heat of an approaching fire.



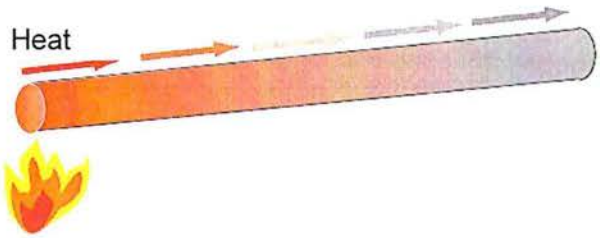
Radiant Heat (indicated by arrows)

Convection – this is observed where heated air rises and cool air flows in to take its place. The huge clouds over severe wildfires are often referred to as "convection columns". Convection plays a significant role in the development of bushfires because of it's influence on wind strength and direction. Convected heat can also move horizontally where a wind is pushing it forward.



Convection

Conduction – this is where heat travels along an object, such as a metal surface. Materials that transfer heat easily are said to be heat conductors whereas materials that do not can insulate the person or object from the heat source. Earth and wood are very poor conductors of heat and can insulate a person from heat. Therefore, if a wildfire is approaching, a safe place is underground. Covering yourself with loose earth will give some protection. A barrier between you and the fire should not be a good conductor but should be a good insulator.



Conduction

4 STRUCTURE AND TYPES OF WILDFIRE

4.1 Parts of a wildfire

Terms commonly used to describe wildfires are: **origin**, **head**, **tail**, **flanks**, **rate of spread, flame height** and **intensity**.

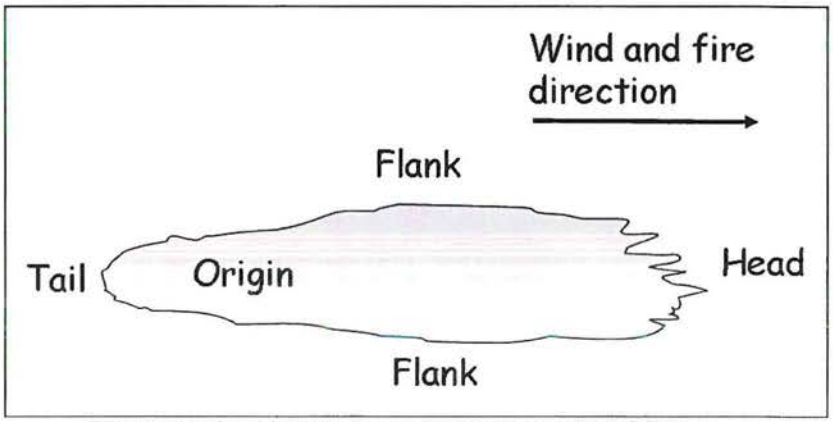


Diagram showing terms relevant to parts of fire

Intensity is a measure of how much heat a fire is giving off i.e. how "hot" the fire is. Intensity is a function of rate of spread and quantity of fuel.

Flame height is simply a general description of how tall the flames are (disregarding flare-ups). Generally, the taller the flames, the more intense the fire.

Rate of spread is how fast the fire is moving. Forward rate of spread refers to the speed of the head of the fire.

Origin is where the fire started – important to protect this area for fire cause investigation.

Head (or front) of the fire is where it is spreading fastest – the tallest flames and greatest intensities are found here. Generally the hottest part of the fire.

Flanks of the fire are the sides between the head and the rear, roughly parallel to main direction of spread. Fire intensity is less than at the head.

Tail of the fire is where spread is slowest and intensity generally the least.

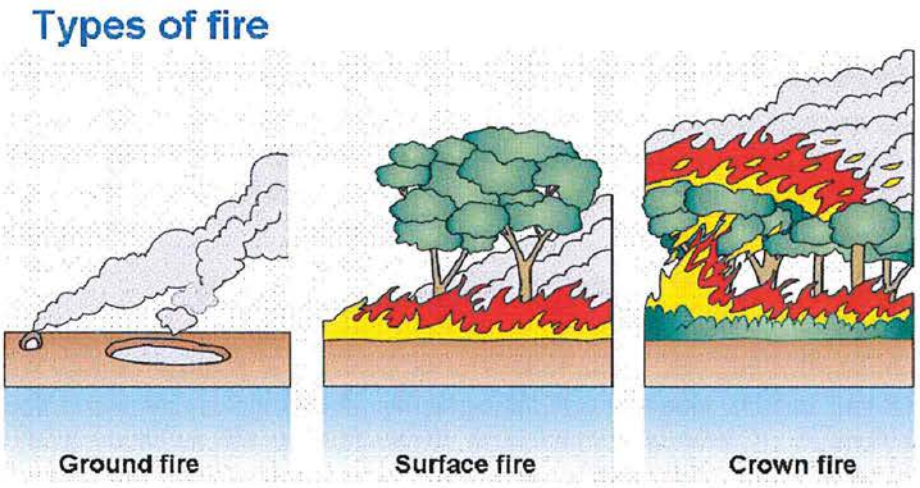
Generally, firefighters using hand tools can only safely tackle flames under light wind conditions that are up to 1 to 1½ meters in height. Higher flames than this generate too much heat. Be aware that flames driven by a moderate to strong wind may lie over and may be less than $1^1/_2$ metres high. A fire such as this would be too intense to attack with hand tools.

4.2 Types of fires.

Surface fires burn in the layer of fallen leaves or needles (eg pine or sheoak) on the ground and in grasses and shrubs above fallen leaves. The layer of fallen leaves is referred to as "leaf litter" in fire terms.

Crown fires burn in the tops (or crowns) of trees above and ahead of an intense surface fire. Crown fires are caused by the flames igniting the crowns. They generally require an intense surface fire to be present before the crown will ignite. The presence of elevated fuels, high winds, low relative humidity or an uphill run of the fire may all contribute to development of a crown fire.

Ground fires are sub-surface fires that burn organic material in or under the soil layer (such as peat, coal, old windrows etc).



4.3 Spotting

Spot fires are new fires ignited ahead of the main fire by embers or burning material carried upwards and forwards by the convection column and/or wind. In native forests most spotting is caused by burning bark, but spotting can be caused by burning leaves, twigs or embers from hollow trees.

Typically, fibrous stringybark trees cause massive short distance spotting. Long ribbon bark is more aerodynamic and causes long distance spotting.

Stringy bark

Ribbon bark

Spot fires can accelerate the overall rate of spread of a wildfire with a corresponding increase in intensity particularly when the main fire overtakes a spot fire. Spotting increases suppression difficulty with spots outside control lines which then have to be individually controlled, or control lines relocated to incorporate them. Multiple spot fires will increase the danger of entrapment to firefighters.

