

FIREFIGHTER MINIMUM SKILLS (INTEGRATED)

VFM170

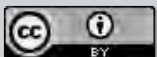


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INTRODUCTION

Symbols



Activity - A task or activity is to be performed.



Take Note - Important information to remember.



Warning - Take extreme care and precautions.

Participant Information

Firefighter Minimum Skills (FMS) is a component of the Volunteer Learning and Development Framework (VLDF) and enables volunteers to become a Rural Firefighter. To be eligible to undertake FMS training recruits must have successfully completed the RFS Awareness Program, Brigade Induction and IMS Principles.

The main aim of this program is to develop recruit firefighter competence necessary to safely respond to wildfire and carry out activities as a member of a Rural Fire Brigade while under limited supervision. The program comprises of numerous national units of competency as follows:

- PUAFIR215 - Prevent Injury
- PUAOHS001C - Follow defined occupational health and safety policies and procedures
- PUATEA001B - Work in a Team
- PUAOPE013A - Operate Communications Systems and Equipment
- PUAEQU001B - Prepare, Maintain and Test Response Equipment
- PUAFIR204B - Respond to Wildfire

This guide has been written as a reference for your studies in the above listed units of competency. Each competency is broken up into a number of elements (written as tasks) and performance criteria, which show what you are expected to do in carrying out the instruction in the element. Detailed information on the competency unit can be found on the National Register website www.training.gov.au.

Read through the guide carefully. It provides you with the information and outlines the skills you will need to develop to achieve competency in this unit. In face-to-face sessions with an instructor, you will see the skills that are outlined in this guide demonstrated and will have the opportunity to practise them for yourself. Evidence of your competence will be gathered over time and in a variety of team situations.

Where information is given to you in the form of a presentation, be sure to take notes. Your instructor will be drawing on their own experience that will be additional to the material in the Participant Guide. Undertake all the activities and self-checks in this guide. Ask for help or clarification where necessary from your First Officer, coach or mentor.

QFES recognises prior learning. Should you feel that you already have some or all of the required skills/competencies outlined in the unit description, you are encouraged to apply for recognition of prior learning. Information regarding QFES policy of issues such as appeals, grievances and the RPL application process can be sourced through any RFS Regional or Area office.

The assessment process for this program is detailed in the VFM170 Firefighter Minimum Skills (Integrated) Assessment guide available from your assessor/mentor.

CHAPTER ONE

BRIGADE SAFETY

1.1 Personal Protective Equipment

Personal protective equipment (PPE) assists you to work in a safe manner. Your life and the lives of fellow emergency personnel and members of the public may depend on your knowledge and use of PPE. QFES has developed procedures for the use of PPE to minimise the risk of harm to you and other emergency personnel. It is important that you follow these procedures.

The ways in which you use or wear PPE can sometimes aggravate the problems associated with hot working environments. Working and breathing in a respiratory mask can increase the difficulty of firefighting. Gloves may add to the difficulty of tasks. Tight fitting overalls can restrict air circulation around the body and inhibit the cooling effect of perspiration. Ear protection may make communication difficult.

PPE can provide protection against:

- Levels of radiant heat
- Falling objects
- Sharp objects
- Hot surfaces and flames
- High noise levels
- Poor visibility
- Toxic atmospheres and oxygen deficiency

Helmets

Helmets are designed to meet specific standards and to be appropriate for structural or rural firefighting environments. The range of helmets used depends on the conditions in which firefighters generally operate. You should not work at an incident without the approved helmet. A helmet protects your head from:

- Impact and puncture injuries from such things as falling tree limbs or rocks
- Scalding water running off hose streams
- Steam created by firefighting
- Extreme temperatures and radiant heat
- Contact with electrical hazards and hand tools

Chinstraps should be worn to ensure that the helmet remains in the correct position. The inner harness of the helmet should be adjusted to achieve a correct and comfortable fit on the head. Abrasives or solvents cannot be used to clean helmets. Helmets can also develop cracks or break if they are misused or handled incorrectly.

Protective Clothing

The preferred protective clothing for rural firefighting consists of flame-resistant two piece pants and jacket combination that cover most of the body and allow free air flow between the garment and the skin. Protective clothing is available to suit male and female firefighters. Protective clothing will not only help to protect your body from the effects of exposure to radiant heat and flames, but will also help to minimise injury from a flash fire, explosion or burning embers. Protective clothing is also designed to protect from chemicals, water, products of combustion, and minor cuts and abrasions.



Underwear and any other items to be worn under protective clothing should be made from natural fibres. Underwear made from synthetics such as nylon, rayon or polyester should not be worn. Socks made from synthetic fibres such as nylon can melt and cause serious burns if burning embers fall into the boot. Soiled protective clothing should be laundered separately from other clothing or laundered using purpose designed cleaning equipment. This will ensure that any contaminants on the clothing are removed before they are worn again. Detergents, soap-based products and bleach may affect the flame-resistance of materials. Damaged or worn-out clothing should be repaired or replaced.

Boots

The type of boots used in firefighting will vary according to the environment. Regardless of the design, boots should allow for flexibility and movement, provide ankle support, have a heat resistant sole and have a non-slip tread that enables firefighters to maintain a stable footing. It is not advisable to wear elastic-sided boots.

Gloves

Gloves protect the hands and wrists from abrasions, cuts, burn injuries, splinters and blisters. Basic leather gloves currently used for firefighting purposes are generally light, durable and provide protection while not impairing dexterity. Gauntlet style gloves provide more heat protection. Wear gloves on the fireground at all times, as you may have to carry out tasks at a moment's notice. Practise performing tasks wearing gloves until working with them becomes second nature. Note that wet leather gloves do not offer protection from radiant heat.

Goggles

It is essential that goggles are carried and worn whenever you are working in smoke or other areas where eye irritation or injury is possible. You will at times have to accommodate working with dirty, scratched or fogged up goggles, which may limit and temporarily impair visibility. When it is safe to do so, clean or replace your goggles.

Hearing protection

Equipment and machinery used during firefighting may be noisy and has the potential to damage your hearing. Use hearing protection such as earmuffs or earplugs when operating or working near noisy equipment. Hearing protection must be compatible with eye and head protection. It can be difficult to hear instructions, warnings and radio messages when wearing ear protection; appoint a 'buddy' to monitor the radio for you. You can become isolated from what is going on around you, so you must be alert and look for visual signals.



TAKE NOTE

PPE must be worn correctly to provide you with the maximum protection available. PPE does not offer unlimited protection. Rural firefighting helmets are not designed for internal structural firefighting as they are not sufficiently reinforced.

1.2 Health Hazards

Fatigue

Firefighters have one of the most dangerous jobs in the world, and suffer high levels of physical and psychological injury. The work of a firefighter is unique. It is physically hard, mentally demanding and exposes the firefighter to hazards unlike most other jobs. Vigorous firefighting activity and exposure to excessive smoke and heat can present a number of health hazards.

Conditions at an incident can be physically stressful and lead to fatigue. If you are tired, you are likely to make mistakes that can cause injuries and put others at risk. It is important not only to take full advantage of rest breaks, but also to limit the length of your shifts. If you are physically fit, you are less likely to experience fatigue in the short term. This does not mean that you can avoid taking adequate breaks and rest. Symptoms of fatigue can include:

- Tiredness and lack of energy.
- Slow reaction time.
- Impaired judgement.
- Inability to make decisions.
- Erratic performance.
- Irritability.

The following actions will minimise the likelihood of fatigue:

- Take short breaks during your work and drink water frequently.
 - Use breaks wisely, cool off, sit in the shade.
 - Replace energy by eating foods such as bread, cereals, potatoes and pastas.
- Pace yourself and adjust your work rate.
- Rotate crews.



WARNING

You should not drive a vehicle or operate machinery if you are fatigued. Driving while tired puts you, your passengers and others at risk.

Sunburn

Prolonged exposure to the sun can lead to sunburn. If you are wearing complete PPE, sunburn is unlikely. Be aware that you can easily be sunburnt when the sky is overcast. When working outdoors during the day you should wear a water-resistant sunscreen with an SPF factor of at least 15+. Apply sunscreen liberally to any exposed skin and remember to reapply every two hours. Symptoms of sunburn can include:

- Redness of the skin.
- Tenderness in the affected area.
- Blistering, sometimes involving more than one layer of skin.

If you are sunburnt, you should:

- Apply cool, moist compresses to burn area
- Rest in a cool place
- Drink cool fluids

Dehydration

Dehydration will occur if fluids lost through perspiration are not replaced regularly. Fluids, preferably water, must be taken well in advance of commencing hot and strenuous work and regular water intake must be maintained while on the job. You should always drink more water than you need in order to prevent dehydration. Failure to do so can lead to overheating and the onset of heat-related illnesses.



Medical research has indicated that the sugar content of drinks such as tea, cordial, coffee and soft drinks reduces the rate at which water is absorbed into the bloodstream. Water is best during firefighting. Cool water is naturally preferred if it is available. However, never chill your drinks because this can quickly quench your thirst without providing you with adequate fluid. Chilled drinks can also cause stomach cramps.

Use your rate of perspiration as an indicator of when you need to drink. On the fireground you should drink frequently, at least 150 to 200ml every 10 to 15 minutes. If in doubt, drink a litre per hour. If using hand tools, you may need to increase this to two litres per hour. You should always carry containers of fresh water, especially when assisting outside your local brigade area. Never drink water from vehicle tanks or knapsacks as it may be contaminated.

Heat Related Illness

Illnesses caused by exposure to extreme temperatures are progressive and can become life threatening. Once the signs of heat illness begin to appear, a person's condition can rapidly deteriorate; if the appropriate precautions and actions are not taken, death can occur. Overheating of the body can be caused by:

- An environment that is too hot.
- Perspiration that cannot evaporate freely.
- Lack of fitness.
- The body's thermostat malfunctioning as a result of disease, drugs or alcohol.
- Lack of hydration.

Firefighters are particularly vulnerable to heat-related illnesses because of the conditions in which they work. Hot, humid conditions, radiant heat and the stress of wearing personal protective equipment (PPE) can increase the likelihood of heat related illness. You should watch for signs that other firefighters are affected by heat and assist them to take the appropriate action.

Heat Stress

Heat stress occurs when the body's cooling system (perspiration and circulation) are being stressed but are not yet overwhelmed by the heat load. The body cools itself by perspiring and directing additional blood flow to the skin so that this blood can be cooled as the perspiration evaporates. As exercise produces heat internally, it is possible to become heat stressed even in relatively cool conditions.

Hot and humid conditions make the situation worse. Radiant heat and extremes of air temperatures above normal body temperature (37°C) can add an external heat load to the heat generated internally, further contributing to heat stress. As heat stress continues to affect the body, internal body temperature will rise and physical performance will drop. Failure to recognise the symptoms or ignoring them could lead to serious heat illness such as heat stroke or heat exhaustion.

Heat Cramps

Heat cramps are muscular spasms that can be caused by excessive fluid loss during physical activity. They are often the first indication of a heat-related problem when subjected to heat or during/after exercise. Symptoms of heat cramps can include:

- Muscular pain and spasms.
- A feeling of tightness.
- Inability to relax contracted muscle.

If you are experiencing heat cramps, you should:

- Take regular sips of water or electrolyte fluids.
- Rest in a cooler environment.
- Gently stretch or massage the muscles.



Heat Exhaustion

Heat exhaustion develops as a result of a person becoming exhausted from working in heat. Even if fluid intake is sufficient, exhaustion will eventually set in if physical exercise continues beyond a person's normal endurance limits. Heat exhaustion is a combination of physical exhaustion, dehydration and upset body chemistry. Severe heat exhaustion can lead to collapse and a form of shock.

Symptoms of heat exhaustion are common to the first stages of heat stroke and can include:

- Feeling faint, light-headed or dizzy.
- Weakness.
- Headache.
- Blurred vision.
- Thirst.
- Increase in heart rate.
- Profuse sweating.



When heat exhaustion is more severe, symptoms can include:

- Vomiting.
- Confusion, drowsiness and weak pulse.
- Shallow breathing and unconsciousness.

To assist a person suffering heat exhaustion you should:

- Move them away from the work environment or heat source.
- Lay them in the shade.
- Give them frequent small drinks of water.
- Remove/loosen clothing.
- Provide extra cooling such as fanning and splashing water on the face.
- Do not give salt tablets.
- Position unconscious casualties in the recovery position and monitor breathing and circulation.
- Call an ambulance and get on-site medical assistance urgently.

Firefighters suffering from heat exhaustion are sometimes unaware of their condition and try to keep working, even to the point of collapse. It is important that firefighters keep an eye on each other. Should you observe a fellow firefighter slowing down, not looking well, or speaking and acting oddly, you should presume that person has heat exhaustion and take action.

It can take many hours to recover from even mild heat exhaustion. Anyone suffering from a mild dose should have at least one night's sleep before working again, even if recovery is rapid. More severe heat exhaustion will require medical treatment with intravenous fluids and admission to hospital.

If a casualty continues to work on after heat exhaustion, one of two things is likely to follow. Either the heat exhaustion will become sufficiently severe for the casualty to collapse or the body will seriously overheat, leading to heat stroke.

Heat Stroke

Heat stroke is the least common and most severe heat-related illness. It occurs when the body's temperature rises to dangerous levels, at which time the body starts to 'cook' internally. In cases of severe heat stroke, this process is irreversible and death will occur. This can happen quite rapidly and it is essential that the firefighter be externally cooled as quickly as possible. Urgent medical assistance must be arranged. Symptoms of heat stroke can include:

- High body temperature (often 40°C or more).
- Red, hot and possibly dry skin.
- Erratic behaviour.
- Disorientation.
- Weakness or collapse.
- Reduced conscious state or unconsciousness.



Seizures may occur in cases of severe heat stroke. The vigorous muscle contractions involved in seizures rapidly raise body temperatures even further. A person who experiences seizures after exposure to extreme heat will die unless immediate cooling is achieved. Immediate, effective cooling is essential. To assist a person suffering from heat stroke, you should:

- Remove them from the work environment.
- Remove their clothing down to underwear.
- Aggressively sponge or spray them with water.
- Immediately transport them to hospital.
- Fan or expose them to a breeze.
- Position unconscious casualties in the recovery position and monitor breathing and circulation.
- Call an ambulance and get on-site medical assistance urgently.



WARNING

Do not hose down or cover a firefighter believed to be suffering from a heat related illness with water. The sudden change in temperature may cause the body to go into shock.

Biological Exposure

Injury can occur through infections, bites and stings, and exposure to the biological hazards of micro-organisms bacteria, viruses, fungi, parasites. You may encounter insects and snakes during firefighting activities at any iZone or rural incident as well as in locations such as fire hydrants.

Clothing or furnishings stained with blood or bodily fluids, uncapped needles or syringes and contaminated sharp objects may be infected with diseases such as Hepatitis (A, B and C) and HIV AIDS. Firefighters exposed to micro-organisms such as those associated with typhoid, tuberculosis and Hepatitis B can become infected themselves (*INCDIR 19.4 Infection Control*).

Precautions must be taken to avoid infection, including:

- Wearing appropriate protective clothing.
- Inspecting the area before entering.
- Covering sharp objects.
- Taking care handling objects.
- Assuming that all blood and body fluid is infectious.
- Awareness of uncapped needles and syringes.
- Alert to the possible presence of insects and snakes.

To prevent contamination, wash affected areas and change clothing. Place soiled clothing into a sealable bag and contaminated items into a suitable container for disposal. Thoroughly clean equipment. If contamination is suspected, apply pressure near the cut to bleed the area, wash it with disinfectant soap and water and cover with an impermeable dressing. Report the injury to a supervisor as soon as possible and seek medical aid.

Radiation Exposure

Materials that emit high levels of energy such as x-rays, UV radiation and electromagnetic radiation are classified as radioactive materials. Radiation is related to the emission of radio-active energy such as plutonium and uranium. Distance and shielding are the two major forms of control that can be used to avoid a radiation hazard.

Radioactive materials are commonly found in hospitals and also in x-ray equipment used in various industries. Some telecommunications transmitters will use microwave radiation of a level high enough to damage human's biological tissue. The lead agency for any radiological incident is Queensland Health Radiation Health Branch. QFES attendance at radiological incidents may involve firefighting, rescue, control of contamination spread, and alerting responsible agencies and specialists.

Critical Incident Stress

Due to the nature of incidents, firefighters are at risk of critical incident stress. This condition, resulting from involvement in a situation that causes a strong emotional response, can interfere with a firefighter's ability to function. The effect of one crew member's stress reaction can impact on the effectiveness of the crew as a whole. Physical symptoms of critical incident stress can manifest as:

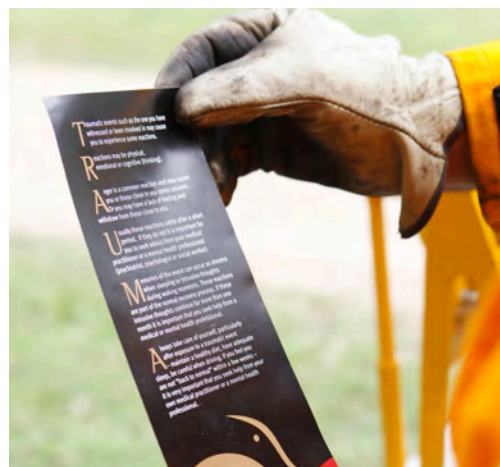
- Physical – nausea, upset stomach, tremors, feeling uncoordinated, chills, diarrhoea, dizziness, chest pain, rapid heartbeat, increased blood pressure, headaches, muscle aches, sleep disturbance and rapid breathing.
- Mental – slow thinking, difficulty in making decisions, difficulty in problem-solving, confusion, difficulty naming common objects, distressing dreams, disorientation, difficulty concentrating and memory problems.
- Emotional – anxiety, fear, guilt, grief, depression, feeling lost/abandoned/isolated or numb, wanting to hide, wanting to limit contact with others, anger and irritability.

Occupational stress is not limited to critical stress resulting from exposure to incidents that evoke strong emotional response. It can also arise from personal interactions and from attempts to perform beyond one's personal capacity or in fields where training has been insufficient.

Through FireCare, QFES provides counselling and support to personnel suffering from critical incident stress. Arrangements for peer support can be made through your Area Office or by contacting FireCare yourself. FireCare provides the following services to QFES:

- Confidential, professional counselling.
- 24-hour telephone crisis counselling.
- Critical Incident Stress debriefing.

Sessions are strictly confidential and can mitigate some of the long-term consequences of a critical incident. Peer supporters are carefully selected and trained to provide initial care and assistance to individuals and groups who are experiencing either personal or work-related stress. Independent professional counselling services are available to all staff at every level. Seek help sooner rather than later.



1.3 Fireground Hazards

Safety must be given priority over all other fire suppression considerations and activities. When working at an incident, you must avoid putting yourself at risk unnecessarily. By following safe work practices you can minimise the risk of injury.

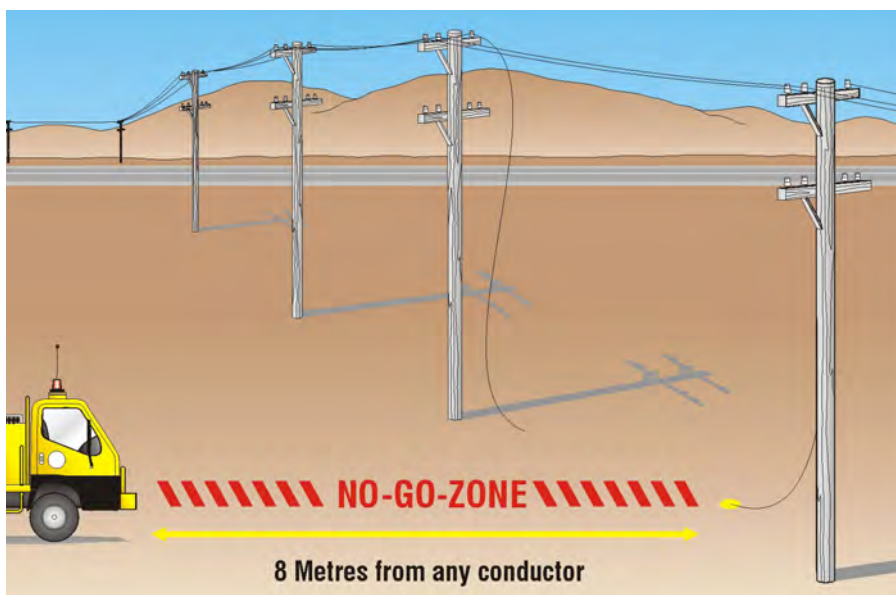
Heavy Machinery

Personnel working near any machinery, either in a vehicle or on foot, risk being crushed if the machine operator is not aware of them. All machine operators have restricted fields of vision to the front and rear due to the engine and roll-over protection systems. Dust, smoke and darkness may further impede the operators view. At night heavy machinery hazards pose an even greater risk. When working around any machinery such as a bulldozers, graders, tractors, ploughs and bobcats you must ensure the operator is aware of your location at all times, day or night.