4.4 Extreme fire behaviour

Extreme fire behaviour is intense fire characterised by **dark coloured smoke, surging flame heights, crown fire and mass spotting**. Unless you are a trained fire fighter it is advisable to move to a safe place well away from fires of this intensity.

5 FACTORS THAT AFFECT FIRE BEHAVIOUR

Fire behaviour is the way a fire reacts to environmental factors. These factors can be summarised as **fuel, weather** and **topography**. A change in any one factor will change fire behaviour. Continually monitoring these factors will enhance your **situational awareness** of the fire behaviour.

5.1 Fuel factors.

There are five properties of fuel that affect fire behaviour:

- moisture content
- quantity
- size
- arrangement
- type

Moisture content of fuels affects how intensely they burn. An increase in fire intensity is indicated by an increase in flame height and heat output.

Moisture content is related to how dry the season and day has been. For example, several years of dry weather will result in the soils being dry deep down and heavy fuels (such as logs) will be dryer inside which may result in them burning away quicker with a greater heat output. Logs with a high moisture content inside them may not stay alight.

Without rain, fuel moisture of fine fuels is governed by the dryness of the air around them (measured by relative humidity). The relative humidity is usually highest (and the fuels the dampest) at early dawn. Fire intensity will therefore usually be lowest at that time – a good time to backburn in forest. The relative humidity will usually be the lowest in mid to late afternoon and associated fire intensity will be greatest at that time. Grass fuels dry out first, followed by the fine fuels in the forest and finally the heavier fuels.

Fuel quantity also affects fire intensity. In forest fires, more fuel means more intense fires that may travel faster and generate more spot fires – and are harder to control and extinguish. Fuel quantity relates to the sum of the surface, bark and elevated fuels and is usually measured in tonnes per hectare. Grass and spinifex fuels are generally low fuel quantity (compared to forests) but can still burn with high intensity and speeds. The purpose of fuel reduction burning is to reduce the fuel quantity and therefore the associated fire intensity.

Fuel size governs how quickly fuels burn. Fine fuels are less than 6 mm in diameter (grass, spinifex, leaves, twigs etc) and burn quickly. They sustain the flame front of a fire. Heavy fuels, such as logs, usually need fine fuels to ignite them.

Fuel arrangement and distribution means how items of fuel lie in relation to one another. Loose, continuous fuel arrangements (such as grass) burn more readily than compacted and/or discontinuous fuel beds (such as young spinifex). Fuels in the air (elevated fuels such as pine or sheoak needles) burn with a greater intensity than fuels on the ground.

Different **fuel types** can lead to differences in fire behaviour because of characteristically different fuel components. Grass fires are comprised of fine fuels and burn out quickly. Coastal heath or scrub, or similar vegetation comprises elevated fine fuels with high oil content and burns ferociously. Forest types vary considerably but generally include plants with high oil content, some elevated fuels and heavy fuels which can result in intense fires with considerable residual burning of larger fuel components like logs. Pine plantation fires vary according to the age of the plantation and the continuity of the fuels. Recently established plantations may have continuous grass growth between the trees so will burn like a grass fire. Pruned or thinned plantations have less continuous fuels and are less likely to crown. If prunings or thinning debris are still present then crown fires are more likely.

Grass fire northern Australia Pine fire Gnangara

5.2 Weather factors.

Weather influences fire behaviour through the impact of temperature, atmospheric moisture (relative humidity), wind and atmospheric stability.

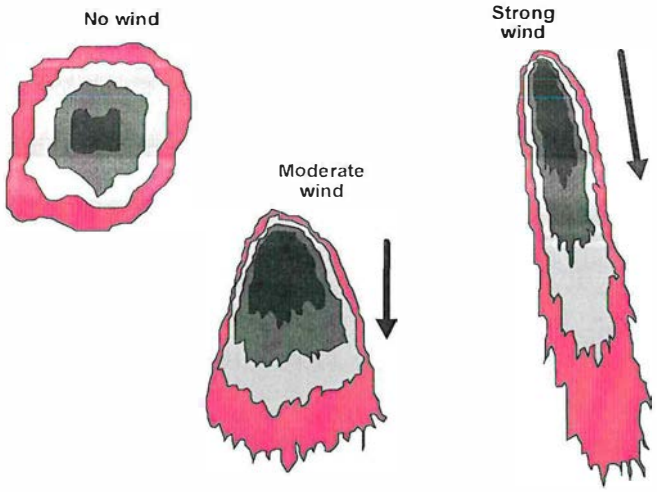
Temperature affects fire behaviour by influencing things such as fuel moisture, local winds and atmospheric stability.

Relative Humidity (RH) directly affects the moisture content of dead fine fuels, and thus how readily they burn. High temperatures and low relative humidity produce low fuel moisture contents which may result in severe fire behaviour.

With RH under 25% fires will generally burn well (depending on fuel moisture content). Flame heights and fire intensity will increase as RH lowers. A crown fire is more likely to occur, all other factors being equal, when the RH is less than 7%.

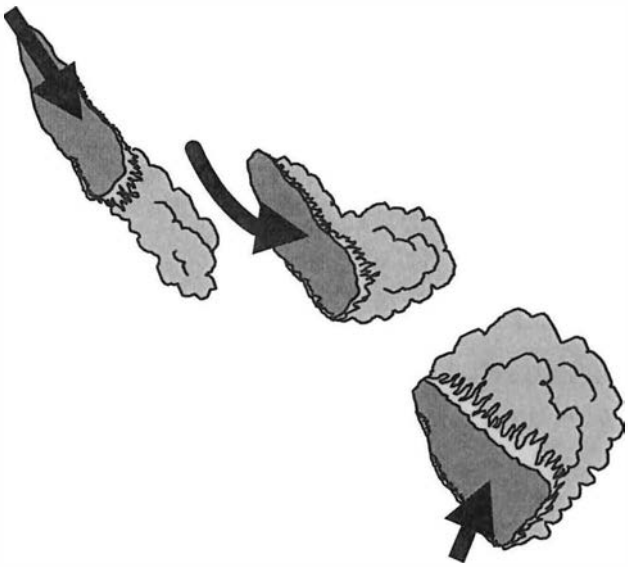
Wind is the most powerful influence on the direction and speed of a fire's spread. Wind affects the fire's rate of spread (speed) by tilting flames over unburnt fuel, accelerating their preheating, and carries embers to cause spotting. Wind direction (described as the direction from which the wind is blowing) largely determines the main direction of fire spread.

Strong, steady winds produce long narrow fires.
Moderate or variable winds may produce a broader fire shape.
Light winds will allow fire shape to be determined by fuel and slope factors.



Typical fire shapes related to wind strength

A significant change in wind direction can mean that the flank of a fire becomes a long head fire zone. This can happen when a cold front moving across southern Australia swings winds rapidly from the north west to the west or south-west. The much wider front on the eastern side of the fire spreads rapidly at much higher intensities.