If you need to approach an operator, do so only when you have made eye contact and signalled your need to communicate. Only approach when you receive the signal it is safe to do so, remain in the line of sight of the operator at all times. At night you should carry a torch or remain in a well lit area. In all cases you must follow the operator's instructions.

Electricity

It is vitally important that all crew members continually monitor the incident for signs of electrical hazards such as downed wires. If you are unsure whether a scene is electrically safe, do not enter. Notify the appropriate authority, requesting that all electrical services to the incident scene be disconnected, to neutralise all electrical hazards. You must always consider downed electrical wires as live until informed otherwise by a power company representative. A downed live power line will result in electricity being on the ground surface for several metres around the area where the wire is making contact. If it is in contact with an object such as a fence or a vehicle, the whole object should be considered as live.



Procedures/considerations at structural fires:

- Isolate power at main switch if possible.
- Be aware that there may be a secondary electricity supply.
- Remove and impound fuses.
- Note position of circuit breakers.

Procedures/considerations at electricity pole fires:

- Site the appliance well clear of wires.
- Secure area.
- Contact Firecom to request electricity provider to attend the incident to render the poles safe.
- Note position of circuit breakers.

Procedures/considerations with fallen wires:

- Treat as live.
- The electricity supply authorities have specialist equipment for disconnecting power from faulty lines. Keep clear until the authority advises that the power has been disconnected.
- Remain 8m from lines carried on poles. The clearance distance may need to be greater if conducting agents such as water are on the ground.
- Secure the area. Keep personnel and vehicles clear of power lines. Carbon deposits rising in the smoke column can provide a pathway for the electricity to arc to the ground.
- Where possible, keep your feet together to avoid becoming part of an electric current.
- Do not aim water streams at broken or sagging power lines. An electric current can flow through the water jet to the operator.
- If carrying out a rescue from a vehicle in contact with electricity wires, have occupants stay in the vehicle unless there is the threat of fire; then they are to jump clear of the vehicle, feet together.

Natural Environment

Falling or rolling trees and rocks can cause serious injuries or death. In rural areas, environmental hazards include obstacles such as rocks, stumps and holes hidden by long grass to firefighting hoses. Be alert for unexpected changes in ground height such as embankments and cliffs. Steep slopes and banks can give way under foot, particularly where soils and sand have been softened by water.



Avoid jumping or climbing over fencing; burnt or rotten posts and rails may collapse under your weight causing injury. It is safer to go under or through a fence than over it. When climbing through a fence, use a piece of equipment, such as a beater or a rakehoe, to separate the strands of wire. If a wire needs to be cut, those in the immediate area should be made aware of the possibility of the wire recoiling.

Bushfires are often associated with strong winds that can break away or dislodge previously broken tree branches. It is possible for living or dead trees to catch fire, fall to the ground, or drop branches with little or no warning. Burning stags (dead trees) are particularly dangerous. Also be aware that trees that are being pushed by machinery may suddenly snap and spring back in the opposite direction, as in a whiplash effect.

Chainsaws

Chainsaws are often used at wildfires to cut open burning logs or fell trees and branches that are blocking roads. They are useful items of equipment but are potentially dangerous. Do not use a chainsaw unless you have been appropriately trained. Whenever you are using a chainsaw, always wear a helmet, a face shield, ear protection, gloves, chaps and high visibility overalls.

- Ensure you have a firm footing.
- Be aware of obstructions in the work area.
- Be aware of the position of personnel when operating equipment or tools.
- Avoid operating electrical equipment in damp or wet weather.
- Adhere closely to the manufacturer's instructions and safety procedures.

Vehicles

Drivers of RFS vehicles, or other vehicles, responding to an incident will obey the Queensland and Australian road rules. Vehicles at, or travelling to or from a fire, are a potential hazard to emergency personnel and other road users. When working on or around vehicles at an incident observe the following safety guidelines.

- Know the size and limitations of your vehicle.
- Always wear a seat belt where fitted.
- Ensure all loose items are stowed safely and doors/latches are closed securely.
- Park the vehicle safely and securely away from falling branches or flying embers.
- Mount and dismount the vehicle using the steps and rails provided.
- Be cautious when stepping onto uneven or broken ground.
- Whenever possible have someone to guide you when reversing.
- Never walk or stand behind a vehicle that is reversing.
- Always be alert to other vehicles especially during conditions of poor visibility.

Aircraft and Helicopters

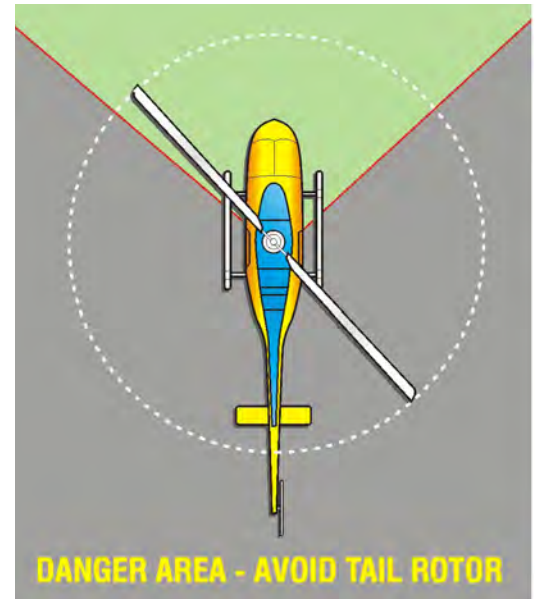
Observe the following procedures when working around helicopters.

- Stay in the pilot's field of view at all times.
- Stay away from spinning main and tail rotors.
- Stand outside the main rotor disc area and await pilot's signal before approaching the helicopter in a crouched position.
- Do not approach the helicopter unless the rotors have stopped or are spinning at operating speed, a slowing rotor can tilt downwards, in windy weather reducing head height.
- Be aware of ground irregularities on uneven, sloping terrain. Approach and leave the helicopter from the lowest down slope side and within the pilot's view.
- Carry long objects, stretchers, and hand tools horizontally.
- If the helicopter is creating dust, cover your eyes and crouch down with your back to the helicopter until the dust clears.



To seek permission to approach any helicopter, signal the pilot by extending one arm horizontally at chest height with thumb extended upwards. You may approach the aircraft only when a returned up-signal is received from the pilot. The only forms of head wear that may be worn near a helicopter are an approved flight helmet or head wear fastened securely by means of a chinstrap. Other types may be blown through the rotor disc, causing damage to the blades.

Approach from the front, within the region from 10 o'clock to 2 o'clock as seen by the pilot. The tail rotor area of a helicopter is unprotected and very difficult to see due to its high rotational speed. Depart the aircraft only after permission is given and then within the 10 o'clock to 2 o'clock region (as depicted in the drawings below). This ensures avoidance of the tail rotor and enables the pilot to monitor personnel movement.



There are general safety principles that apply when working around aircraft.

- When working around aircraft, follow normal safety procedures by not approaching until the pilot has given permission.
- Wear appropriate eye, ear and head protection (baseball caps can easily fly off).
- Stand clear of landing zones and do not smoke within 30m of aircraft refuelling equipment.
- Always follow the directions given by the pilot, flight crew or aircraft coordinator.
- Stay clear of the tail rotor and the motor disc which can tilt to within 1.5m of the ground.
- Carry all equipment horizontally, below head height and only under supervision of the pilot.

If you are caught in a firebombing zone remember the following:

- Move away from the fire line.
- Do not run or panic.
- Watch out for dead or suspended branches.
- Place any hand tools well clear of you.
- Hold your helmet on or protect your head with your arms.
- Watch your footing.
- Wash with cold water if you come in contact with foam or retardant.

Exposure to Smoke and Dust

Smoke is a mixture of unburnt particles, gases and vapours. Some smoke particles are merely irritating but others can be lethal, penetrating deep into the unprotected lung. It is the size of the particle that determines the depth of the penetration. Smoke can make you feel dizzy, nauseous, and drowsy. Superheated smoke and air can damage the throat, larynx, airways and lungs. PPE, including respiratory protection, must be worn when a smoke hazard exists.



Earth-moving equipment and fire suppression vehicles create intense amounts of dust at wildfires. This dust reduces visibility and increases the possibility of inhaling particles. Combustible dusts may originate from coal, grains, sugar, wood, plastics and metals and be generated during processing, transport and any movement. A dust explosion is the very rapid flame propagation that can occur when particles of a finely divided combustible solid, suspended in air, are ignited.

When visibility is reduced by smoke or dust, firefighters can very easily become disoriented. It is essential that you limit your exposure to smoke and dust and protect yourself by wearing appropriate respiratory equipment. Eye protection will also help to prevent eye problems that can arise as a result of dust entering the eye.

Chemical Substances

Off-site plans and manifest logs identify the chemical held on site. At incidents involving vehicles, trains or vessels carrying hazardous materials, manifests must be accessed to identify chemicals in transport. At fire stations and brigade buildings, a Safety Data Sheet (SDS) must be provided to supply hazard information where a hazardous substance is stored on site. The outer surface of containers holding dangerous goods must be clearly marked with HAZCHEM labels.

Dangerous Goods Classes and Divisions				
1.1, 1.2, 1.3	EXPLOSIVES		2.3	TOXIC GASES
1.4	Substances and articles which present no particular hazard		3	FLAMMABLE LIQUIDS
1.5	Very insensitive substances which have a mass explosion hazard		4.1	FLAMMABLE SOLIDS
1.6	Extremely insensitive articles which do not have a mass explosion hazard		4.2	SUBSTANCES LIABLE TO SPONTANEOUS COMBUSTION
2.1	FLAMMABLE GASES		4.3	SUBSTANCES WHICH, IN CONTACT WITH WATER, EMIT FLAMMABLE GASES
2.2	NON-FLAMMABLE NON-TOXIC GASES		5.1	OXIDIZING SUBSTANCES
2.2 Sub-risk 5.1	OXIDISING GAS (Oxygen and Nitrous Oxide - only for road or rail transport or for storage in Australia)		5.2	New Label, ORGANIC PEROXIDES
				Old Label (not permissible after 1 January 2011)
			6.1	TOXIC SUBSTANCES
			6.2	INFECTIOUS SUBSTANCES
			7	RADIOACTIVE MATERIAL (Category I)
				RADIOACTIVE MATERIAL (Category II or III)
			7 Cont	FISSILE MATERIAL
			8	CORROSIVE SUBSTANCES
			9	MISCELLANEOUS DANGEROUS SUBSTANCES & ARTICLES

Interaction with hazardous materials affects your health. You must protect yourself from exposure through inhalation, skin absorption, ingestion or direct contact. As firefighters may be exposed to chemical hazards, this exposure must be managed. Toxic substances can enter the body by inhalation, absorption, ingestion, or injection.

If exposure does occur, the appropriate decontamination procedures must be implemented. With many decontamination methods available, the method selected will be dependent on the contaminant properties, location and extent of contamination. Exposed persons are tagged (*INCDIR 16.1 Hazardous exposure tags*) as an additional precaution.

Airborne substances, such as dusts, particles, fibres (e.g. asbestos) viruses and bacteria inhaled at an incident, enter the body by way of the respiratory system. They may result in short-term and long-term health effects for a firefighter. The possibility of exposure to gas is common at incidents involving fire due to the presence of carbon monoxide in the smoke.

Ingestion occurs when foreign matter is swallowed or enters the mouth. This can occur when contaminated hands or implements are placed in the mouth. Ingestion hazards can be managed by observing the following:

- Do not eat, drink (or smoke) in the work area.
- Wear gloves at all times at the scene and remove them once outside.
- Wash hands prior to leaving the scene.
- Wash hands and rinse the mouth with water several times.

1.4 When Threatened by Wildfire

Survival in a Vehicle

When in danger from fire, you are safer in a vehicle than on foot. Firefighting vehicles can offer significant protection from flames and radiant heat. Fuel tanks are unlikely to explode due to the pressure relief provided by venting systems; however, you should check for any unshielded fuel lines that may melt or leak if subjected to heat (*INCDIR 27.3 Burnover Procedure*). You may need to evacuate the vehicle if the atmosphere becomes too toxic. The following guidelines should be followed if entrapped in a vehicle:

- If time permits, wet the cabin area down.
- Crouch down in the cabin.
- Do not use an extinguisher in the cabin.
- Drink water frequently.
- Report your situation by radio and keep a portable radio with you.
- Check that all protective clothing is donned and properly adjusted.
- Remove all exposed flammable liquid containers and flammable materials and place them some distance away on the leeward (away from the wind) side of the vehicle.
- If the vehicle has a spray system or protection hose fitted, ensure that the pump is running and valves are open to provide water.
- Park in an area with minimal combustible fuel (bare ground away from trees) facing the cabin of the vehicle away from the approaching fire. Close all windows and vents. Turn on headlights and hazard lights.
- Shelter behind protective curtains or under woollen blanket.



Survival on Foot

If you are on foot and are not in the vicinity of a vehicle or structure. Certain aspects of wildfires can work in your favour. Heat from a fire rises, so the air at ground level will not be as hot as the air higher up. A fire is constantly moving and the intense heat associated with the flame front will pass after a period of time.

Your survival may depend on whether you take the following action:

- Do not try to outrun the fire uphill. Try to reach bare or burnt ground.
- Do not run through flames unless they are low enough for you to cross safely and you can see the ground behind the flames. Breaks in the fire may occur where there is less fuel.
- Protect yourself from radiant heat by covering up with protective clothing.
- Protect your airway by wearing a smoke mask or respirator.
- Create a survival area by clearing fuel and lying face down in depressions, behind rocks or logs.
- Cover all exposed skin with dirt if possible.
- Use extreme caution if you need to take refuge in dams or streams.
- Do not take refuge in elevated tanks.

Dead Man Zone

A dangerous aspect of wind is that it can change the direction of the fire without warning. This can cause long and relatively quiet flanks to suddenly become active fire fronts and firefighters can become overrun by fire in the area known as the “Dead Man Zone”. For further information refer to the CSIRO Project Vesta Dead Man DVD available from Rural Training. The table below shows the distance in meters that a line of fire will travel in five minutes.

FIRE DANGER INDEX (FDI)	SLOPE		
	Level Ground	10° Upslope	20° Upslope
20	87m	174m	348m
40	170m	340m	680m
60	258m	510m	1020m
80	338m	676m	1352m

Survival in Machinery

Firefighting machines such as bulldozers, graders and tractors can provide some protection if you are threatened by fire. If you are trapped in firefighting machinery:

- Clear an area of flammable material.
- Park the machine in the centre of the cleared area, with the smallest surface area of the appliance facing the fire front.
- Shelter in the cabin or seek refuge under the machine in a shallow trench.
- Leave the machine running.
- Lower all machine attachments.

1.5 Ergonomic Hazards

Ergonomic hazards that you will encounter relate to the way you work in your workplace. Ergonomics is aimed at enhancing the healthy interrelationship of humans, equipment and the work environment. Essentially, ergonomics is the practice of making the work environment safer and more productive for the worker. General workplace ergonomic risks include the following:

Manual Handling

- Forceful exertions (e.g. lower back - lifting heavy weights away from the body, arm/hand - pinch grip, forced or prolonged and repeated deviation at wrist)
- Awkward postures (e.g. spinal rotation under power, shoulder elevations under power, prolonged seated work, elbows elevated, deviated wrists)

Environmental Conditions

- Heat - heat stress/hypothermia
- Cold - cold stress/hypothermia/frostbite
- Particulate agents - smoke/dust
- Noise
- Liquid and gaseous agents

Localised Contact Stress

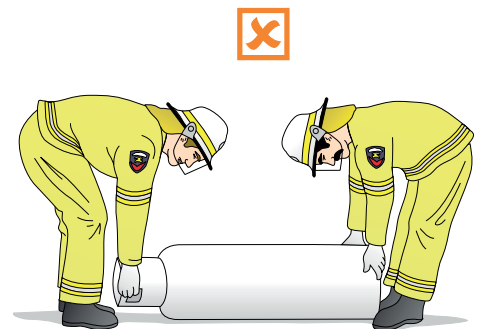
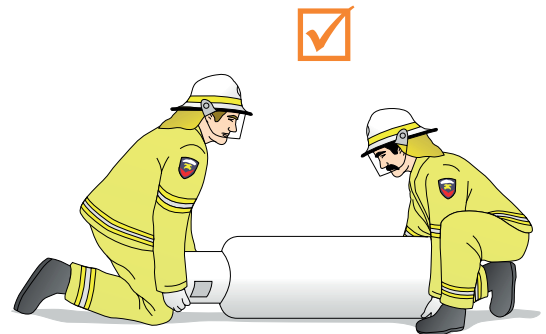
- Body part contacts unpadded sharp edge
- Grasping small diameter tools
- Using body part as striking tool

Vibration

- Extended operation of power hand tools
- Heavy equipment operation

Repetitive / Prolonged Activity

- Tasks with short cycle times



Firefighters are frequently injured when lifting or carrying fire hoses, auxiliary pumps and working on uneven and burnt ground. By the nature of the fire and rescue environment, firefighters assume awkward positions. A significant number of firefighter injuries also relate to the mounting and dismounting of emergency vehicles. Step heights, handrails and the condition (such as uneven surfaces) of the ground must be considered when travelling to or from an incident.

1.6 Hazard Controls

Part of your role as an active firefighter is to be aware of the existence of hazards and to be active in determining how they can be minimised. To reduce the likelihood of injury, hazards must be controlled to whatever degree is possible in the specific situation. By consistently applying hazard and risk management, you can contribute to the management of these hazards. The hierarchy of controls is a list of ways that hazards should be dealt with. The options at the top of the list are more effective as they address the hazard (the thing that could cause harm) rather than just the risk (the harm that the hazard could cause).

The hierarchy of controls are as follows:

1. Elimination - eliminating the hazard
2. Substitution - replacing the hazard with one that is less hazardous
3. Engineering controls - through isolation or redesign
4. Administrative controls - minimising exposure through procedures and/or instructions
5. Personal Protective Equipment (PPE)

Because it is not always possible to apply the first three controls to fireground hazards, you will find that in most cases it is administrative controls and a strong emphasis on PPE that are in place to reduce risks to operational firefighters. For QFES firefighters, hazard control is addressed via training, work procedures and practices, experience and knowledge, and the supply of PPE.

The decision now is whether to eliminate the hazard or to prevent or manage the exposure to the identified risks. If this control process does not occur, the hazard will cause or continue to cause injury in the workplace. The first priority is to eliminate the hazard altogether. When this cannot be done, or is too expensive/inappropriate to carry out, other steps must be taken to minimise the exposure to the risk.

Since firefighters respond to events that have already happened, the only option is to minimise and manage the risks to prevent injury. At the station, a wider range of options are available. Administrative controls involve minimising exposure to a risk through the use of procedures or instructions (such as rostering to decrease exposure time) while PPE is worn by persons as a final barrier between themselves and the hazard. Implementation of the identified control measures into the workplace include:

- Ensuring that personnel are aware of correct operating and supervisory procedures.
- Communicating with those who will be affected to explain the control measures and the reasons for the change.
- Setting up training and instruction programs for the workers.
- Ensuring on-going maintenance, monitoring and review of effectiveness.

Changes in fire behaviour will impact on fire development, on the appropriateness of tactics, on the safety of firefighters and in many instances on the environment itself. One aspect of your role as a firefighter is being alert to changes in fire behaviour and in the effectiveness of hazard controls and reporting observations to your supervisor. As a result escape routes and safe refuges may need reassessing, vehicles may become trapped, radiant heat levels may increase, firefighters and the public may be at risk, water supply may now be inadequate, or more resources may be needed.

Your personal hazard controls are your PPE, your equipment, the amount of fluids you take in, the procedures you follow and the approach that has been taken to controlling the incident. Monitor your own behaviour. Many of the controls are dependent to a large extent on your behaviour. If your equipment is faulty or deteriorating in any way, you must take responsibility for reporting it and taking the necessary steps to keep safe.

Notification of hazards or changes in the effectiveness of controls away from the fireground can be done face-to-face, via e-mail or by memo. On the fireground, communication is more restricted but can still be effective using radio (over long distances), hand signals (over moderate distances), and voice or touch (between fireground team members).

1.7 Manage and Assess Risks

Risk management is the core approach in health and safety for preventing and managing work-related injury and illness. The process of risk management can be summarised in the following stages or steps:

Step 1 - Identify the hazard

Step 2 - Assess the risks that may result because of the hazard

Step 3 - Decide on control measures to prevent or minimise the level of risk

Step 4 - Implement those control measures from the previous step

Step 5 - Monitor and review the effectiveness of implemented controls

There are many other Codes of Practice outlining the risk management process for specific hazards that can be found on the Department of Justice and Attorney General website (www.deir.qld.gov.au). It is essential that clear and accurate records of the stages of the risk management process are kept. The records should indicate that the risk management process has been conducted properly and should include all important information about the hazards and associated risks at the workplace.

Once a hazard (or a group of hazards) has been identified, the assessment of risk is the next step in the risk management process. The risk assessment involves determining the likelihood or probability of the incident occurring, coupled with determining the type and severity of the injury or illness that may occur. With the hazards identified, it is necessary to determine how likely it is that the injury or disease will occur. This is achieved by determining the answers to a range of questions such as:

- How often does the situation occur?
- How many people are likely to be exposed to the hazard?
- What are the skills, experience and training of the persons performing the work?
- How long is the person exposed?
- What are the volumes and concentrations of materials?
- What are environmental conditions?
- How effective are current control measures?

These questions may alter, depending on the hazard and situation that presents itself. The following scale indicates the likelihood of the injury/disease occurring. The severity of the consequence can range from minor (first aid only - no lost time) to moderate (casualty treatment, lost time), major (serious bodily harm) to extreme (death, permanent disablement).

VERY LIKELY	<i>Could happen frequently</i>
LIKELY	<i>Could happen occasionally</i>
UNLIKELY	<i>Could happen, but rarely</i>
VERY UNLIKELY	<i>Could happen, but probably never will</i>

The final stage in the risk assessment is to determine the level of risk. This is estimated by the relationship between the likelihood and the consequence. This relationship may be represented by the following matrix. From this table, the level of risk is estimated by plotting the likelihood against the severity of the consequence. The rating determined can be a guide to prioritising the risks that need to be dealt with. High risk indicates that something must be done about these risks immediately. Medium risk indicates that something should be done about these risks as soon as possible. Low risks may not require immediate attention.

		CONSEQUENCES			
		Extreme	Major	Moderate	Minor
LIKELIHOOD	Very Likely	<i>HIGH</i>	<i>HIGH</i>	<i>HIGH</i>	<i>MEDIUM</i>
	Likely	<i>HIGH</i>	<i>HIGH</i>	<i>MEDIUM</i>	<i>MEDIUM</i>
	Unlikely	<i>HIGH</i>	<i>MEDIUM</i>	<i>MEDIUM</i>	<i>LOW</i>
	Very Unlikely	<i>MEDIUM</i>	<i>MEDIUM</i>	<i>LOW</i>	<i>LOW</i>

1.8 LACES

Remember to follow LACES when on the fireground.

L LACES	A lookout must be assigned to a safe vantage point with communications to all crew members to specifically watch for hazards.
A AWARENESS	Monitor and look out for changes in fuel condition, weather and topography that affect fire behaviour. Crew condition, work progress and other nearby crews and equipment must also be monitored. PPE is compulsory.
C COMMUNICATION	Maintain lines of communication and report any problems. Firefighters maintain communications with all crew members and command. Any communication problems and black spots are reported. Ensure your instructions and transmissions are clear.
E ESCAPE ROUTES	Check for at least two escape routes and advise others of these. Develop and communicate the decision trigger to activate an escape.
S SAFETY ZONES	Identify and work from an anchor point when possible. Select or construct a large enough area for anticipated conditions. Park your vehicle in a safe location.

1.9 Situational Awareness

Situational awareness means knowing what is going on around you so you can figure out who to do. In regards to safety, it means being aware of:

- What hazards to look out for in the situation.
- What is going on around you right now.
- What could happen next.

Wildfire hazards can come from the fire, your surroundings, within yourself, and fellow firefighters. By constantly scanning for hazards you should be able to build up a mental picture of what is going on around you. You should share this information with the other members of your crew so that the whole crew has a clear idea of what is happening. By applying your understanding of fire behaviour you can also get a good idea of what is likely to happen next and anticipate hazards.

1.10 Workplace Health & Safety

Every volunteer has the right to expect that the system of firefighting and related activities ensures their health, safety and welfare. Sadly, on average, one or two rural firefighters die during some activities each year, and a few hundred receive significant injuries. One of the main responsibilities of all QFES and RFS personnel is to help prevent this toll.

The main focus of occupational health and safety is to prevent illness and injury occurring as a result of work. No one goes to work to deliberately sustain an injury or to become ill. Everyone benefits from having good health and working in a safe environment. However, safety is sometimes seen as an obstacle to work, an unproductive and expensive exercise with a small return to the organisation. Because of this, legal requirements for health and safety have been introduced to ensure that employers and workers comply with health and safety standards.

Nationally uniform laws ensure all workers in Australia have the same standard of health and safety protection, regardless of the work they do or where they work. Nationally uniform work health and safety laws means greater certainty for employers (particularly those operating across state borders) and, over time, reduced compliance costs for businesses.

The *Work Health and Safety Act 2011* provides a framework to protect the health, safety and welfare of all workers at work. It also protects the health and safety of all other people who might be affected by the work. All workers are protected by the WHS Act. This includes employees, contractors, subcontractors, outworkers, apprentices and trainees, work experience students, volunteers and employers who perform work. The WHS Act also provides protection for the general public so that their health and safety is not placed at risk by work activities.



The WHS Act aims to:

- Protect the health and safety of workers and other people by eliminating or reducing workplace risks.
- Ensure effective representation, consultation and cooperation to address health and safety issues in the workplace.
- Encourage unions and employers to take a constructive role in improving health and safety practices.
- Promote information, education and training on health and safety.
- Provide effective compliance and enforcement measures.
- Deliver continuous improvement and progressively higher standards of health and safety.

The WHS Act specifies that every employer has a duty of care and is obliged to ensure the health and safety of their workers, assist employees to meet workplace health and safety obligations, ensure the health and safety of non-workers, ensure orderly conduct of all work, and ensure that workplace operations do not endanger the public.

All persons in the Department of Fire and Emergency Services, Rural Fire Brigades (RFB) and QFES have WHS obligations. Obligations of persons involved at the rural workplace relate to QFES (in the role of employer) brigade officers, active and support members (volunteers in the role of workers') involved in firefighting operations, as well as visitors to the brigade.

Health & Safety Obligations

The main focus for you at this stage is the major duties of the employer and the worker. Health and safety in the workplace can only be achieved through commitment of employer and employee. Under section 19 of the WHS Act, the person in control of a business undertaking has three primary obligations.


1. To ensure, so far as is reasonably practicable, the health and safety of workers while the workers are at work in the business or undertaking.
2. To ensure, so far as is reasonably practicable, that the health and safety of other persons is not put at risk from work carried out as part of the conduct of the business or undertaking.
3. To ensure, as far as is reasonably practicable, the provision and maintenance of a safe work environment, safe equipment and structures, safe systems of work, safe use and handling of equipment, adequate welfare facilities, provision of training and supervision to protect from risks, and monitoring the health of workers and conditions of the workplace.

Under section 28 of the WHS Act, workers are required to take reasonable care for their own health and safety and that of others who may be affected by their actions while at work. Workers (including volunteers) have four primary obligations.

1. To take reasonable care for his or her own health and safety.
2. To take reasonable care that his or her actions do not adversely affect the health and safety of other persons.
3. To comply, so far as the worker is reasonably able, with any reasonable instruction that is given by the employer to allow the person to comply with the WHS Act.
4. To cooperate with any reasonable policy or procedure of the employer relating to health or safety at the workplace that has been notified to workers.

1.11 Policies & Procedures

A core value of QFES is safety - the health, safety and well-being of its employees, volunteers, contractors, visitors and the community. Together, we aspire to achieve Zero Harm. DFES is committed to provide a workplace that is free from harm and encourages a culture that has safety as an absolute priority. The Work Health and Safety Policy states that to achieve Zero Harm, they will:

- Build and maintain an effective health and safety management system.
 - Establish health and safety performance objectives and targets.
 - Continuously review and improve health and safety performance.
 - Ensure health and safety risks are identified and managed to a level as low as reasonably practicable.
 - Comply with and endeavour to exceed all applicable legislation.
 - Provide equipment and plans that meet relevant standards.
 - Provide appropriate health and safety training.
 - Report and investigate all workplace incidents, injuries and illnesses to determine causes and implement actions to try to prevent them from recurring.
 - Not condone any breach of health or safety standards or procedures.
 - Encourage employee and volunteer involvement, provide recognition for personal contribution and promote the importance of health and safety in the workplace.
- 
- Promote and support leaders to motivate, coach and champion positive health and safety behaviours for all personnel.
 - Provide early intervention following a workplace injury or illness to optimise recover and achieve a timely return to the workplace.
 - Communicate this policy to employees, volunteers, contractors and other relevant stakeholders and ensure it is reviewed periodically.
 - Support healthy lifestyle and wellbeing initiatives to build a health and resilient workforce.

The policy also states that employees, volunteers and others who work for the department are expected to:

- Respect and abide by the standards of conduct defined in the Code of Conduct for the Queensland Public Service.
- Ensure work activities are conducted in a safe and healthy manner.
- Identify safer, smarter and better ways of working.
- Follow health and safety procedures and instructions.
- Wear all personal protective equipment as prescribed.
- Report all incidents as soon as practicable.
- Present to work in a fit and healthy state.
- Personally contribute to making the department a safe and health place to work.

CHAPTER TWO

TEAMWORK

2.1 Principles of Teamwork

A brigade is a group of individuals working together for a common cause - the protection of life, property and the environment. Such a group can operate as a team only by observing discipline and respecting lines of authority. A safe crew is one in which all members are competent to carry out allotted tasks, cooperate as members of a team, and respect the authority of their officers.

Firefighting is a team activity. It is not something you can do safely or effectively while working alone. Teamwork extends not only to actual firefighting, but to almost every brigade activity such as equipment maintenance, training, community education, and even social events. A team can be described as a group of people where members have complementary skills and are committed to a common purpose or set of performance goals for which they hold themselves mutually accountable.

Working as a team implies working with each other in a consistent direction. Many tasks that need to be carried out by brigade members are already clearly defined in various policies and procedures. They help ensure that activities run smoothly and safely, and consistently get good results. Whenever you are given a task, you should always check if there is already a procedure outlined for doing it, and complete it to the required standard.

Active Participation

Active participation means taking part in activities in a way that helps the team achieve its purpose. To do this you need to have a clear idea of the roles and responsibilities within the team. The Incident Management System (IMS) is used to define roles and responsibilities at each particular incident, including those where many brigades and many officers may be involved.

Whether your brigade is involved in an emergency or non-emergency activity, active participation means contributing to identifying the goals and objectives of the team. Through team meetings you can discuss and help shape the future development of your brigade. Make a point of participating in meetings and brigade gatherings whenever it is reasonably possible for you to do so.

Almost everyone has a role within the brigade that they prefer to do, but there is also great value in swapping roles with others as time goes on. Being flexible in what you can do is very important in a volunteer service, as you can never be certain about which members will be available for any particular fire or incident. At some types of incidents, some members may have more expertise than others. It makes sense to give those with the greatest expertise a more leading role in such situations.

Sharing Information

The way a team performs depends on the way the members communicate and inter-relate with each other. If team members work against each other, there is confusion and little or no achievement. However, if they share knowledge, skills and information between them, then the team can become much more effective than the sum of its individual members. Sharing information comes down to some basic communications skills. Here are some simple techniques you can use to increase the effectiveness of your communication within a team situation.



- Before you commence any task, seek the information you need to carry it out, discuss what hazards are involved, and how they can be avoided, eliminated or controlled.
- If you think a task is unsafe, or you are not confident about your ability to do something competently, tell your First Officer your concerns about that task.
- When you are given an order, paraphrase it back to make sure you understood it correctly.
- If there is a disagreement about something, focus your attention and discussion on what is right not who is right.
- Share important information with your team members. If you see something hazardous or a significant change in conditions, report it. If something concerns you, speak up about it.
- After each incident or training activity, participate in a debriefing. Agree on one thing the team could do better next time around, and work out how to make that improvement happen.

Team Support

Team support works in both directions. It refers to the support you give to others, and to accepting the support they give to you. Probably the person who needs the most support is your First Officer. You might sometimes think of them as an 'all-knowing' person who deals out orders to members. Remember that First Officers are only human and will differ in leadership style and skills. Take that into account in the way you inter-relate with them. The best support you can give a First Officer is not just to mindlessly do whatever they say, but to support their decision making by:

- Accepting that they can make errors.
- Feeding them good quality information.
- Operating to the required standard.
- Respectfully questioning their judgement when you have objective concerns.



Look out for opportunities to support others in the team. Offer help if they are in difficulty or have a high workload. Be aware of the limitations and needs of others. Not everyone will always see things or be able to do things the way you do, and you may need to adjust the way you work with them. By interacting honestly and respectfully with other brigade members you can help create an atmosphere of mutual trust that allows errors to be identified, admitted and corrected before they become dangerous.

Feedback

Getting feedback is an important and ongoing part of being a brigade member. Giving feedback to others should be constructive, and focus on the person's behaviour, not the person themselves. Recognition and praise should be given when it is deserved, but it should not be given if it might reinforce dangerous behaviour, bad firefighting habits or poor performance. Accepting feedback from others is often the most difficult aspect of team support. When feedback is given to you, do not regard it as an insult to your ability. Most feedback given to you is likely to be friendly and constructive, but realise that not everyone has the skills to give feedback in that way. Even poorly expressed feedback can contain good learning points and should not be totally ignored or rejected.

Conflict

Rural Fire Brigades (RFB) usually consist of people who are enthusiastic, if not passionate, about what they do. They also frequently work together at incidents that are challenging and sometimes emotionally charged. These tend to build strong bonds between people. On a positive side this can result in great friendships and teamwork, but on a negative side it can also sometimes lead to tensions between people.

Conflict between members, if skilfully handled, can often lead to positive outcomes. Sometimes the conflict is imaginary; simply a misunderstanding of what each thought the other was on about. But conflict can also be an indicator that some important issue needs to be resolved. By focussing discussion on what people really need, a solution that satisfies all can be found. If things can't be resolved informally, QFES has formal grievance procedures that can be applied.

Following Instructions

At an incident your job is to carry out instructions and to keep your Incident Controller (IC) or First Officer informed of any changes in the situation that may affect their strategy. When you are tasked by your IC or First Officer, confirm the task and carry it out according to instructions. It is your responsibility to follow safe work practices and procedures that you learn. Examples of safe work practices include:

- Using Personal Protective Equipment appropriate to the task.
- Following the guidelines for avoiding heat stress.
- Maintaining communication with other members of your crew.
- Maintaining a high level of awareness of your surroundings and changing conditions.
- Reporting changes affecting operational areas taking note of refuge areas.

Encouragement & Recognition

Team members may sometimes feel that their efforts are not recognised or appreciated enough. Maintaining team morale helps to ensure the team operates effectively. It is essential that all members feel appreciated and acknowledged, and that their contribution is worthwhile. Sometimes it is the little words of encouragement or a simple thank you that helps maintain the morale and momentum of your brigade.

Recognition or acknowledgement from higher levels of management can also go a long way to improving the team dynamics. By taking the time acknowledge, encourage and support the members of your team, you are helping to develop good networks that you can call on when you may need encouragement yourself.

Team Goals & Objectives

Every member of the team is working towards achieving the goals and objectives of the team as a whole. These goals and objectives need to be identified for the team to function effectively. Each team member can contribute to this identification process in the following ways.



-
- Tasks are assigned to meet the needs and goals of the team. It is important these tasks are completed. If you are unable to do so, ask a team member for help or speak to your team leader.
 - Attaining new competencies and knowledge is vital to keeping the team skills base current and developing. Extra training is a good way to increase your knowledge.
 - As with learning, skill development is essential to the development of the team. A brigade can benefit greatly from a spread of skills among its members.
 - Personal development makes most people happier and more confident. By developing personal skills, knowledge and abilities you can be more effective in helping your team achieve.

You can contribute towards the identification and development of team goals by:

- Speaking at training and team meetings.
- Suggesting training events.
- Suggesting public education events.
- Participating in team discussions on the development of goals.
- Being open to opportunities to bring new information to the team.
- Participating in training events.
- Participating in public or community events with your brigade.

2.2 Firefighter Classifications

There are three main streams within the QFES organisation - career, part-time, and volunteer. Each stream has its own rank structure with the Rural permanent and Fire & Rescue permanent staff aligning their rank titles. The Rural stream also includes volunteer firefighters who respond mainly to rural wildfire incidents. The Commissioner, Deputy Commissioner and Assistant Commissioners are responsible for the overall operation of QFES.

Career Operational Positions

Assistant Commissioners are mainly focused on the strategic and operational readiness of the region for which they are responsible. The Assistant Commissioner RFS is responsible for the State's rural operational activities.

The Director Operations RFS holds the rank of Chief Superintendent and is responsible for the coordination of head office operational service delivery and the coordination of volunteer services. The responsibilities of the Director include:

- Actively support the development and implementation of 'iZone' initiatives.
- Manage the operational planning and coordination functions of RFS on a state-wide basis.
- Develop, manage and evaluate systems and processes for supporting volunteers throughout the State, including operational policy, communications, reporting, liaison, training and equipment provision/maintenance.
- Provide Incident Management Team (IMT) support on a state-wide basis.
- Manage the implementation, coordination, training and system development of the Australasian Inter-Agency Incident Management System (AIIMS) within RFS.
- Provide expert advice to the Assistant Commissioner and Regional Inspectors.
- Support the Assistant Commissioner during bushfire operations that involve the activation of the State Operations Coordination Centre or in the field, as required.

Positions at the rank of Superintendent cover a wide range of job functions in the operational areas of QFES to provide high quality preventative and responsive fire and rescue services. Regional Managers RFS hold this rank and their responsibilities include:

- Manage Regional operations and ensure the effective delivery of volunteer fire management services to rural and remote communities through the best utilisation of the human, financial and capital resources of the area.
- Assist in the development, implementation and evaluation of RFS.
- Service strategic plans, operational plans, policies and procedures to ensure the effective management of RFS.
- Manage communication within the workplace and liaison with other regions, emergency services, agencies, the media and the community.
- Be an integral part of RFS Senior Management Team to assist and promote a teamwork approach.
- Support the Assistant Commissioner during bushfire operations.

Positions at the rank of Inspector also cover a wide range of job functions with the focus on district operations. Area Directors RFS hold this rank and their responsibilities include:

- Manage area/district operations and ensure the effective delivery of services through the best utilisation of the human, financial and capital resources of the area/district.
- Respond to large-scale Urban and rural fires and other emergency incidents, to take charge and direct operations in accordance with QFES operational requirements.
- Contribute to the development, implementation and evaluation of regional strategic plans, regional operational plans, regional policies and procedures to ensure the effective management of proactive fire service delivery.
- Manage communication within the workplace and liaison between other regions and units, other emergency services providers, government and non-government agencies, the media and the community.
- Support the Regional Manager during bushfire operations.

Station Officers are unique to the Fire & Rescue stream and manage station work groups in accordance with QFES policies, practices, and procedures. Their responsibilities include:

- Manage, at station level, fire prevention and fire investigation functions and coordinate and conduct public safety and education activities.
- Manage emergency incidents including fire, road accident rescue/entrapments, hazardous material, and as required, take command in order to provide and maintain effective operations.
- Promote a positive, safe and healthy teamwork environment and manage staff activities to ensure a quality outcome at both station and incident levels.
- Manage the effective utilisation and maintenance of station resources including equipment and facilities.
- Manage communication within the workplace, and liaise with other QFES stations, other emergency services, other agencies and the community.