Escalation of a fire edge due to wind change

Wind changes can be caused by a cold front, trough movement or a sea breeze. All are common occurrences in South West Western Australia.

This can be a very dangerous situation for firefighters working on the flank or people generally near a flank of the fire, especially if they are away from the fire's edge. When a fire changes direction it accelerates at full speed and may cover some distance in less than a minute.

People must ensure their safety on when on a fire's flank, by staying close to a safe zone such as a burnt out area.

When a wind change is expected, priority is given to controlling as much as possible of the flank that is anticipated to become the head of the fire and firefighters must ensure they are working safely (i.e. near the black) at all times.

Atmospheric stability affects vertical air motion and local wind patterns, cloud and thunderstorm development.

An unstable atmosphere may produce gusty winds and allow a fire to develop a powerful convection column. Fire behaviour can be intense and unpredictable.

A stable atmosphere resists the development of a strong convection column over a fire. Fire behaviour will be less intense and more predictable.

5.3 Topographic factors.

Topography is the shape of the land. This can affect fire behaviour through the influence of slope and aspect (the direction a hillside faces).

Slope greatly affects a fire's rate of spread. Compared to level ground, fires spread much faster upslope, and much slower down slope.

The rule of thumb is that fires travel twice as fast for every 10 degrees of slope uphill, and proportionately slower downhill (flame heights and fire intensity also significantly increase). A fire travelling up a 30 degree slope would travel at 8 times the speed of the fire on the flat (flat, 10 degrees x 2, 20 degrees x 4, 30 degrees x 8).

It is very dangerous to be uphill of a fire, with unburnt fuel between you and the fire.

Aspect affects fire behaviour through the quantity and dryness of the fuels that occur there. North and west aspects have less, but usually much drier, fuels than southern and eastern aspects, and may support more intense fires. Northern aspects are also more likely to be exposed to the worst fire weather (hot, dry north east, north and north westerly winds).

6 FIRE SUPPRESSION

6.1 Principles

Fire suppression includes all activities connected with restricting the spread of a bushfire and making it safe. This includes attacking the fire, containment, mop up and patrol.

Fire suppression is based upon the principle of removing one, or two sides of the fire triangle. A typical approach to use for suppression of a small fire is:

- **Knockdown** the flames with water to reduce the intensity (indicated by flame height and rate of spread) to enable direct attack. The knockdown can be performed with a tanker, a knapsack or firebombing aircraft. This method of knockdown can only occur if there is sufficient water nearby.
- **Contain** the fire with a mineral earth break ("control line or containment line"). This is particularly important for a forest fire, where there are heavy fuels. These fuels will continue burning for some time and the purpose of the mineral earth break is to stop the fire escaping this perimeter. A grass fire, with complete burning of the fuels, may not require a mineral earth break.
- **Mop up and patrol**. This is to extinguish all burning materials that may cause the fire to escape containment at some time in the future.

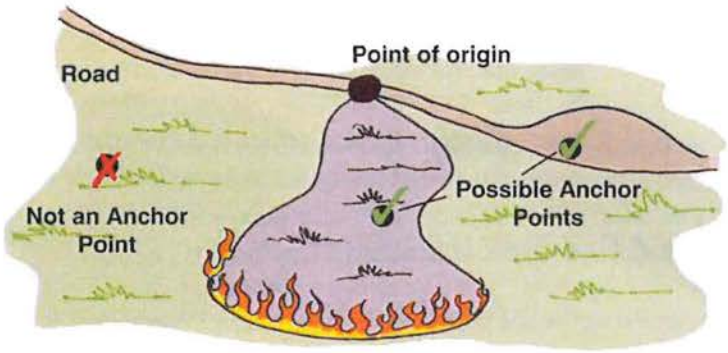
A bulldozer simultaneously knocking down a fire and constructing a containment line. A fire tanker is nearby in support but out of photo shot.

6.2 Anchor point

Firefighting must always be conducted from an "anchor point". An anchor point is a location from which a fireline can be constructed. It is used to minimise the possibility of being outflanked by a fire while the line is being constructed and is therefore located where a clear area already exists. Anchor points may be used as refuge areas if large enough.

Possible anchor points include:

- road or fire trail
- bare ground
- blacked out fire edge (however, if possible you must avoid the area of origin for wildfire investigation purposes)
- site of a recent bushfire (ie. little or no vegetation), and
- non flammable area such as a lake or river.



Graphic: CFA

Possible anchor points

6.3 Fire control strategies.

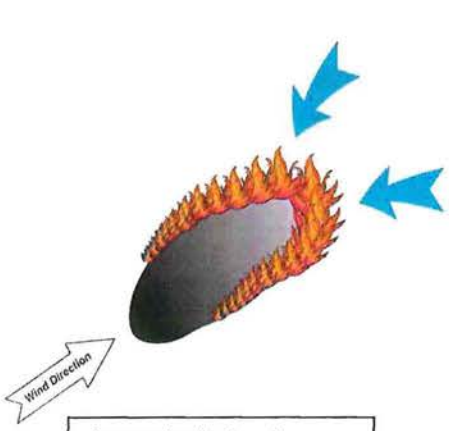
A fire control strategy is the overall plan for attacking the fire. The main strategies for attacking a wildfire are direct attack, parallel attack and indirect attack. The strategy is selected based on the fire intensity (both current and predicted), access and resources available.

Direct attack means fighting a fire right at the edge of the flames by using water and/or by constructing a mineral earth control line. Direct attack:

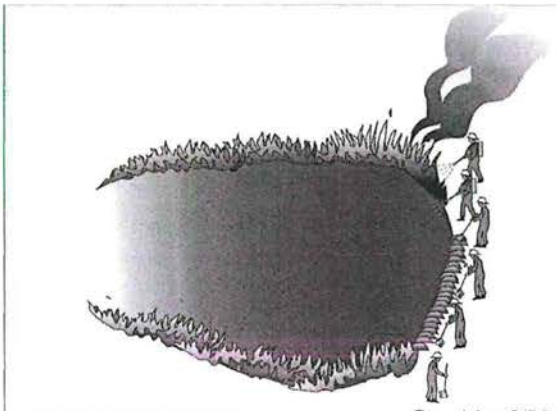
- is possible only on low intensity fires
- keeps the fire area as small as possible.
- allows the earliest possible control of the fire
- requires crews to work in a hot, smoky environment.

A direct head fire attack means making a direct attack on the head (or front) of the fire. This is only possible if the fire is slow moving with low flame height (low intensity) and there is an anchor point from which to work. Selection of this method should only be employed where the chance of success is very high.

Direct attack. Firefighter is right on the fire edge.