Firefighters form part of the front line team that responds to emergency incidents. They are responsible for maintaining a constant state of readiness both in their equipment and personal abilities. They participate in equipment maintenance and testing and the delivery of fire safety and suppression strategies to the community. Responsibilities of a firefighter include:

- As part of a fire crew, respond to fire, road accident rescue/entrapments, technical rescues, hazardous material and other emergency incidents.
- Promote community safety by assisting with the inspection of property, buildings and emergency response equipment and with the development of evacuation plans and emergency response procedures.
- Maintain QFES equipment, resources and facilities to ensure a constant state of operational readiness.
- Contribute to all station activities and promote a productive work environment through a positive team approach to all tasks.
- Communicate effectively and appropriately within the workplace, with other emergency service personnel and with members of the community.

Volunteer Positions

Volunteer firefighters are unpaid employees appointed to a fire station that is not permanently manned. They may hold other jobs in the community and respond to a range of incidents dependant on the location and risk. On completion of the incident they then return to normal day-to-day activities. Obligations and responsibilities of brigade members:

- Obey the lawful instructions of the First Officer/OIC/IC of a fire incident.
- Obey the operational chain of command.
- Be familiar with the operational guidelines of the brigade and RFS.
- Abide by the rules of the brigade.
- Carry out only those duties that they feel confident or competent in completing without subjecting themselves or others to any threat to safety or well being.
- Conduct themselves at any recognised QFES and/or RFS activity in a manner which does not bring disrepute



The First Officer of a brigade is elected by the brigade members at an annual or biennial general meeting or at a special meeting in the case of a casual vacancy. A First Officer will provide direction and leadership during brigade operations and ensure the safety of brigade members. The First Officer has the powers of an authorised officer while undertaking fire operation duties as indicated in Division 3 Section 83 of the Fire and Emergency Services Act 1990.

The responsibilities as set out in the Rural Fire Brigade Manual are to ensure that:

- All active members are offered training to a level commensurate with the brigade's classification.
- All active members are familiar with the operation of all brigade equipment.
- A record is kept on all fires attended by the brigade, an Incident Report for all fires is forwarded to the Area Director and any other report on any fire or incident is submitted to the appropriate authority.
- Training is conducted on a regular basis.
- All support members are aware of their role.
- All operational records are maintained.
- Where relevant, breathing apparatus is operational and safety records are maintained.
- Assistance, including fire scene preservation, is provided to fire investigators.
- An on-going hazard reduction program is developed and a map record of the program maintained.
- An effective liaison is established and maintained with neighbouring brigades and effective plans for mutual aid are developed.
- Regular contact is maintained with the Fire Warden(s) in the area.

Part-Time Auxiliary Positions

Auxiliary personnel carry out many of the operational type duties of an equivalent person in the permanent ranks within the parameters of the front line nature of the position. Responsibilities of an Auxiliary firefighter include:

- Promote community safety and emergency preparedness by supporting and participating in community education activities.
- Develop and maintain competencies by actively participating in regular drills and other relevant training courses provided by QFES to ensure safety and effectiveness on the fire ground.
- Maintain the required attendance standards for emergency incidents and training.
- Contribute to incident reporting and general station administration as required.
- Be an integral part of the work group and promote a positive team approach in all work activities.
- Comply with legislative, policy and procedural requirements appropriate to the position.
- Communicate effectively with QFES personnel, other emergency service providers and the general community.
- Contribute to a safe and healthy work environment by adhering to organisational health principles and procedures.

Auxiliary firefighters are located throughout the state, mainly at stations crewed entirely by Auxiliary personnel. Depending on their location, Auxiliary firefighters may also work together with career operational and rural volunteer firefighters in the provision of fire and rescue services. The Captain is the highest-ranking auxiliary fire officer located at fire stations. This officer is in charge of a station and is responsible for operations and the running and good order of the station. Responsibilities of Auxiliary Officers are very similar, with the Captain assuming a more managerial position in some aspects.



The responsibilities of a Captain include:

- Respond to and assume control of fire and other emergency incidents, where required.
- Promote community safety and emergency preparedness by contributing to community education activities.
- Contribute to the recruitment and selection of suitable Auxiliary Fire Protection Officers to meet the needs of the community.
- Ensure completion of incident reporting and general station administration.
- Promote a positive team approach in all work activities.
- Comply with legislative, policy and procedural requirements appropriate to the position.
- Communicate effectively with QFES personnel, other emergency service providers and the general community.
- Contribute to a safe and healthy work environment by adhering to Workplace Health and Safety principles and procedures.

A Lieutenant is generally placed in charge of a fire crew. Officers at this rank can also undertake special portfolio work. Their responsibilities include:

- Respond to and assume control of fire and other emergency incidents, where required.
- Promote community safety and emergency preparedness by contributing to community education activities.
- Contribute to the recruitment and selection of suitable Auxiliary Fire Protection Officers to meet the needs of the community.
- Contribute to the planning and delivery of skills maintenance drills and other relevant training courses.
- Ensure maintenance and repair of operational equipment and station facilities.
- Contribute to completion of incident reporting and general station administration.

Fire Communications Positions

Firecom is a key player in the incident response team. The primary function of the Firecom Centre is to maintain an effective telecommunication system for the receipt of emergency calls, the subsequent mobilisation of QFES and other emergency vehicles and the maintenance of communications with mobile units. Secondary duties revolve around the maintenance of equipment, procedures and information supporting the primary function.

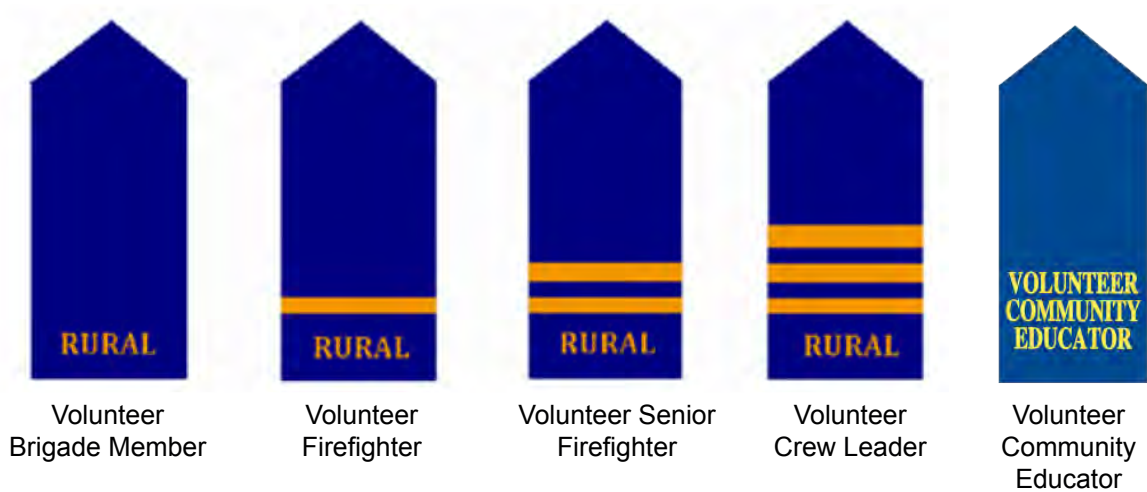
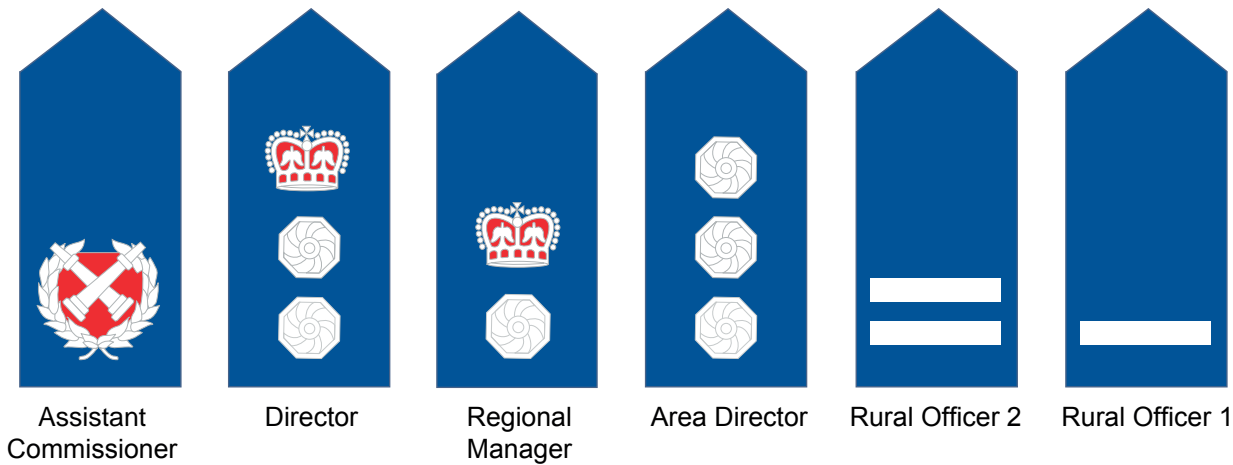
The main purpose of the Firecom Centre is threefold:

- Provide the community with access to QFES in an emergency.
- Provide the public with a direct contact to fire communications.
- Provide firefighters responding to emergency incidents with assistance required to successfully combat the conditions at the incident.

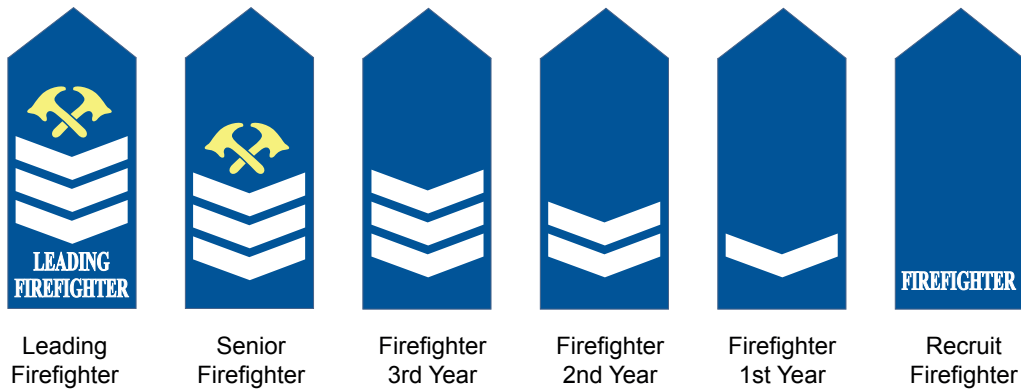
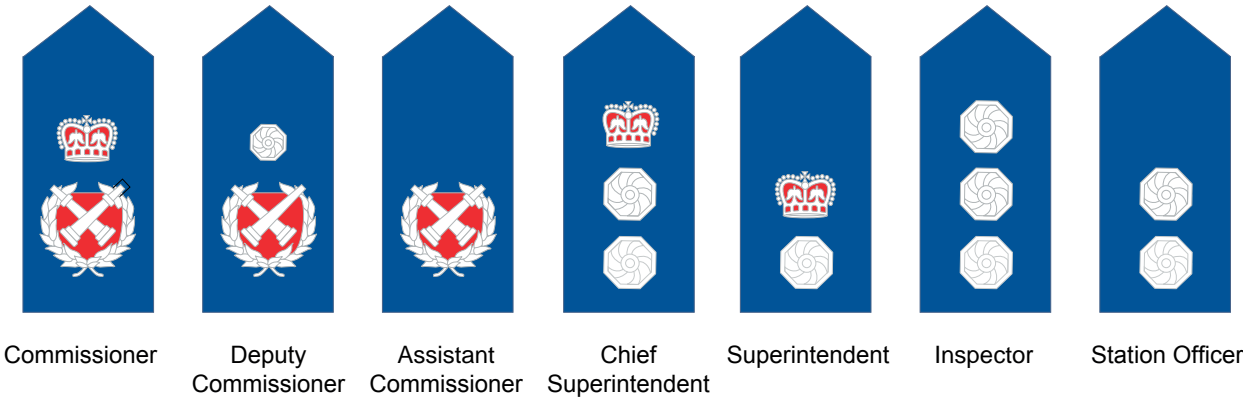


2.3 Firefighter Epaulettes

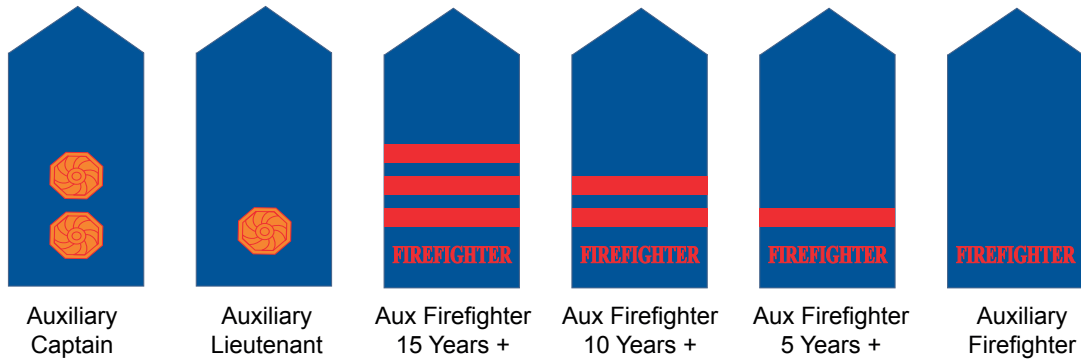
RFS Stream



Fire and Rescue Full Time Stream



Fire and Rescue Part Time Stream



2.4 Team Interaction

In any team interaction occurs between the team leader and members, and between the individual members. The team leader's main role is to:

- Make decisions about firefighting strategies and tactics.
- Ensure that members are aware of and are in agreement with the task goal.
- Develop skills of team members (training).
- Provide necessary resources.
- Encourage cooperation between members.
- Keep the team focused.
- Appraise results and provide feedback.
- Acknowledge achievement.

On the fireground, you will undertake actions that draw together the components of successful team interaction. Completing tasks efficiently and safely will depend heavily on the sharing of information and development of skills. A firefighter trained in the operation of a new piece of equipment who imparts those skills to the rest of the crew is an example of this sharing. Firefighters learn from their peers as well as from instructors.

In training and response activities, you will work cooperatively with other team members, asking for and receiving help, adapting to changes in tactics and roles as incidents escalate or reduce in complexity or size. At a road traffic crash (RTC) rural firefighters arriving first on the scene will size up the situation, put in place and initial action, report to Firecom and request assistance. Should a full-time or part-time fire and rescue crew arrive, that role may change. The fire and rescue crew may assume control of the RTC if required to do so.

Changing Roles

Individual roles and responsibilities can also change during an incident. When other agencies respond to an incident, the concept of teamwork broadens to encompass the entire team of incident responders. If as first response crew, you are applying first aid to casualties at an RTC and the Queensland Ambulance Service arrives, your role may change - in this case, you may be released by ambulance personnel to carry out scene protection. It is important to communicate throughout this process as you may be required to continue primary care and assist the ambulance crews.

Mentoring

Mentoring is the system used by RFS to:

- Share knowledge and information.
- Provide assistance and feedback in the safe completion of tasks to the standards set down in Standard Operating Procedures.
- Encourage and acknowledge the participation of firefighters.
- Provide support in the achievement of team and personal goals.



Mentors are effective team members who:

- Are experienced – know the job, can explain concepts clearly and answer protégé's questions effectively without being vague and evasive.
- Value learning – show how learning in one situation can be transferred to another situation.
- Are well organised and follow organisational and health and safety procedures.
- Provide good role models for new members.
- Are effective communicators – communicate clearly and effectively and take time to listen and respond to protégés – speak clearly and match body language to message.
- Can motivate members – have the ability to arouse interest and successfully maintain that interest through a combination of methods, resources and activities.

The primary responsibilities of a mentor are to:

- Give advice and information
- Clarify specific points
- Ask and answer questions as required
- Stimulate thought and discussion
- Provide encouragement
- Provide resources
- Assess performance and progress
- Provide constructive feedback
- Monitor progress
- Conduct practical demonstrations
- Provide coaching in practical procedures and/or skills
- Monitor safety at all times



Coaching

A mentor may act as a coach who helps others acquire new or additional skills and improve their performance. Senior firefighters can be appointed to mentor a new member as can an experienced volunteer. Coaching is used with members who need direction and supervision because of inexperience in some areas. It provides support and praise to build self-esteem and involvement in decision making and enables the experienced member to increase his/her commitment to doing a job.

Developing Respect & Trust

The development of mutual respect and trust is the first step in developing an effective relationship where the learning process is supported. If the individual abilities of each person are valued and used in a supportive way, the whole team benefits. By encouraging members to draw on their personal experience outside RFS, mentors can guide new firefighters not only to help identify team goals but also to make suggestions that could enable those goals to be accomplished more efficiently.

Punctuality is a function of respect. By ensuring you are on time for meetings and training events, you are showing you are interested and engaged with the team and the events being undertaken. If you know you are going to be late or unable to attend, notify a fellow team member or your team leader beforehand.

Team Meetings

The Brigade Management Rules define a general meeting as “a gathering of members at which officers and office-bearers are elected and brigade activities, including financial dealings, are discussed”. Rural Fire Brigades must hold brigade meetings to conduct business. Team meetings enable:

- Information to be shared
- Contributions to be made
- Goals to be developed
- Procedures to be refined
- Conflicts to be resolved



The Rural Fire Brigade Manual provides an overview of what the agenda should contain however every member has the opportunity to provide input. Many brigades function adequately without the need for a Management Committee and all the business of the brigade is conducted at an annual or biannual general meeting.

Firefighters and/or officers will also attend meetings with their Area Director to inform crews about changes to operational procedures, policies and equipment. Firefighters may also have a structured meeting at the start of the shift, where they are briefed by the outgoing crew and shift activities are organised.

Safe Person Concept

As a firefighter you also have your part to play in achieving the ‘safe person’s’ goal on the fireground. You have a responsibility to the organisation, yourself and fellow firefighters. You must be vigilant for your own safety so that colleagues are not directing their resources to assisting you rather than to managing the fire, and you must be vigilant for the safety of your partner and your crew. This is true teamwork.

The underlying principle of the safe person concept is that, in view of the unpredictable and hazardous nature of the fireground environment, support systems are developed to ensure the safety of individuals whilst still enabling them to react flexibly to unforeseen or changing situation. Those support systems encompass:

- Safe systems of work
- Training
- Equipment
- Information
- Personal protective equipment
- Supervision
- Personnel selection
- Recruitment and development

*We will risk our lives **a lot**, in a highly calculated manner, to protect saveable lives.*

*We will risk our lives **a little**, in a highly calculated manner, to protect saveable property.*

*We will not risk our lives **at all** for lives and property that are already lost.*

The ‘Safe-Person Concept’ along with training, work procedures and the provision of equipment are adapted to research findings that have been analysed by emergency services. In this way, the organisation continues to meet emerging standards of safety. Such flexibility supports the safety of all personnel, managing the dynamic risk involved with any circumstance or incident.

2.5 Sources of Information

Rural volunteers provide a depth and capacity that cannot be achieved through the number of paid firefighters. Through experience, research, training and practice, operational procedures have evolved, continue to be refined and are subsequently documented. While this knowledge is now being captured, it is under constant review, providing a high level of detail regarding what needs to be done and how it should be done to achieve the best outcome.

Operations Doctrine

The QFES Operations Doctrine (OPS DOC) is the organisational system for managing operational incidents. It features a number of components that combine to provide the principles and standards QFES has set toward incident management. All operational procedures, directives, guides and forms are guided by the Australasian Inter-Service Incident Management System (AIIMS), which will also ensure inter-agency consistency and effectiveness during multi-agency emergency and interstate incidents.

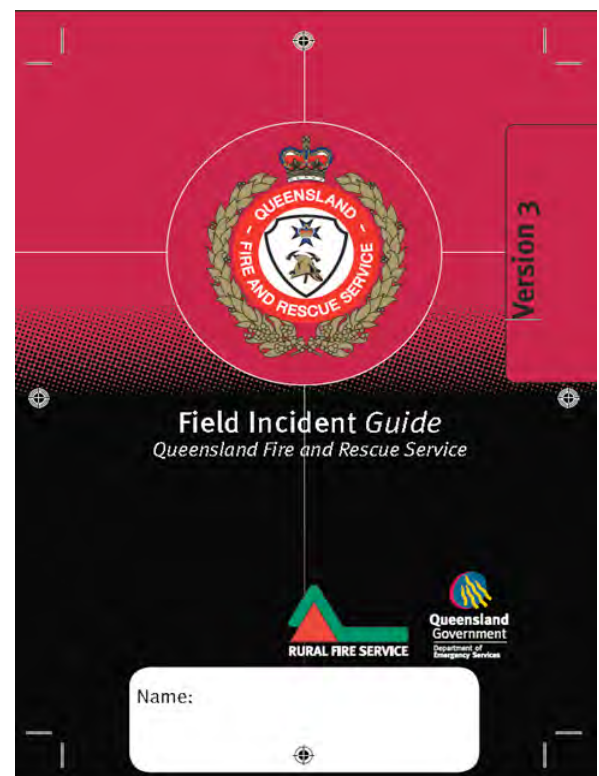
The Incident Management System (IMS) is the QFES application of AIIMS and provides the specific detail for managing incidents. Primarily this system details information on Command and Control processes and structures. Details include roles, terminology, incident classification and Incident Management Team (IMT) structure.

Incident Action Guides (IAG) address the various incidents, such as structural fires, that QFES personnel attend. Information includes specific hazards, tactics, and other considerations for the Incident Controller. The IAG provides a generic approach to incidents with the flexibility to account for the specifics that may be encountered at a given incident.

Incident Directives (INCDIR) are a rule of order and provide the organisation's direction regarding operational response issues. Many existing procedures will fall into this category. In addition, reference material will be supplied in this area such as Air Signals and HAZCHEM Code.

Incident Forms (INCFORM) include organisational approved incident management forms and checklists. Incident Worksheets provide a number of worksheets that can be used on the incident ground.

The Field Incident Guide (FIG) provides a summary of the relevant field information from the IAGs, IMS, INCDIRs, checklists and other helpful information for staff on the incident ground. The single pocket sized guide provides information for both Fire & Rescue and rural fire operations.



CHAPTER THREE

COMMUNICATIONS SYSTEMS & EQUIPMENT

3.1 Radio Communication Basics

Radio communication is the transmission of messages by electronic means, without the use of wires. It occurs when a message is transmitted via a radio operated by one person, and received by a radio operated by another person in a different location. Transmit is often indicated by the letters TX and receive is indicated by the letters RX.

In radio communications you speak into a microphone, which converts the sound waves of your speech into an electrical signal. This signal is transmitted via an aerial to create radio waves. Radio waves can be detected through a receiving aerial on another radio, amplified within that radio and converted back into sound waves through a speaker so you can hear them.

When a radio message is sent, your voice is converted into an electronic signal that is superimposed over the frequency of the radio waves being transmitted. The radio frequency carrying the signal is called the 'carrier wave' and the process of superimposing the signal onto the carrier wave is called 'modulation'. A radio receiver tuned to the same frequency can extract the signal out of the radio waves being received and convert it back to voice. This process is called 'demodulation'.

Radio Frequency

The full range of radio frequencies is called the 'radio spectrum'. Not all frequencies within the spectrum behave in the same way. These differences in behaviour mean that radios operating on different frequencies can have quite different types of performance. The frequency of a radio wave is the number of waves (cycles) per second passing a given point. Radio frequencies are described by a unit of measurement called a hertz (which equals one cycle per second).

Depending on the frequency band used, radio waves may travel more or less in a straight line, similar to light waves. They may be reflected by some surfaces, or undergo refraction depending on atmospheric temperature and humidity. The radio antenna size is an indication of the frequency band being used.

Frequency Band	Hertz
High Frequency (HF)	3-30 MHz
Very High Frequency (VHF)	30-300 MHz
Ultra High Frequency (UHF)	300-3000 MHz

Characteristics of VHF & UHF

The fundamental component of VHF and UHF radio transmission is the optical path. However, the characteristic of a VHF and UHF transmission is that the waves can be reflected off a solid object. This means that by moving around, you can establish an alternative path by reflected wave.

Three types of waves may make up a VHF and UHF radio transmission.

- Direct Wave - travels in a straight line from the transmitting antenna to the receiving antenna.
- Refracted Wave - bent by the effect of the atmosphere resulting in the wave travelling further around the curvature of the earth.
- Reflected Wave - similar to the direct wave but reflected or rebounded off a solid object such as a hill.

Line of Sight (LOS)

Radio transmission requires a clear path between antennas known as the 'line of sight'. To have a clear line of sight there must be no obstructions between the locations such as hills, buildings, or trees. Obstructions that can interfere with a visual line of sight can also interfere with a radio line of sight. The positioning of radios is critical in establishing communications. Generally the higher you can get, the greater the LOS and thus the better the chance of communicating.



Interference & Disruption

Transmission can be disrupted by heavy smoke, weather and other sources of electrical energy such as power lines and high energy output areas. Anyone using a frequency very close to the frequency allocated to QFES can also cause interference. This will be heard as conversation, clearly discernible and obviously coming from an outside source. Areas recognised as having severely degraded or radio RX/TX consistently are referred to as radio black spots. High terrain, tall buildings, tunnels, steel cladding or other power sources can be the cause of this situation.

Other areas where reception is intermittent or weak are referred to as being in a shadow. These areas need to be identified within each region so that staff will be aware of potential loss of communication with mobiles. The impact of smoke, dust, rain clouds and vegetation tends to reduce the range of the UHF signal more than an equivalent VHF signal. The reduced effect of the refracted wave combined with increased frequency also reduces the comparative range of UHF radios over VHF radios.

Loss of Radio Communications

The most common reasons include:

- Volume control turned down.
- Radio set on the wrong channel.
- Flat battery (particularly for portables).
- Equipment failure.
- Unit you are calling is out of range.
- Unit sited in a poor location.
- Radio turned off, not connected to power source, connection broken.
- Aerial not connected, connection broken, aerial broken.
- Signal strength reduced due to weather, interference, black spots.
- Crew injured or incapable of operating the radio.



When you experience a loss of radio communication, take the following actions.

- i. Check the radio controls including channel selection
- ii. Check the battery level indicator and change the battery if required
- iii. Shut down revolving lights to allow vehicle battery to be recharged.
- iv. Check the radio for damage and make sure the antenna is correctly attached.
- v. Assess the signal path over which the unit is operating.
- vi. Assess the unit site. Is there a more suitable location with less interference?
- vii. Is the equipment being used correctly? Read the manual or seek assistance.
- viii. If a unit cannot be contacted and there is a possibility of the crew being injured, take immediate action to check the situation.
- ix. If you cannot re-establish communications inform your First Officer, OIC or IC.

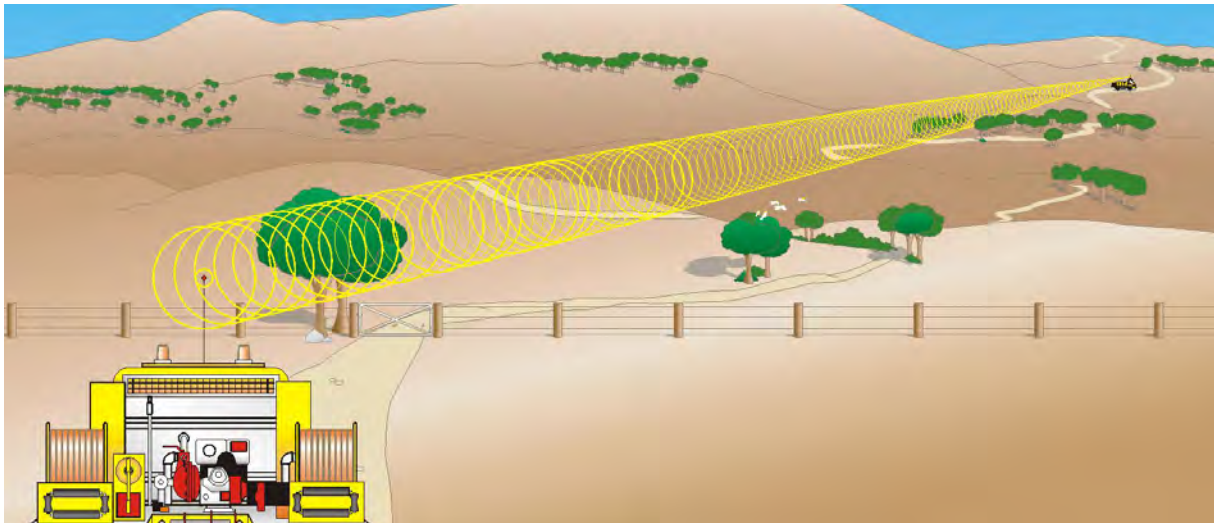
Transmitter Range

A radio has limited range however, the more powerful the transmitter, the further the range (within limits of LOS). Remember that radio waves travel in straight lines, although they can be reflected off some of the layers of the upper atmosphere or off some buildings. Because of this, radio reception is always best from a high, unobstructed location. If radio reception is poor move to a more favourable location, usually higher up or on the opposite side of a hill or building, before attempting to transmit.

3.2 Methods of Transmission

Simplex Systems

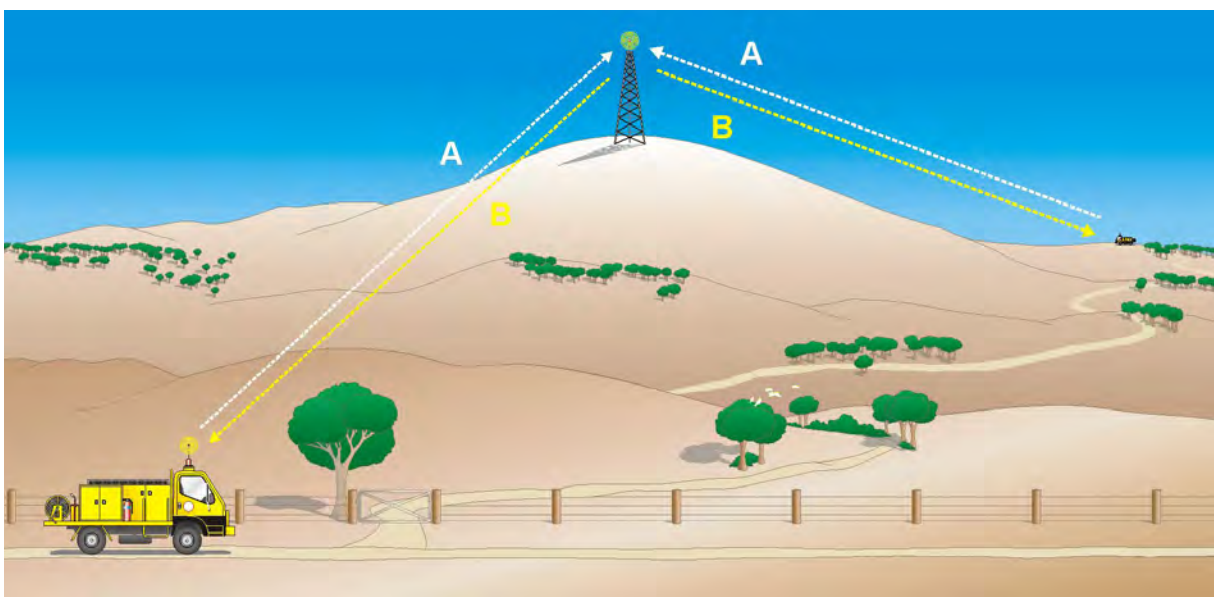
Simplex is communication between two parties using a single radio frequency, without using a relay or repeater. Hand-held portable radios are intended primarily for simplex use. Base stations and mobiles transmit and receive on the same frequency and all radios in a system can hear transmissions from all other radios. Two mobiles transmitting at the same time will cause mutual interference and two mobiles can engage the whole system and make it difficult for control. Because it limits the range of communication, this mode is usually reserved for localised incident or fireground operations (i.e. mobiles involved in the same incident).



Duplex Systems

Duplex is communication where transmission and reception occur at the same time on two separate frequencies. This action is possible by using device called a Talk Through Repeater (TTR). The TTR receives radio messages on one frequency and simultaneously re-transmits those messages on another frequency. Using a repeater can overcome one of the main disadvantages of VHF/UHF radios; line of sight limitations. A disadvantage of using a repeater is that if a repeater fails, none of the mobiles working through the repeater can talk to each other.

If one or both of two units are not in line of sight to the repeater station they will not be able to communicate, even though they may be in line of sight to each other. Communication between mobile units is not possible without repeaters because of the different transmit and receive frequencies. The following illustration shows base transmitting on channel A and receiving on channel B and mobiles transmitting on channel B and receiving on channel A.



3.3 Components of Transmission

Base Radio Systems

There are three base radio systems and any one, or a combination of several, may be used, depending on the location of the communications centre.

Local and Remote Control

The base radio and aerial are at a single location. The radio has both a speaker and a microphone and there may be remote control units in other parts of the building.

Remote Control via Landline

Used then the communications centre is in a poor radio reception area. The base radio can be relocated to a better position and a landline used to connect the base radio to the remote unit in the communications centre.

Remote Control via Radio Link

Used when the other two systems are not suitable. The base radio can be located at an elevated site away from the remote control unit. A radio signal links the remote control unit at the communications centre to the base radio.

Repeaters

Where the distance between two transmitting radios is too great for radio signals to be effectively sent and received, a repeater may be established. A fixed station is mounted on a tall building, tower, high point or mountain. This then allows the automatic re-transmission of radio communications received from any radio within range of the repeater. Mobile radios need to have a channel selected appropriate to their geographic location.

Voting Groups

In a voting system the signal from a radio is sent to all repeaters. The radio automatically selects or votes the repeater with the first signal that meets the required preset signal standards. The radio then transmits the signal via the selected repeater to its destination. Nominating a new channel that will scan a set of channels within a region, creates a voting group. This system enables a mobile unit to move over a larger area than usual without the radio operator having to physically change channels to maintain communication.

3.4 Radio Networks

There are two types of QFES radio networks. The first, a controlled network, allows brigades access to the Communications Centre (Firecom). A controlled network may also be established at a large incident to allow an Incident Management Team (IMT) to command effectively. The second, a non-controlled network, allows brigades to communicate on the fireground.



Controlled Network (Firecom)

Firecom can provide a link between units on the ground and additional resources from QFES and other agencies such as Queensland Ambulance Service (QAS) and Queensland Police Service (QPS). Access to the Firecom network is through a series of repeater stations, covering Queensland. Band plans have been predetermined at local, regional and state levels for adoption when IMTs are established at incidents. When QFES units are mobilised by Firecom, they are expected to maintain contact with Firecom throughout the incident with a series of calls over the network.

It should be remembered that the Firecom network should only be between the Firecom operator and the brigade. The Firecom channel is not to be used for communication between brigade units, except in exceptional circumstances and with permission of the Firecom operator.

Non-Controlled Network (Fireground)

Normal communications on the fireground are between brigade vehicles and between brigade vehicles and the brigade base station. Some brigades, however, may have access to a repeater on a fireground channel. Repeaters serve to extend the area of radio coverage, so are normally located in areas where communications are difficult. Many rural brigades in the central and western areas of Queensland, operate UHF Citizen Band fireground networks. Local arrangements apply for channel allocation and may vary depending on conditions and location.

Communication Plans

Coronial inquiries into large fire incidents have provided findings which indicate that poor communication on the fire ground is a major contributing factor to firefighter injury and death. To assist with radio communication at large incidents, QFES have developed Communication Plans for each region. As an incident grows in size and complexity so should a communication plan grow and provide a radio infrastructure to cope with the needs of personnel on the fire ground. The format for radio communication plans are the same for each region, however the area covered may vary. Each radio communication should contain a detailed map of the area covered.

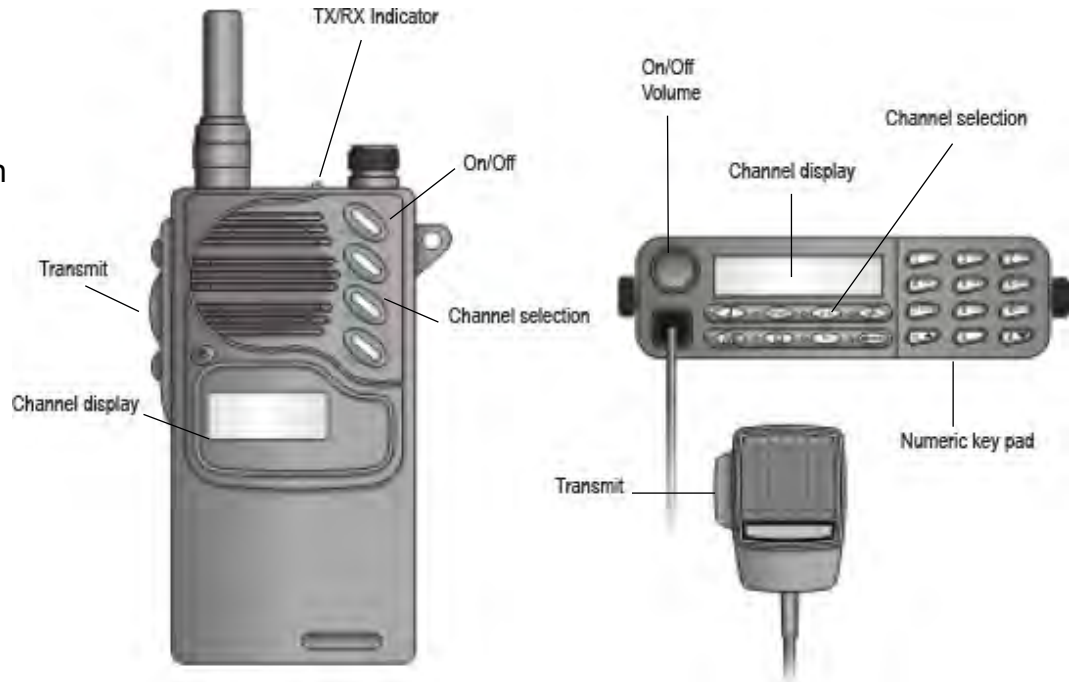
The plans will show, from a small, simple incident through to a large and complex incident, where personnel and resources are required. In addition, included in each communication plan is an alternate radio plan which provides additional radio channels for use when more than one incident is occurring at the same time in an area. You should discuss with your coach/trainer/mentor the use of the radio communication plans for your station or brigade area.



3.5 Communications Equipment

QFES recently purchased VHF and UHF radios from suppliers who provided several models of both mobile (vehicle-mounted such as Motorola, Simoco and Tait) and portable (hand-held such as Motorola, Simoco, GME and Tait) types. All radios, however, have the following controls:

- On – off switch
- Volume adjustment
- Channel selection
- Transmit button
- Mute/squelch switch
- Channel display
- TX/RX indicator



You need to become familiar with the type of equipment you are operating. This familiarisation will ensure a safe working environment not only for you but for the rest of the team. Regular testing of radios and other communications equipment is very important. If left unattended for a period of time, radios can become unreliable and may deteriorate due to dust or changes in weather, including humidity. This deterioration can reduce the operational life of the equipment.

It is strongly suggested that operators read the instruction manual provided with the radio before attempting to use the equipment. During brigade training and maintenance, members should become familiar with the controls on the mobile and portable radios.

Base Radio

Base radios are used by Firecom and some RFBs. Base radios have higher power or wattage output than mobile or portable radios. Operators of base radios are responsible for:

- Coordinating the exchange of information from mobile to portable.
- Controlling the use of the radio network.
- Maintaining radio network discipline relating to radio procedures and protocols.
- Keeping airways free from unnecessary chatter.



Mobile Radio

A mobile radio is mounted in a vehicle or appliance. The distance over which it can transmit is significantly shorter than that of a base radio. The position of the appliance with the mobile radio at the time of transmission has an effect on the distance of transmission to another appliance or base radio. An external speaker is fitted to this type of mobile radio. Some appliances have both an internal and an external system which ensures that firefighters can listen to relevant transmissions especially in the case of an emergency situation.

The aerial is generally dependant on a ground plain. A ground plain is the horizontal surface beneath the aerial. The highest possible aerial placement in the centre of the vehicle establishes the best possible conditions for transmitting and receiving. There is a 'no ground plain' aerial which is obviously not dependent on being centrally located. It does, however, still need to be located in an elevated position on the appliance.

Portable Radio

Commonly called hand-held radios, a portable radio is totally self-contained with its own aerial and power supply, enabling it to be carried from one location to another. Portable radios are normally used for portable-to-mobile or portable-to-portable transmissions. They are not designed for primary communications to Firecom. QFES issues portable radios to ensure that crews can maintain contact during fireground operations at incidents.

Mobile Phone

Mobile phone networks, where available, can provide crews with a means of contacting Firecom or their base station with information of importance. They are also useful for incident communications where radio networks can become clogged with multiple radio transmissions. Mobile phones offer the user more privacy with less radio interference.

Satellite phones are now becoming a useful tool in areas where conventional mobile networks are not present. They are not limited by the area of coverage of the mobile telephone system, as they communicate directly through an orbiting communications satellite.