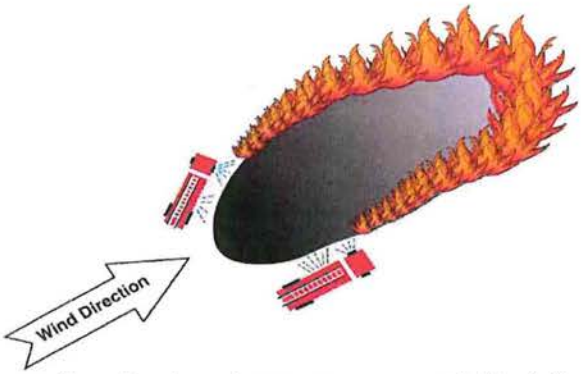
Arrows indicate where headfire attack should commence



Graphic: CFA

Firefighters conducting a head fire attack using hand tools

A direct flank attack means working on the flanks (sides) of the fire usually commencing near the rear of the fire and progressing along the flanks towards the head. A flank attack is the strategy most used for attacking low to moderate intensity fires.



Graphic: CFA

Flank attack on a fire. Tankers have commenced attack from the tail fire

A flank attack can be dangerous if a wind change is expected, especially if firefighters are away from the fire's edge. When a fire changes direction it moves at full speed and may cover some distance in a short amount of time.

Firefighters must ensure their safety on the flanks, by staying close to a safe area such as the burnt edge.

When a wind change is expected, priority is given to controlling as much as possible of the flank that is anticipated to become the head fire. Firefighters must watch for the wind change and ensure they are working safely (i.e. near the black) at all times.

Parallel attack is similar to direct attack except that firefighters move further away from the flames, such as building the control line away from areas of heavy fuel or use bare or rocky areas as part of the fireline. The area between the fire and the control line is burnt out.

Parallel attack. Burning out has not yet commenced.

Parallel attack can be potentially dangerous if fire fighters get too far away from the fire, exposing them to the risk of being overrun by the fire. The pace of burning out should be managed so that the resultant additional fire can be controlled and all firefighters remain safe at all times, staying close to burnt areas.

Indirect attack means using suitable existing breaks or constructing control lines some distance from the fire edge, back burning the intervening fuels or allowing the fire to burn out to breaks. Indirect attack:

- is used for intense or inaccessible wildfires
- allows choice of best location for control lines
- initially keeps crews away from heat and smoke
- means a bigger fire area
- usually involves backburning, which is often difficult.

Indirect attack using a backburn from an established control line

Sometimes **defensive firefighting** is used. This means not attacking the fire at all. It is necessary when:

- extreme fire behaviour is occurring
- firefighting resources are inadequate to make a safe attack
- the fire is remote and not able to be immediately attacked.

Defensive firefighting may mean concentrating on defending lives and assets. Safe refuges or escape routes must be available.

Mop up means finding and treating potential sources of re-ignition once the fire perimeter has been contained. It is very important in forest fires where heavy fuels such as logs, stumps, hollow trees can smoulder for days or weeks. Mop up work is done progressively inwards from the control line to a specified standard.

Approaching a log to mop up.

6.4 Fire control tactics

To implement the selected fire control strategy, two main types of tactics are used. These are either wet or dry firefighting.

Wet firefighting refers to the application of water on a fire edge. Water may be applied by tankers, knapsack, or by firebombing aircraft (either alone or mixed with foam or retardant).

The application of water is most effective when the fuels are fine, such as in grass. However it is less effective in forest fuels, where heavy fuels such as logs sustain residual burning, long after the fire front has passed. Water can be used in the knockdown and mopup stages of firefighting.

Dry firefighting refers to fighting the fire by surrounding the fire with a mineral earth break (control line) and, if required, burning (with the wind) or backburning (against the wind) into the fire.

In forest fire fighting the amount and depth of fuel means a control line is almost always required to contain the perimeter of the fire. Control lines may be:

- a one metre wide break constructed by handtools (rakehoes, axes, slashers)
- much wider breaks constructed by bulldozers
- existing roads or tracks, perhaps widened by bulldozers.

Backburning is highly risky and must only be done under the direction of the Incident Controller, in ideal conditions and with sufficient time and resources to prevent its escape. An escaped backburn always makes the fire situation much worse.

7 HAZARDS AND RISKS AT FIRES

The following are common hazards that may be found on the fire ground. Each fire may present its own set of hazards and there may be some that are not mentioned here. Maintaining situational awareness will assist a person in recognising hazards and risky situations.

7.1 Hazards at fires

The hazards encountered at fires pose considerable risk to anyone in their vicinity. It is vital to be able to recognise hazards and take the appropriate action to avoid or reduce the risks these hazards pose to firefighters, support personnel and the affected community.

The major hazards at fires include:

- radiant heat from the fire itself. This can be fatal – you must find some form of shield if trapped
- smoke – carry a smoke mask and goggles, get low if caught in heavy smoke
- dehydration and heat stress – carry enough drinking water to allow 1 litre per hour, work at a sustainable pace
- falling objects (trees, limbs) – always wear a hard hat, be aware of and avoid overhead hazards
- vehicles and machinery – if on foot, work a safe distance from machinery.

Tree across fire boundary

7.2 Key risky scenarios

All persons at fires need to think ahead, recognise risky situations and either mitigate them or avoid them.

Some key risky situations that should be recognised and avoided, are as follows:

- Where fire behaviour is likely to increase in intensity due to variations in fuel, weather and/or topography.
- Where you are uphill of the fire.
- Where there is unburnt fuel between you and the fire.
- Where the fire is spotting.
- When the fire location is unclear.
- There is limited visibility (e.g. due to smoke, terrain or vegetation).
- You are in an unfamiliar area.
- At night time.

- When there is no safe area for retreat.
- There are no escape routes away from the fire.
- You have been given unclear instructions.
- You are tired or fatigued.
- You are working alone.

Firefighters should always maintain **SITUATIONAL AWARENESS** particularly by observing FUELS, FIRE BEHAVIOUR, WEATHER, TOPOGRAPHY and ESCAPE ROUTES. This will assist in focussing on fire fighter safety.

7.3 Wind changes

Wind changes can be caused by a trough movement, cold front or, sea breeze. All are common occurrences in Western Australia.

This can be a very dangerous situation for firefighters working on the flank of the fire, especially if they are away from the fire's edge. When a fire changes direction it accelerates at full speed and may cover some distance in less than a minute.

Firefighters must ensure their safety on this flank, by staying close to a safe area such as a burnt out area or other designated safe area.