Pager

A pager is a compact receiver that provides for one-way communication. Pagers are an effective form of communication, but in some systems delays can be experienced because messages sent by emergency personnel may not always have priority over others.



Equipment Maintenance

Regular radio testing checks are necessary to determine the operational readiness of equipment and ensure overall system integrity. Reference may need to be made to code manuals or manufacturers' user guides, specific equipment training notes and Standard Operating Procedures (SOPs). Selcall alerting is used by Firecom and is the process of activating a radio via its selcall (identifying code). Activation takes the form of a ring or other tone, or, if to a vehicle radio, a horn blast.

Poorly maintained batteries are a major cause of failure of portable radios. There are two types of cells used in the batteries supplied by the QFES – Nickel Cadmium (NiCd) and Nickel Metal Hydride (NiMH). When you receive a new battery for a portable radio, it is essential that you read the instructions to determine the correct charger to be used, the duration of the initial charge and the requirements for conditioning. Recommended actions are:

- NiCd - Use a timer to charge the battery two hours per day and ideally fully discharge and fully recharge once per week.
- NiMH - As for NiCd, but only fully discharge and fully recharge once per month.



WARNING

To avoid discharging the appliance battery, keep radio transmissions to a minimum when the appliance engine is turned off. Transmitting uses more power than receiving. You never know when you will need to move or relocate in a hurry.

3.6 Radio Procedures

The QFES radio network is established to allow personnel on appliances or other authorised vehicles to transmit and receive operational and administrative information. All QFES network users should ensure that the highest level of professionalism is evident at all times whilst assessing the network. Policies and procedures should not be compromised in such a manner as to cause any unnecessary burden to the organisation or any of its members.

All QFES radio communications network users should ensure that the Queensland Government Privacy Policy is not breached at any time. Privacy of individuals must be respected and network users must ensure that all QFES personnel identities are protected by using standard radio procedures. Information of a sensitive or identification nature, should be relayed to or from Firecom by other means such as mobile telephone, landline, or fax.

When making a transmission ensure the antenna is as high as possible and vertical (for a portable unit). Listen to determine whether anyone else is transmitting. Press the transmit button and pause for one to two seconds before talking. If the other station you are calling is not expecting a call from you, or you have not called them for some time, it may be wise to first make a call to establish communication, rather than giving your actual message straight away.

Speaking Techniques

It is important not to shout or scream into the microphone of the radio. Hold the microphone upright approximately a thumb's length or 100 mm away from the mouth, to the side, speaking across the microphone, not directly in front and adjusting distance to accommodate the normal level of your own voice. The memory jogger RSVP will help remind you of the most efficient way to use your voice when transmitting via radio equipment.

R RHYTHM

S SPEED

V VOLUME

P PITCH

- Rhythm - Speak naturally and in complete phrases that make sense. Speak with a natural rhythm and so not use speech fillers such as um, ah, and er.
- Speed - Speak steadily at a medium speed. Pause between phrases if the message is being written down.
- Volume - Speak slightly louder than in a normal conversation, but do not should. Do not allow your voice to fade away at the end of a message. Speak across the microphone and keep your mouth close and at a constant distance.
- Pitch - Pitch your voice a little higher than normal. Avoid dropping your voice on the last syllable of each word and at the end of a sentence.

Phonetic Alphabet

The phonetic alphabet is a set of internationally accepted words that clearly identify specific letters of the alphabet. The phonetic alphabet helps the operator spell out words where confusion is likely. To use the phonetic alphabet, follow these steps:

- Say the word.
- Say the pro-words "I spell".
- Spell out the word.

Use plain English spelling unless the following conditions exist:

- Radio conditions are known to be poor and when transmitting difficult or unclear words.
- The correct spelling is critical (eg Steven VS Stephen).
- Numbers and letters or single letters need transmission.
- The receiving station requests use of the phonetic alphabet.

PHONETIC ALPHABET					
A	ALPHA	J	JULIET	S	SIERRA
B	BRAVO	K	KILO	T	TANGO
C	CHARLIE	L	LIMA	U	UNIFORM
D	DELTA	M	MIKE	V	VICTOR
E	ECHO	N	NOVEMBER	W	WHISKEY
F	FOXTROT	O	OSCAR	X	X-RAY
G	GOLF	P	PAPA	Y	YANKEE
H	HOTEL	Q	QUEBEC	Z	ZULU
I	INDIA	R	ROMEO		

Numbers & Times

Standard numerical terminology as spoken in a normal conversation is permitted on the QFES network with the exception of numbers used in Standard Incident Codes. The twenty-four hour clock is used for all transmissions of time to reduce the risk of error. This system automatically differentiates between AM and PM. Firecom personnel will use the twenty-four hour clock time to end a series of transmissions.

Prowords

Prowords are words commonly used over a radio network that have an accepted meaning. The use of standard pro-words means that all users, including members of other agencies, will be able to communicate effectively. Using prowords can reduce the time spent on the radio at an incident and mean quicker and more effective actions. The most commonly used prowords and their meanings are shown in the following table.

PROWORD	MEANING
FIGURE (NUMBER)	Used before every group of figures in a spoken message except before call signs, time and map references
I SPELL	I shall spell the word phonetically
OUT	The transmission has ended and I do not expect a reply
OVER	The transmission has ended and I expect a reply
RADIO CHECK	This is my signal and readability check
ROGER	I have received and understood your last transmission
GO AHEAD	I am ready to receive your transmission
THIS IS	Used in conjunction with a radio call sign to identify the caller
MORE TO FOLLOW	Breaks long transmission
ALL AFTER	Recommence long transmission after break
SAY AGAIN	Repeat the words/message

Hazmat Information

HAG form information must be read slowly and clearly. When Firecom personnel have received sufficient information to identify a chemical, the following information will be transmitted to the officer in charge:

- Substance name
- UN number
- HAZCHEM code
- APP code
- HAG numbers
- Plain language HAG text



Standard Incident Codes

Standard incident codes are a form of abbreviation for use by fire service personnel to minimise on-air time by users of the QFES radio network. When used as intended, codes enable the radio network to cope with a higher level of radio traffic when multiple incidents are in progress. Codes should not be used to replace vital information in situation reports when a definitive explanation is required to describe action being taken. Firecom centres use an abbreviation of the codes for transcribing instead of the word code.

Code Red Procedure

Code Red procedure is used during heavy radio traffic to allow the transmission of messages which are considered to be life critical in nature. Code red will normally be initiated by a mobile unit but can only be declared and lifted by the Firecom centre. 'Red Red Red' is an interruption device and indicates that a mobile unit or the Firecom centre has a critical message and requires clear access to the network. All other units are to cease transmitting. 'Code Red' is initiated by the Firecom centre and is an instruction to all mobile units to maintain radio silence until the code red procedure is lifted.

Radio Logs

All communications to and from Firecom are recorded at Firecom. It is important to listen to Firecom's 'repeat back' of the information you provide and check that the details have been heard correctly. At major incidents communications to and from the Incident Management Team (IMT) are logged. When recording messages, you must be aware that accuracy and speed are very important.

General Principles

- All radio users should be familiar with particular brigade radio equipment.
- Check your channel selection prior to making a transmission.
- Listen first to ensure no transmissions are in progress. Do not try to override another transmission.
- Think before speaking.
- Know who you want to contact and the message you want to transmit.
- Speak clearly and use short, concise sentences ensuring information is accurate.
- Use correct terminology and follow procedures.
- Do not interrupt, unless initiating a Code Red procedure.

3.7 Radio Call Signs

Call signs are assigned to all QFES Communication centres, appliances, support and senior officer vehicles. Call signs should be used at the initiation of all radio transmissions as a means of identification. Communication centre call signs consist of 'Firecom' followed by the region name of the communications centre.

Fire & Rescue Stations & Appliances

Fire & Rescue stations are numbered uniquely within each region from 1-99. The naming convention for Fire & Rescue appliance call signs is the region identifier (1-9), followed by the station number and an alpha character to identify the type of appliance.

PRIMARY ROLE	APPLIANCE TYPE	ALPHA IDENTIFIER
Pumper	Rescue Pumper	A-B
	Pumper	C-D
	4x4 Pumper	E
	Hazmat Pumper	F
Pumper	Turntable Ladder	G
	Hydraulic Platform	H
	Ladder Platform	I
	Telescopic Aerial Pumper	J
	Spare	
Rescue	Emergency Tender	K
	Technical Rescue	L
	Command & Rescue Unit	M
	Spare	N
Hazmat	BA & Hazmat Response Unit	O
	BA Support Unit	P
	Hazmat Support Unit	Q
	BA & Hazmat Support Unit	S
Comms	Command & Control Unit	T
	Communications Unit	U
Specials	Tanker	V
	Foam	W
	Facilities Unit	X
	Light Attack	Y
	Spare	Z

Rural Appliances

Rural appliance call signs are allocated to each brigade appliance, support vehicle, command vehicle or transportable firefighting equipment, to identify the attending Brigade, the type of appliance or vehicle and the type of the mobile firefighting equipment transported. The naming convention for rural appliances call signs is the Brigade name followed by a numerical identifier to identify the type of appliance, vehicle or mobile equipment.

PRIMARY ROLE	NUMERICAL IDENTIFIER
RFB Base Radios	1 - 14
Firefighting Trailers	15 - 24
Mop-Up Units	25 - 29
Light Appliance	41 - 47
Medium Appliance	51 - 57
Heavy Appliance	61 - 67
Water Tanker	70 - 80
Support Vehicles	81 - 89
Command Vehicles	91 - 99

3.8 Standard Messages

Standard radio message procedures are established to provide uniformity and understanding to all users of activities taking place, and provide efficiency in radio use when reporting all aspects of operations. All QFES radio network users should be familiar with any Operations Doctrine pertaining to Incident Management. Additional information can also be found by referencing the organisation's Radio Procedures Handbook. All personnel must adhere to standard messaging to ensure that transmitting time is brief, allowing for easier access for all users. All personnel should be trained and regularly exercises in the use of standard messages.

Response Message

The Officer-in-Charge is to transmit a response message advising Firecom that the mobile unit is going to the incident and the type of response - respond or proceeding Code three zero. Firecom centres may transmit a firecall message to advise mobile units that they have urgent firecall information to transmit. In addition, a firecall message can also be transmitted by mobile units to prepare Firecom centres to receive new incident information. Firecom must ensure that location details are correct and that the details are confirmed by the mobile unit.

Arrival Message

The Incident Controller of the first arriving appliance is to transmit an arrival message to Firecom. The arrival message will contain the appropriate arrival code to describe initial incident observations. The arrival code for all subsequent attending appliances will be Code eight.

Assistance Message

The Incident Controller may request additional assistance such as equipment, personnel, and other agencies. The assistance message is to include the relevant GARS level and sufficient detail to ensure that the appropriate resources are dispatched with minimum delay including the need to any external resources.

Informative Message

Informative messages or situation reports provide succinct information about the state of an incident and the action being taken. This information ensures the relevant Firecom centre and senior officers are fully informed of current incident conditions. As soon as practical a primary descriptor of the incident should be relayed to Firecom. Primary wordback should include all known descriptors of an incident. Follow-up reports are to occur after crews are tasked and the officer-in-charge has completed a size-up.

Firecom centres may provide advisory advice to responding mobile units that more than one call has been received regarding the incident in question. This will normally be passed using the proword 'multiple calls'.

Modes of operation should be included in the message for all incidents, except technical rescue. Secondary informative messages should occur progressively (approximately every 20 minutes) or as the situation changes. Situations other than regular updates, that require the transmission of an informative message include, but are not limited to the following:

- Injuries to members of the public or QFES personnel.
- A search or rescue is being instigated.
- Primary/secondary search complete.
- Persons reported missing have been accounted for.
- An under control message is transmitted to Firecom when the situation is under control.
- A stop message is transmitted to Firecom when all resources are on scene.
- Any situation that may endanger the public or personnel.
- Any situation where community warnings or information may need to be delivered.

CHAPTER FOUR

EXTINGUISHING MEDIA & EQUIPMENT

4.1 Heavy Machinery & Aircraft

Bulldozers, graders and other earth-moving equipment can be sourced from rural property owners and heavy construction industry when needed for the control and suppression of fire. Government based and private fixed or rotary winged aircraft can be acquired when aerial support is needed. These resources are invaluable in identifying the size and location of fires to support and assist ground operations. In rural areas, aircraft may also be used for dropping aerial incendiaries used to contain a wildfire within designated firebreaks.

Fire spotter aircraft are used for obtaining incident intelligence, sending accurate mapping details to ground crews, and performing reconnaissance of known fire prone areas during days of high wildfire alert level. Fixed wing bombers can deliver large amounts of water or foam to the fire in quick succession, which allows ground crews time to plan and extinguish fires. Rotary wing bombers (helicopter) can also deliver large amounts of water or foam quickly with the advantage of being able to land in remote and inaccessible areas.

4.2 Hand & Power Tools

There are four basic applications for hand and powered tools:

- Constructing fire control lines and fire breaks.
- Controlling a backburn from a fire control line or fire break.
- Containing a fire.
- Patrolling a fire.

Rakehoe

This tool is primarily used for the construction of fire control lines, up to one metre wide. Armed with rakehoes, six firefighters using the 'step-up' method can construct a firebreak one metre wide to bare earth in eucalypt fuel. The rakehoe is also referred to as the McLeod tool and can be used for chipping fire control lines, raking litter, scraping bark from tree trunks, rolling and dragging burnt timber, and smothering a fire with dirt or sand.

It consists of two parts, the head and the handle. The handle is long to enable the operator to keep away from the fire and heat as far as possible. The head has two working sections. The rake consisting of four to six prongs with which to rake and remove flammable material aside to produce a bare earth break. The hoe consisting of a sharp cutting edge to enable larger sticks and roots to be cut and chopped, or clump vegetation (grass, trees) removed from the break width.

When working on the fireground you should always work from a safe anchor point and ensure you wear correct PPE at all times. When moving around carry the rakehoe in your hand at the side of your body, keeping the side of the rake facing you. Hold the rake on the downhill side grasping the handle just above the metal head. Keep a safe working space between crew members and do not chop too close to feet. Keep the head tight on the handle and check the handle periodically for splinters or cracks.

The rakehoe can be used in the direct attack method (on the burning edge) when the fire intensity is low. Always rake the material back into the burnt or burning area. This prevents any cinders or burning material from being spread into unburnt or protected area. It can also be used in a parallel or indirect attack method where you are sufficient distance from the fire edge and it is your intention to carry out backburning in conjunction with constructing a fire control line. Always rake the material back to the side opposite the fire. This ensures an even fuel load, which will prevent flare-up as the flames reach the edge of the fire control line.



Brush Hook

The brush hook can be used for initial clearing of scrub to prepare for crews cutting fire control lines, clearing a large area for the safe siting of tankers and crews, and scraping bark from tree trunks. Care must be taken to keep a safe distance from other firefighters when using the brush hook. Watch for swing back of branches when clearing scrub/woody plants. Wear correct PPE including eye protection.

Axe

The axe can be used for felling trees, removing tree branches and limbs, cleaning bark from trees, and breaking open burning logs/stumps. Along with the rakehoe and brush hook, the axe is used in dry firefighting techniques.

Knapsack Sprayer

Knapsack sprayers come in a range of shapes, sizes and operation modes. Water is your most precious commodity and if you are to carry it on your back to a fire then it must be used with great efficiency. In fire suppression, the use of knapsack sprayers is usually confined to mopping up, blacking out an edge and direct attack on low-intensity fires. Knapsack sprayers consist of a tank, pump, trigger valve and wand, and adjustable nozzle.

The tank is usually constructed of plastic, brass or vinyl and holds up to 20 litres. It is carried by two shoulder straps. The pump is mostly bucket plunger operation built either into the tank compartment or into the wand. Those built into the tank usually allow a build-up of pressure to be attained and released at will via the trigger control valve. Those with the pump installed into the wand demand continuous manual exertion to provide a water jet.

The wand and trigger control valve is used to direct and control the flow of water under pressure. Some trigger valves have in-built filter screens. The nozzles fitted are usually adjustable (flat fan to hollow cone to straight jet) depending on the desired spray pattern. The spray pattern should be adjusted to suit or to ensure free movement. When using knapsack sprayers always work in pairs and ensure you wear correct PPE at all times.

Start from the lower intensity flank side, using this as your anchor point. Work from inside the burnt area and direct the stream at the base of the fire. Avoid using water on anything that could be raked to a safe location. Do not use water on anything that is too large for the volume of water you carry as this will easily deplete your supplies. Be situationally aware and monitor the amount of water remaining in the tank. Before entering the fireground check for leaks and make sure the tank is full. Do not over pressurise the unit or waste large quantities of water on small cinders.

Drip Torch

This tool is used solely for the controlled lighting of fire and consists of a body, filler cap, wand and extension lock, nozzle and wick, bleed screw/breather vent, and sometimes a tap. Every care should be taken when using the drip torch to ensure that it is not waved around or carried carelessly. Burning fuel splashed or dropped can light up an area being protected.

The body or reservoir is made of aluminium alloy, contains the flammable mixture used for ignition. The body holds four to nine litres of fuel. The most common drip torch fuel is a formula of three parts diesel and one part unleaded fuel. Some manufacturers, however, recommend a fuel formula two parts diesel to one part petrol. Always refer to the manufacturer's specifications (located on the filler cap or body of the drip torch) for the correct ratio.

The wand transfers the fuel from the body to the nozzle and wick for ignition. Care should be taken to ensure there are no leaks between the body and wand. If there is a leak, seat a rubber 'O' ring in the base of the retractable wand then fix the wand to the body and tighten firmly. The nozzle controls the flow of fuel to the wick which is soaked with fuel. The bleed screw/breather vent is provided to ensure an even and constant flow as the unit is used almost inverted. Care should be taken to ensure the vent is tightly closed on completion of the operation to prevent spillage during transit.

The control tap is fitted to most drip torches. As with the breather vent, the tap can be used to control the fuel flow and to prevent spillage. A drip torch should be used only when it is safe to do so and then only by experienced personnel under the instruction and supervision of the Incident Controller or First Officer. When the drip torch is in use, a constant flow of fuel keeps the wick alight. Make sure that you use the manufacturer's recommended fuel ratio which is located on the filler cap or body of the drip torch.



To use the torch, follow these procedures:

- Open the bleed screw (breather vent) a quarter turn and turn on the tap.
- Tilt the unit to soak the wick with fuel.
- Return the unit to the upright position on a level surface and ignite the wick.
- Carry in the upright position to point of lighting.
- Lower the wand towards the ground, adjusting the bleed screw to allow fuel to flow past the ignited wick to ignite the ground fuel.
- Raise wand again to vertical position to stop lighting ground fuel.
- When operations are completed extinguish the flame and turn off the tap or lower the retractable wand (if fitted). Close the air vent before stowing and remember to stow the drip torch in an upright position.

When a drip torch is used in backburning activities, the flame that is lit is expected to head towards the main fire. You need to ensure that your fire will meet the wildfire sufficiently in from the lighting edge. Also ensure that you are adequately advanced to prevent the wildfire approaching the control line ahead of you.

4.3 Pumps

A pump is a mechanical device that is used to impart energy to a fluid. Firefighting pumps not only create pressure, but in some cases, reduce pressure within the casing so that the atmospheric pressure will push water into the pump before it is energised and delivered as an effective firefighting stream. The two types of pumps used in the QFES are centrifugal and positive displacement.

Centrifugal Pump

A centrifugal pump uses a rotating impeller to increase the pressure of a fluid. One of the main characteristics of a centrifugal pump is that it cannot pump a gas, it is strictly a liquid pump. For it to work the pump casing must be flooded with water. This is known as priming the pump.

A centrifugal pump cannot prime itself without the assistance of gravity or mechanical assistance from an ancillary pump known as the primer. The primer, which is a positive displacement pump, removes air from the pump casing so atmospheric pressure can force water into the pump casing achieving a prime. The centrifugal pump has many characteristics which make it attractive for firefighting purposes such as:

- It has very few moving parts.
- It requires little maintenance.
- It is small, lightweight and compact relative to output.
- It can be driven directly from an internal combustion engine.
- It is capable of running against closed deliveries.
- It can pump small solid objects such as grains of sand without causing damage.