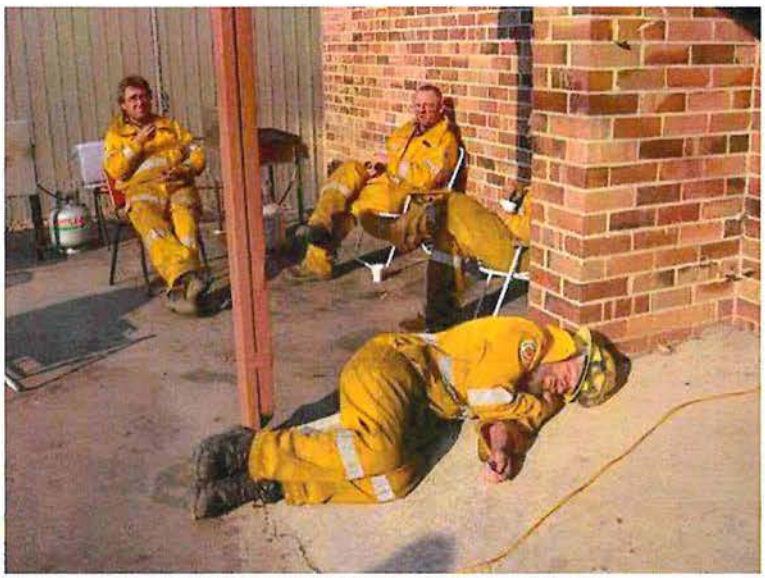
When a wind change is expected, priority is given to controlling as much as possible of the flank that is anticipated to become the head of the fire and firefighters must ensure they are working safely (i.e. near the black) at all times.

7.4 Water, food and rest breaks

Fatigue can be a serious problem for fire ground personnel including support personnel. Appropriate food and water intake, and rest breaks are essential for physical recovery and to relieve mental fatigue. Always carry food and water with you.

Water is required to prevent dehydration and heat illness. Because of the energy expended and the heat of the fire, firefighters use more fluid than normal. During periods of constant physical exertion about a **litre of water per hour** should be consumed. Sip water regularly rather than taking large drinks occasionally.

Adequate food and rest breaks are required to prevent fatigue. Maintain energy levels by regularly eating carbohydrates (bread, crackers, muesli bars, fruit, vegetables, legumes, pasta, rice). Minimise intake of dairy and meat products. Try to rest for at least 10 minutes when having a food break. Try to rest in the shade wherever possible.



Regular rest breaks are important.

7.5 Heat illness

Body temperature rises normally during physical work, and is cooled by evaporation of sweat from skin.

Heat illness (or heat stress) results when the body is unable to cope with the heat load generated by working hard in hot weather, perhaps near the fire. This may cause minor problems such as muscle cramps -- but if not responded to can lead to heat exhaustion and ultimately heat stroke.

Prevention

- Maintain hydration
- Pace yourself, rotate tasks if possible
- Where possible work at a comfortable distance from the fire
- Take regular breaks in the shade
- Monitor your own health, and that of your fellow workers
- Minimise the clothing worn under protective clothing if on fireline
- Protect yourself from the sun, wear sunscreen. long sleeved shirts and pants, broad rimmed hat and cover the back your neck.

Heat exhaustion is your body telling you that it is suffering and needs to recover. It is important to recognise when this begins to occur to yourself or colleagues and commence treatment immediately.

Symptoms

- Skin is moist, clammy and pale
- Skin temperature is normal or decreased
- Headache
- Dizziness
- Perspiring
- Nausea
- Fast, shallow respiration
- Fainting

Treatment

- Remove from heat to a safe location
- Remove excess clothing
- Lie face up with legs elevated
- Cool down with moistened cloth, if conscious give water

Heat stroke occurs when the body's ability to control it's heat load breaks down. It is characterised by hot, (often dry) skin; mental confusion; delirium; loss of consciousness; convulsions; and coma. **Heat stroke is a medical emergency**. Brain damage and death may result if treatment is delayed.

Symptoms

- Hot, dry skin
- Confusion
- Possible loss of consciousness
- Any or all of the previous symptoms of Heat Exhaustion

Treatment

- Seek medical assistance immediately
- Remove from heat to a safe location
- Remove excess clothing
- If possible cover with wet sheet or cool down with moistened cloth
- If conscious give water
- If unconscious, place in lateral position and monitor pulse and respiration

7.6 Electrical hazards.

Electrical hazards can include:

- downed electrical wires (conductors)
- pole top fires
- arcing through thick smoke
- Live electrical wires laying across wire fences
- structural fires.

Where electrical hazards exist:

- inform nearby persons and the power supply company
- keep at least 8 metres away from any point of contact – the ground may be energised
- keep the public at least 30 metres away
- avoid any conductive objects (such as fence wires) that may be in contact with electrical wires
- avoid puddles, wet floors, damp surfaces as they can become energised
- do not touch any casualties in contact with low voltage electricity
- do not spray water on an electrical installation unless you have been properly trained in this technique
- do not work under high voltage power lines in smoke.

7.7 Driving vehicles near the fire

Vehicle crashes have caused a number of deaths and injuries at fires.
In contrast to normal driving circumstances there are additional risks when driving vehicles in the vicinity of a fire.

If you are required to drive a vehicle near a fire:

- Plan your trip beforehand to avoid driving in areas that are at risk of being of being overrun by the fire,
- Let someone know of your proposed route.
- Use an appropriate vehicle for the terrain you are driving in.

Once you are near the fire:

- Turn your headlights on,
- Avoid driving through areas where trees could fall,
- Avoid driving through thick smoke
- Monitor your radio if you have one
- Maintain communications with your supervisor

When you park the vehicle:

- Park facing the direction you intend to leave,
- Park on bare or burnt ground
- Avoid overhead hazards
- Leave keys in the ignition,
- Wind up the windows.

7.8 Vehicles and machinery.

When working with or near vehicles or machines on the fireground:

- never get on or off moving vehicles
- never ride on bulldozers or other equipment unless there is a dedicated seat for passengers
- establish communications with operators when working with machines
- never approach a machine until you are certain the operator has seen you
- do not work immediately in front or behind a bulldozer, but rather to the uphill side
- when bulldozers are pushing over trees, keep two tree lengths clear
- be alert to machines causing materials (eg rocks or logs) to roll or fall
- only use marked climbing positions to get on and off machines and trucks
- take care where hoses, hose reels and other firefighting equipment is being used
- watch out for high pressure jets of water being used nearby

7.9 Safety in firebombing zones.

Firebombing is the dropping of water, foam or retardant slurry from helicopters or fixed wing aircraft on or near the fire. The dropped load can injure personnel by direct impact, or by dislodging or breaking overhead branches due to the velocity and insufficient dispersal of the load.

Personnel near the intended firebombing drop zone should be warned of the drop or drops and instructed to temporarily evacuate the drop zone. This may mean moving up to 50 meters away from the drop zone and staying in your vehicle. However if you are caught in the drop zone:

- find a location away from overhead limbs (especially dead ones)
- place tools away from you
- crouch down holding your hard hat, or protecting your head with your arms.