Positive Displacement Pump (Priming Pump)

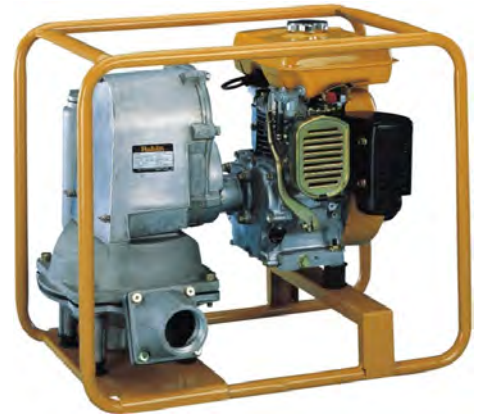
Diaphragm Pump

The diaphragm pump consists of a metal housing that bolts together to capture and seal a rubber diaphragm within the housing. Attached to the centre of the diaphragm is a top plate and a plunger rod that passes out through a hole in the housing to allow connection to a handle. Diaphragm pumps are used on rural appliances as one method to prime the centrifugal pump. Other methods of priming the pump are:

- To gravity feed water from the on board supply provided that supply is above the pump height.
- Unscrew the bung on the top of the pump outlet, pour water onto the pump casing until full then reinsert the bung.

Movement of the rubber diaphragm in a forward and backwards motion by means of manual operation of the handle causes air to be discharged through the discharge valve and be replaced through the inlet valve. If the inlet valve is connected to a static water supply, continued operation of the handle will cause all air to be discharged and eventually replaced with water via the inlet valve.

If a suction hose is connected to the centrifugal pump inlet, and the strainer end inserted in a water supply, the operation of the diaphragm pump will draw water up the suction hose to the centrifugal pump and then fill the whole system with water. On all appliances the primer pump is plumbed into the system to allow full operation simply by turning on a flow valve. Once the system is fully primed then that valve must be turned off before pumping water.



4.4 Hoses & Fittings

The three main types of fire hose you may use on the fireground are suction, hose reel, and delivery hoses. Hoses require specific care and maintenance to ensure long life. Avoiding running them over hot, sharp or abrasive objects and do not subject hoses to sudden increases in pressure. Avoid dropping them or putting strain on couplings. Thoroughly flush and clean all hoses after use, then store them in a clean dry condition out of direct sunlight.

Suction Hose

A suction hose conveys water to a pump when taking water from a tank, dam or river in a process called draughting. This action is required when a pump is usually situated in a position higher than the water supply. A suction hose is reinforced to withstand external pressure so that it will maintain its shape and not collapse when the pump is draughting water. A strainer is connected to the end of the suction hose to prevent solid objects from entering the pump.



When working with a suction hose, you must be careful not to puncture it. A hole in the hose or leaking coupling seals means it will not be able to maintain sufficient vacuum to draw up the water.

Hose Reel Hose

A hose reel hose is a lightweight, flexible hose usually stored on the revolving drum of a 'live' reel (a hose reel able to supply water without disconnecting the hose). It is reinforced to withstand internal pressure (sometimes very high) and covered with an abrasion-resistant outer layer. Hose on a 'live' reel is permanently connected to the appliance's pump.



A hose reel hose can be used at an incident when it is necessary to take a line of hose quickly to a fire using the available water supply on the appliance. It can also be used for the rapid deployment and delivery of water or when rapid retrieval of the hose is important.

Delivery Hose

A delivery hose is used for conveying water from pumps or hydrants to where the water is needed. It is designed to withstand internal pressure. This hose is also used as a supply line from the hydrant to the pump. The types of delivery hose often used in rural firefighting are:



- Percolating (unlined) - This hose is constructed so that when charged (full of water) it continually emits droplets of water, offering protection from burning and scorching when the hose is in contact with heated materials and embers.
- Non-percolating (lined) - This hose does not absorb water. An internal lining of rubber or plastic prevents water seepage. Non-percolating hose is susceptible to hot materials and embers.

Hose Couplings

Couplings are fittings used for connecting two lengths of hose together, or a piece of equipment to a length of hose. The most common couplings are:

- A. Queensland Round Thread (QRT)
- B. Storz (hermaphrodite)
- C. Camlock
- D. British Instantaneous Coupling (BIC)

You should treat couplings with care because damage may cause air leaks. When working with these couplings, you should:

- Never drop or drag them along the ground.
- Tighten them at the joints using the correct size spanner.
- Individually inspect their seals for wear.
- Not treat them with lubricants.



A



B



C

D



A. Queensland Round Thread (QRT)

In Queensland, Fire and Rescue appliances and couplings have traditionally been of the QRT type and as many of the Fire & Rescue trucks are now used by Rural Fire Brigades, you need to be familiar with this type of coupling. Even if your brigade does not have an ex-Fire & Rescue appliance, you will attend incidents where both Fire & Rescue and rural brigade equipment are used together, and you may have to deal with the QRT coupling. Make sure that all the threads and washers are in good condition and carefully align fittings before joining. QRT couplings are either male or female, with female used on the pump inlet (suction) and male on the pump outlet (delivery).

B. Storz

Instantaneous Storz couplings are progressively being introduced for the delivery hose. They are hermaphrodite (neither male nor female) and so are much quicker to connect as either end of the hose may be connected to the pump or nozzle. Ensure that the sealing washers are in place and that they have not been damaged. Storz couplings can be used on suction hoses provided that the appropriate seal is used.

C. Camlock

Camlock fittings are also often used with a suction hose. Ensure that sealing washers are in place and both locking levers are positioned flush to the side of the fittings to ensure an airtight seal. These couplings also exist as male and female, so you need to be aware of each type and how they join together.

D. British Instantaneous Coupling (BIC)

British Instantaneous Couplings are not used in QFES situations but they are the couplings used in the aeronautic firefighting areas such as Brisbane airport and RAAF Amberley, as well as other airport and defence establishments.

Adaptors

An adaptor is made up of two couplings of a different nature, joined together; for example, a Storz coupling joined to a QRT coupling. This means that the Storz end of an adaptor of this type can join to a hose fitted with a Storz coupling while the QRT end of the adapter can connect to the hose fitted with a QRT coupling.

Adaptors like this may be necessary when water is to be transferred from rural to Fire & Rescue appliances or vice versa. An adaptor is thus used to overcome the problems of connecting couplings or hoses fitted with dissimilar couplings. The Storz-QRT adaptor is the most common in the RFS. Adaptors are important pieces of equipment for brigades, especially those which border on urban/rural interface areas.

Branches & Nozzles

Branches and nozzles come in various types and sizes. They provide you with a range of options for delivering water at a fireground. It is important to select the branch and nozzle most suited to a particular task. A nozzle is a fitting that is used with a branch to control the size, pattern and/or velocity of water or extinguishing medium being discharged. A separate nozzle may be fitted to the end of a branch, or the branch and nozzle may be a combined unit.

A branch is fitted at the end of a delivery hose to allow water or other extinguishing medium travelling through the hose to form an effective firefighting jet or spray. It is used to control and direct water at a fire. Most branches are fitted with controls to allow you to control the flow of water and the stream pattern. Some types of branches may be operated to supply a lot water curtain and a jet at the same time.

Most variable branches are capable of being shut off at the branch and some have a pistol grip that makes them easier to operate. These branches operate at different pressures and the manufacturer's specifications should be consulted. Modern branches may be fitted with nozzles that are automatic or have a selectable flow rate called 'select-a-flow'. Fixed flow branches may also be used as they are rated foam-making equipment.

When using a branch, it is essential that you hold it correctly. This will reduce fatigue, prevent accidents and ensure efficient and effective firefighting. Pumps working on too high a pressure will always make branch handling difficult.



Protek Branch



Dial-a-Jet Nozzle

Hydrants & Standpipes

Hydrants are devices that allow you to connect a hose or a standpipe to a water main. Above ground hydrants work on the principle of a screw valve being operated to control the flow of water. The most common above-ground hydrant is the Millcock. The most common below-ground hydrant is the Ground Ball Hydrant (ball valve). Hydrants are situated at regular intervals along mains. You can use hydrants to supply water to a fire appliance or supply water to a branch via a hose. In some cases, you will need to use a hydrant key or spanner.

A standpipe is a portable piece of equipment used to bring the outlet of a below ground hydrant to above ground level. Once you have raised the outlet, you can connect a hose to the standpipe outlet. When you use a standpipe, be aware that because the hydrant is below ground, it may be full of dirt and debris. Dangerous wildlife such as spiders and snakes may also hide under a hydrant cover. Be alert to syringes that may be placed in the hydrant pit. At night, use a torch to inspect the hydrant box before putting your hand in to remove the hydrant blanking cap. When operating a hydrant you should:

- Flush the hydrant to remove debris before connecting a hose.
- Open the valve slowly to prevent water hammer and damage to the hose, especially if the hose is connected directly to the branch.
- Close the valve slowly to prevent water hammer or a possible burst water main.

In addition, when operating a below-ground hydrant that requires a standpipe you should:

- Clear debris from around the hydrant lugs and sealing ring.
- Be alert for broken glass, syringes, spiders and snakes in the hydrant pit.
- Before inserting the standpipe, ensure its threaded collar is screwed completely down, the washer is in place and the hand-wheel or spindle is turned completely up.
- Insert and secure the standpipe into the hydrant lugs and tighten by turning clockwise.
- Flush the standpipe before connecting any hoses.
- After use check the hydrant is properly closed so that there are no water leaks, and that the hydrant pit is left clean of debris.

Do not disconnect the standpipe from a hydrant if water is unavailable, or the flow has failed, until the valve has been closed. This removes the danger of the valve remaining open when the supply is restored.



Above-Ground Hydrant



Below-Ground Hydrant



Standpipe



WARNING

When shipping a standpipe into a hydrant, do not stand over the standpipe. Kneel on one knee with your head to one side of the standpipe. This will protect you from any pressure release or equipment fault that may occur.

4.5 Water

Water, the most common and readily available of the extinguishing media, is undoubtedly the greatest weapon we have in the fight against fire. Economic use of water is the key to efficient fire suppression. Water is available for firefighting primarily from two sources; reticulated supplies (water mains or pipes), and static supplies (dams, rivers, tanks). In rural interface areas, there are a number of townships where reticulated water supplies are available; in some cases, the pressure may be reliant on pumping systems.

Water is used to cool the fuel, reducing the heat and breaking down the chemical reaction causing the fire; however, a large fire may call for a large volume of water. It is the size, location and intensity of the fire that will determine the strategies and tactics employed, and thus the equipment needed to deliver the water. If more than one rural fire appliance is in attendance at the incident, the Incident Controller might set up a relay system of bringing the water through connecting lines from one rural fire appliance to another.

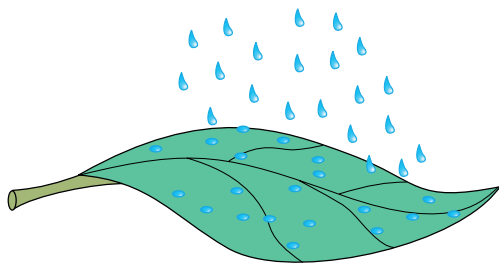
Conserving Water

When working on a fireground, plan your activities carefully to avoid wasting water.

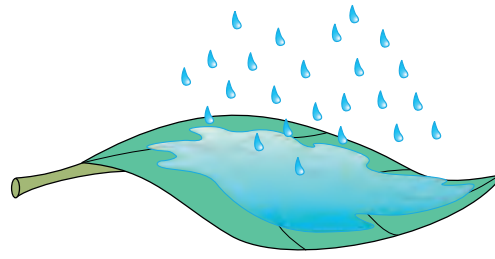
- Use an appropriate hose and always select the smallest nozzle that will do the job effectively.
- Shut off the nozzle when water is no longer required.
- Use a jet stream for initial knock down but then change to spray so that water covers the greatest possible area (or combination of a jet and a back-up spray).
- Direct water at the point where it will have the maximum effect; that is, at the base of the burning fuel and not the flames.
- Where appropriate, use additives such as foam or wetting agents to make the water more effective.

Wetting Agents

These are chemicals that, when added to water, reduce the surface tension of water causing it to spread out and cover a greater area. The use of a wetting agent will mean more economical use of water. Wetting agents allow water to be spread and vegetation to be covered with greater ease. Perhaps more significantly, these agents allow the water to penetrate deeper into the organic composition of the vegetation. Take care when using wetting agents that have an adverse effect on the environment, particularly around bodies of water.



Without Wetting Agent



With Wetting Agent

Jet Stream

A jet is an unbroken stream of solid or hollow core liquid projected from a nozzle. When water is projected through a specially designed nozzle, a jet is formed. The distance that a firefighting jet travels before breaking up or dropping is called its projection. Projection is important when it is difficult to approach close to a fire. In a direct attack a jet is used to establish a break in the fire edge. In a tree fire, a combination of jet and spray is used on burning material at the base of a tree. If this is not done, heat from the base of the tree will reignite material on the trunk.



Spray Pattern

The spray nozzle or variable control branch breaks the water stream into small droplets. These small droplets have a much larger total surface area than a jet and thus a greater capacity to absorb heat. A given volume of water in a spray form will absorb more heat than the same volume of water in a jet. The absorption of heat converts water to steam and extinguishes the fire by reducing the heat, and to a lesser extent, by smothering the fire.



Fog Pattern

A fog is an extremely fine spray of particles of water forming a mist. Fog covers a larger surface area than water spray and maximises the effective use of water. Fog minimises the damage to property and provides protection to firefighters from radiant heat. It enhances the rate at which water is converted to steam, removing more heat than a spray pattern. However, fog has a shorter reach and will not cool hot objects unless it is applied directly onto them. Fog can be affected by wind and can impede firefighter visibility.



4.6 Foam

Foam is a blanketing and cooling agent. It consists of a mass of bubbles made from a mixture of water, foam concentrate and air. It is used when water alone would not be effective or appropriate in firefighting. Foam extinguishes fire by:

- Shielding fuel surfaces from the radiant heat from the adjacent flames.
- Cooling the fuel and isolating it from the oxygen in the air.

Class A Foam

Class A foam, also called bush firefighting foam, is used in wildfire suppression and property protection. It is especially formulated for use on Class A type fires in natural fuels such as grass, forest litter or wood. This foam:

- Lowers the surface tension of water, allowing it to penetrate fuels more easily.
- Clings as bubbles to vertical surfaces, reducing waste through run off.
- Is visible when applied, allowing firefighters to avoid under or over application.
- Enables fires to be put out more efficiently.
- Maximises heat absorption properties of the water.

Class A foam is produced by mixing Class A concentrate with water to form a solution. The solution is then aerated to form a large quantity of foam bubbles. A concentration of 0.1% to 3.0% commonly applies; experience, practice and experimentation at training events will enable you to select the appropriate ratio for the fuel types in your brigade area. The foam can then be applied to a fire through a spray nozzle or special foam-making nozzle, or it can be spread by aircraft.

Foam should be applied to a fire as gently as possible, ensuring uniform coverage. It can be sprayed onto buildings to help protect them from an approaching fire, or applied on scrub or the trunks of trees near the edge of a control line just before lighting a backburn. Foam is also particularly effective in mopping-up work.

Class A concentrate is a powerful detergent which can remove skin oils. Drums of this concentrate should be handled very carefully. The lids or caps should remain properly sealed to prevent spillage or splashing. You should wear gloves, eye protection and long sleeves when emptying containers of Class A concentrate. Wash your hands and face after using the foam.

When using Class A concentrate, be aware of possible environmental contamination. The concentrate should not be handled near, or allowed to enter creeks or rivers. Do not drink from tanks into which Class A concentrate has been placed or which have been used to store Class A concentrate.



4.7 Retardants

Wildfire retardants are chemical substances mixed with water to inhibit combustion. They are applied to vegetation lying in the path of a wildfire. The aim is to reduce the intensity of the fire and slow its progress. The effectiveness of a fire retardant depends on factors such as:

- Type of retardant.
- Amount of retardant applied.
- Length of time for which the retardant will stay effective.

Retardants can be applied from tankers with pumping equipment, but generally they will be dropped from aircraft. The retardant is applied to slow the rate of spread of the fire/reduce the fire intensity. This gives firefighting ground crews time to reach the area involved and begin fire suppression activities. Retardants have an environmental impact that needs to be considered. Some simple safety guidelines when working with foam, wetting agents, and/or retardants are as follows:

- Ensure that firefighting equipment is flushed out to eliminate residue build-up.
- Follow the manufacturer's recommendations on safe handling and clean-up after use.
- Always wear appropriate PPE when handling storage containers.
- Do not drink water mixed with foam, retardants or other wetting agents.
- Refer to information located on Safety Data Sheets.
- Ensure any spills are cleaned-up immediately and reported to your First Officer.

CHAPTER FIVE

PREPARE, TEST & MAINTAIN EQUIPMENT

5.1 Operational Readiness

Response equipment may be defined as the full range (or inventory) of equipment you use to do your job. Within QFES, documents known as a DUCOT (Description, Use, Construction, Operation, Testing) have been developed for the response equipment used by firefighters. It includes, but is not limited to:

- Personal Protective Equipment
- Vehicles and Appliances
- Trailer and Slip-on Units
- Communication Equipment
- Hand Tools
- Power Tools
- Pumps
- Hoses and Fittings



Inventory Checks

It is very important for your safety and effectiveness to carry out an inventory check at the beginning of each shift or training session, and after an incident. Conducting an inventory check involves accounting for items on an inventory list and making sure they are where they should be. All brigades should have an inventory list of their equipment close at hand (including details of where equipment is stored).

The main purpose of the inventory check is to see if anything is missing. If you notice an item is missing during your inventory check, you should inform your First Officer or the Equipment Officer. This action may result in a log entry and a new piece of equipment being ordered. If you notice that a piece of equipment has been sent for repair, service or replacement, or has been out of stock for a long time bring it to the attention of your First Officer who will make the appropriate enquiries.

Safety Precautions

Accidents generally happen through negligence, lack of preparation or insufficient knowledge/training. As with all activities in your workplace, whether routine or at an emergency, you must follow proper safety procedures. Most importantly, you must take reasonable care for the health and safety of others at work who may be affected by your actions or omissions. This means that when operating or checking equipment that others may use, you must do your best to ensure its correct and safe operation.

If you notice anything that is not operating correctly, you must see that it is rectified. Procedures for reporting faults are covered later in this module. You will find specific information on the safe operation of equipment in manufacturers specifications and operators manuals, QFES equipment manual, standard procedures and guidelines, and training materials.

-
- Dress correctly for the job (gloves, protective goggles, helmet, etc).
 - Lift and carry items safely following appropriate manual handling techniques.
 - Use the proper tools and equipment to do the job.
 - Keep work areas as clean and uncluttered as possible.
 - Store flammable materials safely and check for potential fire hazards.
 - Make sure work area is well ventilated.
 - Do not attempt to repair any electrical equipment. Electrical equipment must be repaired by a licensed electrician.
 - Take care when operating equipment in the vicinity of others.
 - Shut machinery down completely before working on it.
 - Inform other people about what you are doing and where you are working.
 - Put up warning notices where appropriate.
 - Call in a licensed electrician on an annual basis to have fuses, wiring and fittings checked.

Machinery Safety

The range of machinery and tools available today for undertaking maintenance is endless and certainly makes general maintenance easier and quicker. It is important to keep the maintenance equipment in good repair. Careless use of this equipment can make it dangerous, even lethal. You can help avoid accidents by paying attention and guarding against your clothing or limbs becoming entangled in the machinery. The following are some likely causes of accidents associated with handling tools or machinery.

- Trying to adjust power tools or machinery while it is in operation.
- Operating equipment/machinery near flammable liquids.
- Smoking or the presence of naked flames near the machinery.
- Not making others aware that machinery is being operated/repaired.
- Not following safety precautions or not using safety equipment (such as guards).
- Not disabling the power source or ignition prior to repairing machinery.

Hazardous Materials Safety

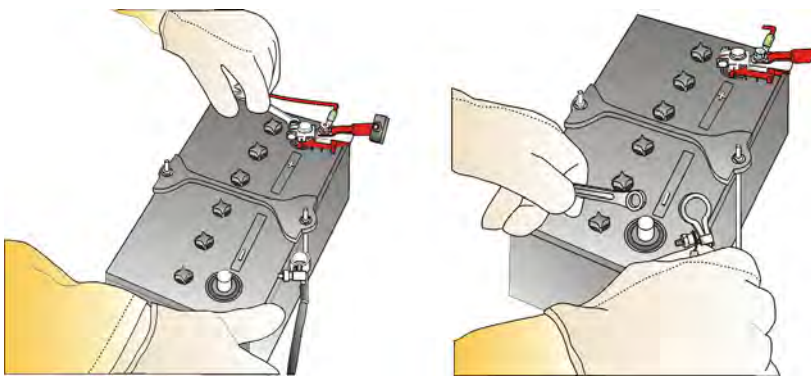
Many products alone are dangerous in some manner. Other products can become dangerous when combined with something else. Dangerous materials are required by law to have special labels; check all labels before handling. By law, suppliers must also furnish a Safety Data Sheet (SDS) with every hazardous product they supply. The SDS gives you such safety information as the components of the product, any hazards or dangers, advice on handling and usage and any personal protective equipment needed when handling the product.