After the drop, beware of slippery surfaces, check for broken limbs overhead. Wash foam or retardant off bare skin with water.

7.10 Safety around chainsaws

Chainsaws should only be operated by persons appropriately trained and accredited. Operators must use mandatory protective clothing and equipment.

- Where cross cutting is taking place, other personnel must be outside the area of potential swing of the chainsaw by the operator and wear hearing protection if nearby.
- Where tree falling is taking place, other personnel must be at least two tree lengths away, away from the direction of fall and preferably upslope, certainly not down slope of the tree to be fallen.

8 PERSONAL PROTECTION

All people who enter a fire ground need to be prepared for what could potentially happen even when it seems there is little risk. Fires can escalate rapidly in intensity, rate of spread and through change in direction. Taking appropriate precautions and having a plan for the "what if" could reduce the chances of a person getting hurt or even killed.

8.1 Personal protective clothing and equipment.

While on the firegound, all personnel must wear appropriate protective clothing and equipment. Essentials include:

- a properly maintained safety helmet,
- natural fibre flame resistant protective clothing made from heavy drill cotton or wool. Loose fitting full length overalls are good as they provide some protection from radiant heat while the "billowing" effect helps to cool your body temperature.
- eye protection (goggles)
- appropriate sturdy flame resistant footwear.
- smoke/dust mask
- gloves

Protective clothing minimises fire danger but it has its limitations. In intense fire situations it is better to move well away from the fire to a safe place.

Too much protective clothing may prevent the escape of body heat and induce heat stress. Try to strike a suitable balance. For example, wear light cotton clothing underneath your overalls.

If you are required to carry out specific tasks e.g. operating a chainsaw, you will be required to wear additional equipment including cut resistant trousers or chaps, and a high visibility vest.

8.2 Sheltering from fire in an emergency.

If isolated or trapped by an approaching flame front, you must avoid the radiant heat and shield yourself from it by whatever means are available.

If on foot:

- move across the slope away from the path of the fire, or to a known safety zone
- move to a refuge area such as a running stream or deep pool, eroded gully, gravel pit or other bare area, previously burnt area, rocky outcrop,
- advise your supervisor of your whereabouts and the action you are taking.
- do not try to outrun the fire uphill,

If in a vehicle:

- position the vehicle facing the approaching fire in a clearing and away from overhead hazards, if possible,
- move fuel containers off vehicle, wet surrounding fuels, fix hose spray over cabin if possible,
- get in cabin from lee side – doors closed, windows up, vents closed, headlights and hazard lights on, engine running
- get as low as possible, cover with woollen blanket,
- stay in vehicle until flame front has passed.

However, remember that it is not possible to survive the intense heat of many wildfires, regardless of the method used for protection. Even if you do survive, it is likely that you will suffer serious burns in the process. It is therefore best to avoid being caught in such places in the first place

8.3 First aid assistance on the fireground.

Personnel need to have access to a suitable first aid kit and know where first aid help can be obtained.

All DEC vehicles should carry a first aid kit. Contractors should carry first aid kits.

Trained first aid assistance may be obtained from:

- Trained first aiders among fire crews
- Trained first aiders in adjoining fire crews
- Radio contact with supervisors, who will arrange for medical assistance
- St John's Ambulance or similar, who often attend at larger fires
- Medical Practices or Health Centres in nearest town.

9 FIRE ORGANISATION

9.1 DEC as a fire service

The Department Environment and Conservation (DEC) is one of the three Western Australian fire authorities, together with the Fire and Emergency Services Authority (FESA) and Local Government Authorities (Bush Fire Brigades).

DEC has legal responsibilities for bushfires on DEC managed land, which includes State Forest, National Parks and other DEC lands which do not fall within a Gazetted Fire

District. DEC frequently assists other agencies at bushfires on other lands as do other agencies assist DEC when requested.

DEC's policy for bushfires on or threatening DEC land is that response will:

- as a priority protect human life including fire fighters,
- protect community assets inclusive of cultural and biodiversity values commensurate with the risk to human life and consequences of fire impacting on human life and those assets,

Safety of the public and fire fighters is DEC's Number 1 priority at fires.

9.2 Emergency Management in Western Australia

In Western Australia the Emergency Management Act (EM Act) establishes the legal framework for dealing with emergency incidents (such as fire, flood, aircraft crash etc). Related to the EM Act are the Emergency Management Regulations and associated policies and plans (eg Westplan Bushfire) for particular emergency incidents. The regulations specify which agency has the responsibility for managing specific types of incident. The policies and plans set out arrangements for prevention, preparedness, response and recovery for the various emergencies that may occur. They also contain arrangements for coordination between agencies or incidents if there is more than one incident or if the incident is so large or complex that multiple agencies and state level support and coordination is required.

In terms of managing an incident, a single **Incident Controller** (IC) is appointed by the relevant agency to manage the incident following the principles of the Australian Inter-service Incident Management System (AIIMS) which is described in the next section.

9.3 Australasian Inter-service Incident Management System (AIIMS)

DEC manages fires using the Australasian Inter-service Incident Management System (AIIMS). AIIMS is an emergency response management system that has been adopted by emergency management agencies across Australia. It is a management system that supports a coordinated and controlled approach to an incident. One of the key benefits is that a number of different agencies can come together and work cooperatively under one structure whilst maintaining their own internal structures and reporting relationships.

AIIMS can be used during various types of emergency situations including:

- bush fires,
- search & rescue,
- whale stranding,
- aircraft crashes
- etc

There are three key principles of AIIMS. These are:

- **Management by objective**. At any incident there needs to be a set of stated objectives that relate to clear outcomes decided on by the Incident Management Team (made up of the fiver managers of each of the functional areas – see below) and approved by the Incident Controller for that incident. Objectives are communicated to everyone involved at the incident.

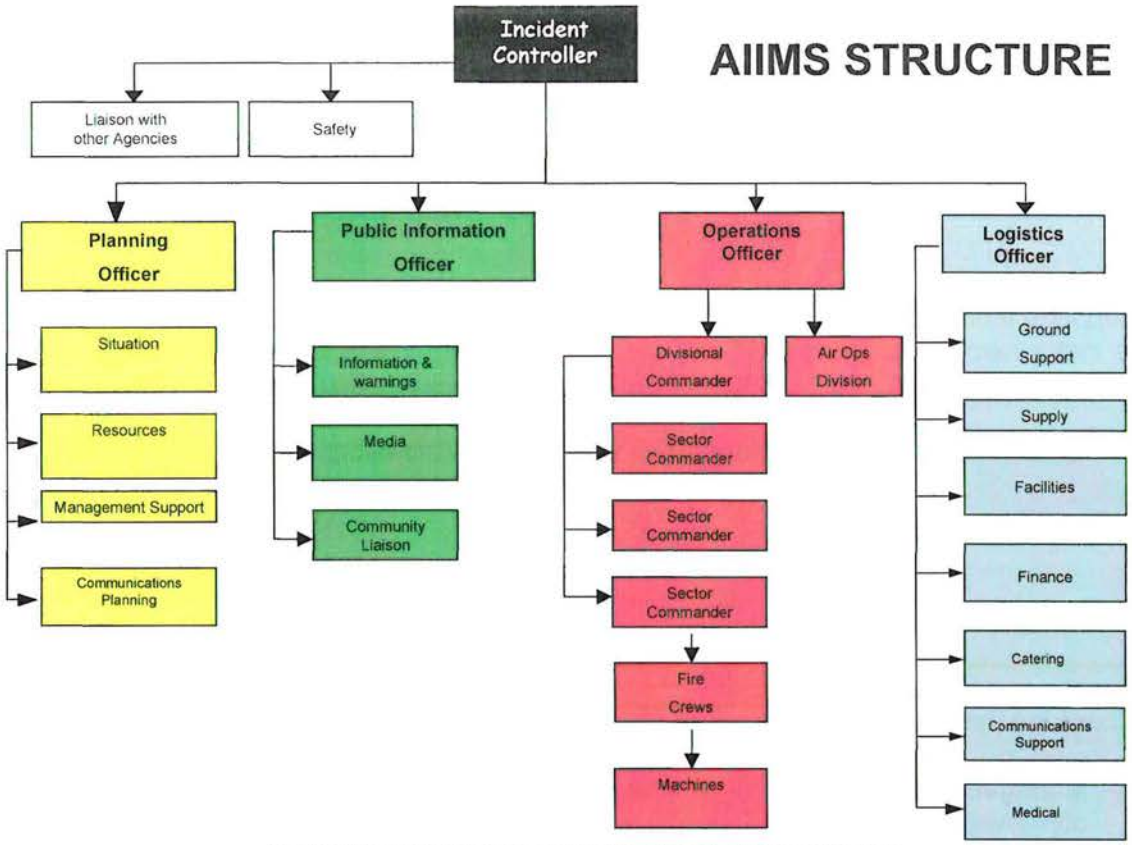
- **Span of control**. Managing to a maximum span of control of 1 supervisor to 5 subordinates maintains the supervisor's abilities to effectively task, monitor and evaluate performance. Providing a chain of command which limits reporting groups to a manageable number reduces the possibility of supervisors becoming overwhelmed or overlooking important issues and adds to communication flow and the safe management of personnel. Delegation can be used to ensure the span of control is not exceeded or where a higher level of supervision is warranted.

- **Functional Management**. AIIMS utilises five management functions to divide the specific types of work carried out to run and resolve incident into sections which are logical and supportive of each other.

  The five **functional** areas are:

  - **Control**: commands and coordinates the response,
  - **Operations**: combats the incident by implementing the plan,
  - **Public Information**: Provides information including warnings, to the community, media and other organisations.
  - **Planning**: develops the plan, monitors the situation and predict future developments,
  - **Logistics**: provides all the personnel, equipment and resources required to achieve the objective.

The following diagram shows how the system might look at a large (or Level 3) fire. The managers of each of the functions (called a Section eg Planning Section) form the Incident Management Team (IMT) and include the Incident Controller, Operations Officer, Public Information Officer, Planning Officer and Logistics Officer.



An AIIMS structure commonly used at level 3 fires

9.4 Communications

Around a fire communication is critically important for rapid distribution of information relating to people's safety and importantly for coordination of the work that needs to be done. Three main pathways for communication around a fire involve the Incident Action Plan, briefings and radio communication.

The **Incident Action Plan** is usually a written document that is handed out to provide much of the required information but is not useful for rapid distribution of critical new information that has to be acted upon immediately eg "the fire has changed direction – evacuate now". The Incident Action Plan (IAP) contains the incident objectives and, strategies, information about resource types, deployment and tasking, maps, communications channels and reporting relationships and other information necessary to direct efforts and run the incident. It is a one way form of communication but forms the basis for briefings.

A **briefing** is used by the supervisor to verbally pass information to those who attend. The information can be about the overall plan (as in the IAP) or about new or changed information. A briefing can be delivered at any time deemed necessary but importantly it enables questions to be asked thus providing for two way communication which in turn may add new and up to date information to all those who attend.

A briefing to deliver the overall plan and instructions should spell out:

- Situation - the big picture, what has and is happening
- Mission – what the plan is to attack the fire
- Execution – what your job is
- Administration – where you obtain fuel, water, meals etc
- Communications – your radio channel
- Command – who you report to
- Safety – warnings
- Questions?

At briefings you should seek clarification if you did not understand any information.

If you believe your skill levels or resources are inadequate for a designated task, you must discuss the matter with your supervisor or agency contact person.

9.5 Two way communication

Timely two way communication ensures personnel are working with the most up to date information upon which to make judgements and decisions. Your supervisor should provide you with updated information as it becomes known. Similarly, you should provide timely reports (feedback) to your supervisor regarding:

- your location (especially if you move),
- progress of work,
- welfare of fellow crew members,
- fire behaviour – flare ups, anything unusual or of concern.
- safety issues
- hazards encountered

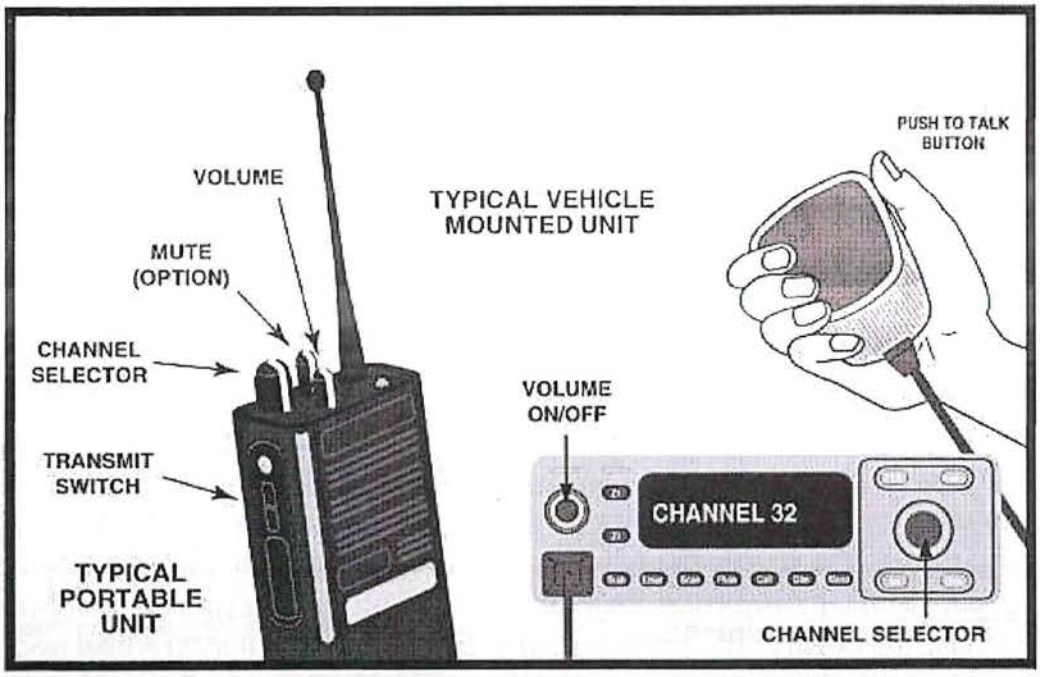
In some circumstances, you may be required to work alone. If so:

- you and your supervisor both need to discuss and agree on where you will be and what you will be doing,
- you need to know where other people in the vicinity are, what they are doing and how to contact them,
- you should stay in radio contact with your supervisor or headquarters and make contact at regular intervals or at any time when your situation changes,
- you should have adequate supplies including drinking water and food.

9.6 Radio communications

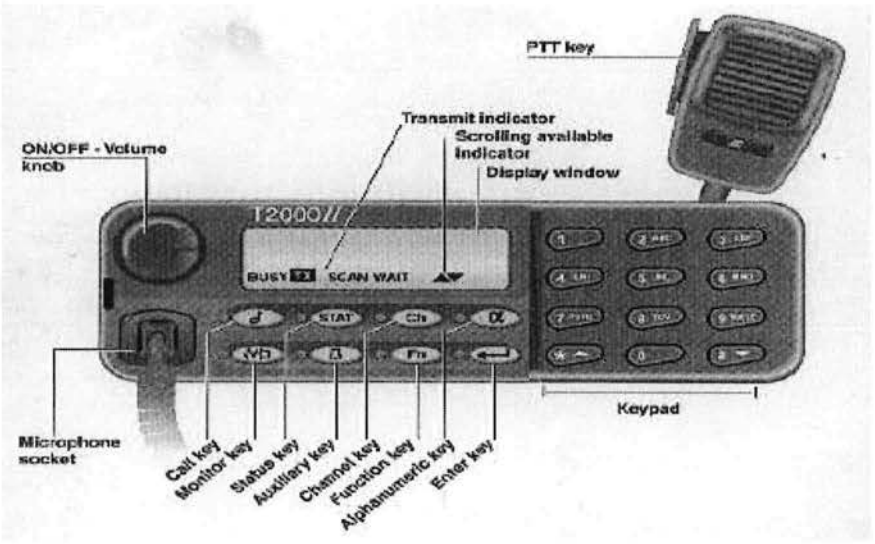
Most emergency service agency vehicles will be fitted with two way radio communications. Use of radios to pass on information at a fire ensures that timely information can reach people who need to receive it – provided they are able to and choose to listen! It enables immediate feedback from the recipient with the added bonus that other personnel who are tuned in to the same radio channel may have heard the message which adds to their awareness of what might be happening.

If you are required to work around a fire you should familiarise yourself with the basic workings of the radio. You should be able to turn it on, select and change channels and adjust the volume. Both portable and vehicle mounted radios will have a "Push to Talk" (PTT) button. This should be pressed to send a message, and released to hear a reply.



Typical portable (hand held) and vehicle mounted radios

Picture courtesy CFA



Tait 2000 *II* Radio Set Commonly used in DEC mobiles in the South West

9.6.1 Radio calls in an emergency

Do not hesitate to use a radio to communicate a life threatening emergency situation. Use the following procedure to get the communication started. The rest of the communication will flow from that.

- Check that the radio is switched on and tuned to a channel being used at the incident (an IAP or briefing should have informed you of the channels being used).
- Press PTT button and say "Emergency, Emergency, Emergency" and the call sign or name of the person you are trying to contact.
- Release the PTT button and await a reply.
- Repeat the emergency call and call sign details if nothing heard after a few seconds.
- Provide only the details necessary to have the emergency dealt with. Do not use any victim's names over the radio.

Department of
Environment and Conservation

Our environment, our future

Procedures for Training, Assessment, Appeals and Complaints/Grievances

The Organisation
The Department of Environment and Conservation (DEC) is a Registered Training Organisation (RTO) and provides quality training and assessment services using the Conservation and Land Management Training Package, the Public Safety Training Package (PSTP), and accredited and non-accredited short courses.

Flexible Training Delivery
Participants with special needs such as language, literacy and numeracy needs have the opportunity to access alternative methods of training delivery. The Course Custodian should be contacted if alternatives are sought for any training program.

Access and Equity
DEC will ensure that all participants have equitable access to the benefits of training and assessment, irrespective of their gender, age, race, religion, culture, linguistic background, marital status, location, socio-economic background, disability, sexual preference, family responsibility or political persuasion.

Nominations and enrolments into training courses and programs will be conducted at all times in an ethical and responsible manner, ensuring fairness and compliance with equal opportunity legislation.

Assessment
To accommodate the needs of individuals, the Department offers various assessment methods including: Skills Recognition, Mutual Recognition, Written and Verbal Assessments.

Under the RTO's mutual recognition obligations, the Department recognizes AQTF Qualifications and Statements of Attainment issued by other RTOs.

All assessments are conducted using an open, supportive process, which ensures participants are aware of the precise requirements of their assessment.

Qualified assessors are used to conduct assessments. Assessors should also be skilled in the competencies they assess. If this is not the case, a job expert will be provided with the assessor.

Flexible learning and assessment options (eg self paced and distance learning and assessment) are available should these better suit the needs of the client. For more information regarding these, please contact the Dwellingup Training Centre.

All training achievements are recorded and participants can request a copy of their training or achievement record at any time. All training and assessment records are held in the strictest confidence ensuring confidentiality and privacy of individuals.

Complaints/Grievances and Appeals Procedures
The Department has fair and equitable policies and procedures for dealing with participants' complaints/grievances and appeals.

Participants have the right to lodge a Complaint/Grievance if they are dissatisfied with the training and assessment services that they have been provided with. If a participant is dissatisfied with the process, relevance or outcome of their assessment, they have a right to Appeal.

Should the complaint/grievance or appeal not be resolved internally, the Department will advise and assist the participant regarding their right to seek appropriate external assistance, as per the relevant policy in place.

Further Information and Contact Details
Further details of training policies, procedures and guidelines are contained in the Training Procedures Manuals available under People Services on the DEC intranet.

Alternatively, staff at the Dwellingup Training Centre can provide information and advice on training and assessment services and procedures at Dwellingup on 9538-1200. For information on the Public Safety Training Package and fire related training contact David Rawet in Bunbury on 9725-5981.