Fuel Safety

Fuel containers should be clearly marked to avoid confusion. Use the coloured fuel tags on issue from your Area office. Tag all fuel jerry cans to minimise the risk of the wrong fuel being used. E10 fuel is not to be used in small engines with rubber hose lines. The upper limits for bulk fuel container storage in or outside sheds are petrol 250 litres and diesel 2000 litres. If both petrol and diesel are stored, the maximum combined storage quantity must be less than 1000 litres.

Battery Safety

- When fully charged, batteries hold a great deal of electrical energy. If you are careless, you may experience severe shocks or burns.
- Be extremely careful when handling battery acid (sulphuric acid which is highly corrosive. This will burn through clothing and skin and can even cause blindness.
- Always protect your eyes and remove any metal from your arms and hands (watches, rings).
- Gases given off by batteries are highly volatile and toxic. Be aware of any fumes escaping. Wear a protective mask to minimise inhaling any gases.
- Check to ensure there are no defects in the battery case.
- Make sure there are no naked flames or sources of ignition in the vicinity when you are handling batteries – the fumes emitted by the batteries are flammable and the shorting of terminals can also cause an explosion.
- When replacing an old battery, ensure the positive (+) terminal and the negative (-) terminal are placed at the correct poles.
- Ensure that the negative terminal is the first to be removed and the last to be fitted. This will reduce the possibility of a direct short across the positive terminal and earth.
- Ensure the terminals are sufficiently tightened.



Vehicle Safety

- When checking or servicing the engine compartment, be sure the engine is switched off and has a chance to cool down.
- If required, tilt the cabin and lock into position before commencing work in the engine compartment as per the manufacturer's instructions.
- If it is necessary to do work in the engine compartment with the engine running, be especially careful that your clothing and hair does not become caught by the fan, belts, or other moving parts.
- In damp conditions, be aware of high voltage shock from wet leads under vehicle bonnet.
- The fan may turn on automatically even if the engine is not running. Turn the ignition switch to the "LOCK" and remove the key to ensure safety while you work in the engine compartment.
- Do not smoke as it may cause sparks or allow open flames around fuel or the battery. The fumes are extremely flammable.
- Be extremely cautious when working around the battery. It contains poisonous and corrosive sulphuric acid.
- Do not get under your vehicle with just the body jack supporting it. Always use automotive jack stands or other solid supports.
- Improper handling of components and materials can endanger your personal safety.

Reporting & Recording Faults

Records are essential to establish what has been done and what remains to be done. The amount of maintenance completed versus that needed reflects the effectiveness of your brigades maintenance programs. Reports can provide valuable information on the effectiveness of maintenance. Reports can also help identify improvements needed in the system, as well as directing attention to practices that may be causing unnecessary wear and tear on equipment. It is important that defects are corrected within a reasonable time frame.

To report faulty or defective equipment:

- Identify the fault through inspection or testing.
- Inform your First Officer or the person responsible for the equipment (for major faults do this immediately).
- Attempt to determine what repair is required; it could be a minor repair that could be carried out in-house.
- Remove faulty equipment and replace with spare equipment where available.
- Tag faulty equipment and send it away for repair.

Each item identified for repair should be tagged with an appropriate label which details the fault. When a piece of equipment is sent for repair, details should be logged in the appropriate register. When you do establish the register, transfer the information. Identification labels should be used to keep track of equipment that is sent for repair. Serviceable equipment returned after repair should have a serviceable label attached.

5.2 Maintenance Process

The maintenance process must be carried out according to QFES procedures and equipment records should be updated according to brigade procedures. Maintaining equipment means performing routine preventative maintenance so that the equipment functions to optimum standard. This could include:

- Replacing/replenishing consumables
- Lubrication checks
- Pressure checks
- Fuel and water checks
- Sharpening
- Flushing

Your first task is to identify and locate the equipment that requires maintenance. You must then obtain QFES procedures and other relevant information about the equipment. This means you may be required to gather operating guidelines, procedures, manuals, policies, and safety information. Manufacturers' instructions on vehicle and ancillary equipment are supplied with all new vehicles and usually stored in the glove box. Where manuals have not been supplied, contact your Area Office.

Inspect

An inspection is when you look at, listen to or touch specific items to identify any obvious physical anomalies. For example, burred threads, broken vehicle lenses, discolouration or missing parts, deteriorating washers, fractured components. The following is a list of useful questions to consider when inspecting equipment and vehicles. They can assist you with the identification of potential problems.

- Is the item present?
- Is the item stowed in the correct location?
- Do I need to consult other sources of information?
- Does it appear to be unsafe for any reason?
- Will it serve the purpose it was designed for effectively and efficiently?
- Does it have all parts?
- Are all the screws, bolts, nuts, washers, rivets, split pins secure?
- Are handles secure?
- Is the handle free of splits, splinters, sharp or protruding edges?
- Are any pieces perished or missing?
- Are cutting edges/jaws sharp and set correctly?
- Do all moving parts move freely as designed?
- Is the item worn to the extent that it will impair proper functioning?
- Are any threads damaged?
- Do batteries, globes, or other consumables need replacing?
- Are there signs of stress fracture?
- Are fuel, oil and fluid levels correct?
- Is the item clean, free of vegetation, rust and excessive grease or grime?
- Is the first aid kit complete and all items within their use-by date?

Test

Testing involves operating equipment to ensure that it is working properly and safely. For example, ensuring that all lights are working on the vehicle and checking hoses for leaks or deterioration. It is essential to the effectiveness of any emergency response that vehicles and equipment are in operational condition at all times. Your safety and that of your crew and the public you serve depend on it. The most efficient way of ensuring that equipment is in an operational condition is to combine an inspection with a test, where appropriate.

Maintain or Service

Servicing consists of heavy technical maintenance of equipment and is usually done by technicians, mechanics or specially trained persons rather than general firefighters. Vehicle operational readiness checks are to be performed as required (at least annually) to ensure that all appliances, including slip-ons, are safe and ready to use in operational situations. An annual station inspection is required in line with legislative and departmental policy.

Clean

Depending on the type of equipment, cleaning may include removing dirt and residue, washing, polishing, and/or decontamination. As cleaning often involves the use of chemicals, mild or otherwise, all cleaning tasks must be undertaken in accordance with recognised procedures and the regulatory requirements regarding OHS.

- Closely follow instructions on labels.
- Don't mix products.
- Store cleaning products in correct and approved containers.
- Safely dispose of unlabelled products.
- Do not use cleaning products for practical jokes.
- Wear appropriate personal protective equipment.
- Refer to supplied safety data sheets.



Accidents generally happen through negligence, lack of preparation or insufficient knowledge/training. Some equipment and machinery is made up of many different pieces or parts, all of which can present opportunities for accidents. Considering safety when you are preparing for maintenance can prevent potential dangers.

When washing vehicles or equipment, you need to be aware of any environmental regulations in Queensland, such as the Environment Protection Act 1994, and Environment Protection (Water) Policy 1997. These regulations will normally prohibit activities that cause polluted water to run into stormwater drains, so you need to prevent detergents and other pollutants from entering stormwater drains when washing vehicles and equipment.

If the vehicle or equipment is not contaminated with grease, oil or chemicals it may be washed at any location using water only. If detergents are used consideration could be given to carrying out the cleaning at another site such as a local truck or bus company, as site with water treatment facilities, a site with commercial washing facilities, or a grassed area.

Restow

Some general guidelines on where to locate small items of equipment are:

- All equipment should be stowed securely such that it won't fall out or off the appliance even when moving over rough terrain or cornering at speed.
- All equipment should be stowed so that it can be accessed safely. You should not have to climb over things or be at risk from sharp or hot objects to get at equipment.
- Equipment which is likely to be needed urgently should be the most easily and quickly accessible.
- Items needed enroute should be stowed in the cabin, such as torches, maps, etc.

5.3 Equipment Maintenance Procedures

Hoses & Hose Reels

Hose reels require periodic maintenance. Apply grease or oil (depending upon the design) to the main shaft. Check the mounting frame, reel ends, swivel joint, locking device and handle, as these are all items that wear rapidly due to the weight of the hose, volume of water contained within the hose and fatigue caused by rough terrain and vehicle vibration.

Suction or delivery hoses provide the most versatile methods of water transfer. A delivery hose is designed to withstand pressure from within and the suction hose from without. A suction hose should never be used as a delivery hose. Maintenance is the same but is less critical for the delivery hose. A small hole or loose connection on the delivery hose would mean that you lose some water and pressure and you would get somewhat wet. With a suction hose, a small hole or loose connection would stop you cold. Air will always be drawn in before water, causing cavitation. Air won't extinguish a fire. A suction hose relies on an airtight seal to work effectively.

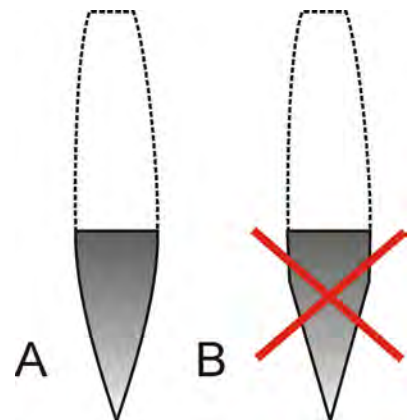


Hand Tools

Hand tools need to be ready for use. They need smooth handles and sharpened blades where applicable. Sharpening can be done with a flat file and smoothing of wooden handles with sandpaper. Care should be exercised when using a file to sharpen tools. Sharpened blades must be protected to avoid blunting the blade or cutting yourself. You can do this by covering the blade whenever the tools are being stowed or carried. When carrying hand tools, carry them parallel to the ground and close to your body.

Sharpening an Axe Blade

Sharpen with a file and stone. Sharpening as in Figure A leaves the cutting edge with sufficient support to withstand the most vigorous use. Do not sharpen as in Figure B. Many new axes usually require reshaping for maximum efficiency (removing the majority of the shoulder).



Fitting an Axe Handle

Do not use heat to remove the old handle as this could soften the cutting edge of the axe. All handles are easier on the hands if lightly smoothed with sandpaper. Once the handle has been removed use a rasp to reduce the new handle until it is a snug fit inside the head and square off the toe of the handle as shown. Drive the head onto the handle by striking the toe of the handle (do not drive the head on by striking the head with a hammer). Then drive the wedge firmly into the handle.

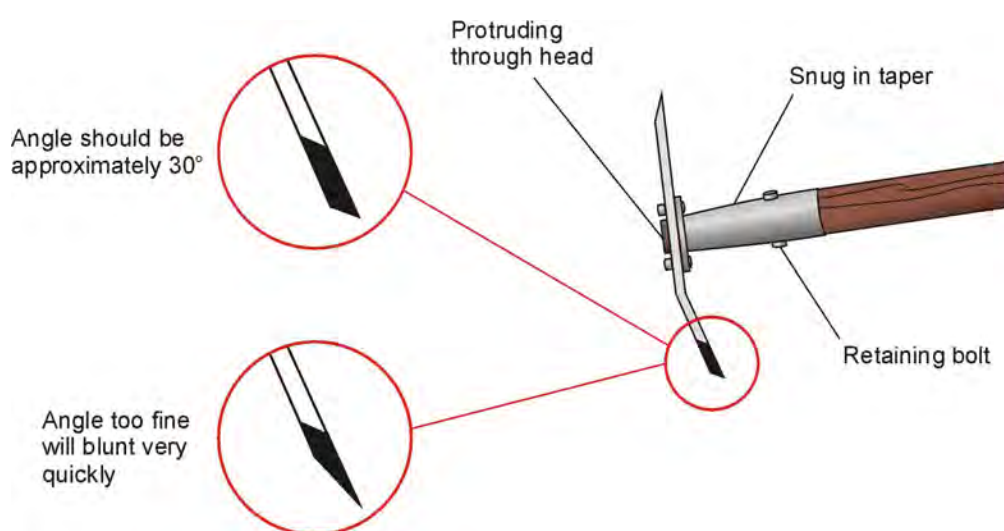
Sharpening a Rakehoe Blade

Because a rakehoe is used for chipping, cutting or scraping, the blade must be sharpened to allow for such usage. As with axes, a blade sharpened at too fine an angle will easily be damaged and the tool will be useless. 30 degrees (included angle) is a sensible angle for the edge of a rakehoe. Sharpen with a file or stone.

Fitting a Rakehoe Handle

Handles for rakehoe normally require some rasping down before they will fit the head.

- Ensure that the tapered section is rasped evenly and that there are no ridges or flats. Any unevenness may cause the handle to 'work' in the head and become loose.
- Make sure that the handle fits snugly in the head. A correctly fitted handle will normally protrude slightly from the end of the head.
- Ensure that the retaining bolt is fitted through the completed tool.

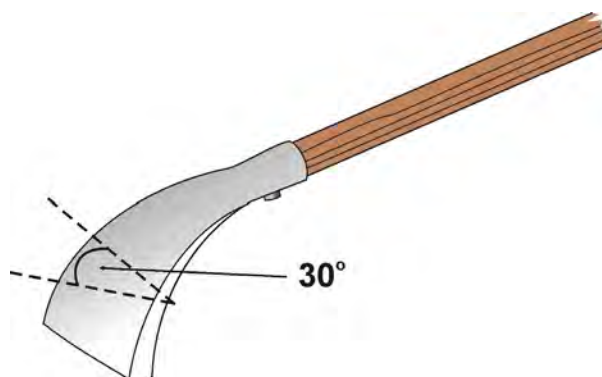


Sharpening a Brush Hook Blade

Brush hooks should also be sharpened with a file or stone and it is simply a matter of following the angle ground by the manufacturer, making your angle slightly less than the machine-ground edge.

Fitting a Brush Hook Handle

Fitting a handle to a brush hook is normally straightforward as the handles are machined to the correct taper. Some light rasping may be necessary. Check that the handle fits well down into the butt of the hook and that it is a snug fit. Use the correct size of retaining bolt through the completed tool.





WARNING

Never use a file without the correct safety gear. You should always sharpen hand tools with a file or sharpening stone. A power grinder may be faster but you can easily soften the steel as a result of generated heat. If you have not yet learnt how to sharpen a tool, seek assistance or pass the task on.

Knapsack Sprayer

Ensure the knapsack operates correctly and the shoulder straps are sound. Ensure it has no major leaks and the nozzle can be adjusted. Lubricate all brass fittings and check the general cleanliness inside the tank and out. Thoroughly clean knapsacks after using any wetting agent as they can be corrosive. Knapsacks should be stored in a secure, upright and easily accessible position.

Drip Torch

Due to the variety of drip torches that are in service in the QFES, it is recommended to refer to the manufacturers specifications for the fuel mixture ratio. Ensure that the fuel control cap and filler cap are screwed on tightly. Ensure the bleed screw is closed and the drip torch is stored upright on a flat surface. The wand should be sitting vertical. Examine the drip torch to ensure that the unit is clean, the wick is serviceable, there is a sufficient fuel supply and all moving parts move freely.

Power Tools

Refer to the manufacturers' manuals for maintenance of power tools. Inspect the power cord for cuts and damage. Inspect the tool for missing parts including safety guards and cracks or defects. Inspect blades for looseness or dullness. Check oil and fuel levels are adequate and the correct fuel mixture has been used. Never wear loose jewellery or clothing. Wear PPE such as goggles, hearing protection and face masks.

Portable Radio

Maintenance checks of radio equipment are covered in Chapter 3. If you detect a fault in a radio take the following actions:

- Attach a label to the faulty equipment.
- Note the fault or problem on the label.
- Advise brigade members of the fault.
- Contact Firecom to arrange for repair.
- Advise Area Office if replacement is necessary.

Attention should be given to the rectification of any equipment deterioration before complete failure of the radio occurs, placing an active fire crew at serious risk.



5.4 Vehicle Maintenance Procedures

Firefighters can carry out some inspections, while others should be done by a qualified person. This section describes only those inspection/maintenance procedures that you can do yourself, if appropriate. Points requiring routine inspection or replenishment such as the engine oil, coolant, automatic transmission fluid, brake fluid are marked white or yellow for easy identification. Follow the instructions and cautions for each of the various procedures. Inspection checks should be carried out on each of the following vehicle components:

- Fuel, engine coolant, oil and exhaust gas leakage
- Exterior and interior lamp operation
- Meter, gauge, indication/warning lamp operation
- Tyres
- Hinges and latches
- Parking brake
- Batteries
- Air filter
- Brakes and brake fluid
- Clutch and clutch fluid
- Steering and drive shaft
- Electrical system
- Body and tray
- Winches
- Tanks
- Windscreen wiper bottle
- Pumps and motors



Fuel, Engine Coolant, Oil and Exhaust Gas Leakage

Look under the body of your vehicle to check for fuel, engine coolant, oil and exhaust gas leaks. If leaks are evident, take your vehicle to an authorised dealer for inspection. Fire & Rescue personnel take vehicles to area mechanic. When checking fluid levels be sure to check the engine oil, auto-transmission fluid, and engine coolant. Manual transmission fluid levels are checked by an authorised dealer during a service.

Engine Oil

It is important to check the oil level at regular intervals (at least weekly). Oil checks must be made with the engine warm but not running. Park the vehicle on a level surface, stop the engine, and then wait a few moments to allow the engine oil in circulation to return to the oil pan to ensure accurate measurement. Remove the dipstick and wipe it with a clean cloth. Reinsert the dipstick as far as it goes. Remove the dipstick and read the oil level, which should always be within the range indicated.

If the oil level is below the specified limit, remove the cap located on the cylinder head cover and add enough oil to raise the level to within the specified range. Be sure to use the specified engine oil with the correct SAE viscosity number according to the atmospheric temperature. Do not mix various types of oil and avoid mixing different makes of oil if possible. After adding oil, close the cap securely.



WARNING

Prolonged and repeated contact with used engine oils may cause serious skin disorders including dermatitis and cancer. Avoid contact with the skin as much as possible and wash thoroughly after contact. Keep out of reach of children.

Engine Coolant

Check the radiator prior to starting up the engine - every time. With older vehicles, ensure that the radiator is filled to the appropriate level. With newer vehicles, ensure that the reservoir tank is topped up. Follow the vehicle manufacturer's operating guidelines. If the engine has overheated, allow it to cool naturally over two hours without removing the radiator cap. Sudden removal of the radiator cap could result in scalding from escaping hot water or steam.

When checking the radiator level, whether at operating temperature or overheated, cover the cap with a cloth before attempting to remove it. Press down firmly and turn slowly anti-clockwise to the first notch until the pressure is released. When the pressure is fully relieved, press down and turn still further anti-clockwise until the cap can be removed. In the case of an emergency, it is possible to remove the cap and refill the coolant system as follows. Doing this will place you at serious risk of harm.

Do not add cold coolant to an engine that has overheated; allow the engine to cool for five minutes then top-up the radiator (slowly, over several minutes) while running the engine to provide circulation of the coolant. This will avoid cracking of the cylinder head or block. Fill the radiator first then top up the reserve tank. Spillages of the radiator contents may cause stains. Wash spills away with clean water. Overheating or excessive use of coolant should be investigated by your authorised dealer.

Due to the aluminium content of the engine fitted to your appliance, it is recommended that you observe the following to minimise corrosion in the system.

- Use approved coolant at the correct concentration by mixing with demineralised water only. Avoid the use of tap water whenever possible.
- To prevent dilution of the coolant in the system, always add a premixed solution when radiator top-up is required.
- Drain, flush and refill with a fresh coolant solution every 45,000km or 24 months.
- Do not contaminate the coolant system with proprietary additives or antifreezes. This may result in incompatibility which can produce corrosion.

Exterior and Interior Lamp Operation

Operate the light switch and combination switch to confirm that all lamps are functioning properly. If the lamps do not go on, the probable cause is a blown fuse or defective lamp bulb. Check the fuses first. If there is no blown fuse, check the lamp bulbs. For information regarding the inspection and replacement of the fuses and the lamp bulbs, consult the electrical section of the vehicle maintenance book.

Meter, Gauge and Indication/Warning Lamp Operation

Run the engine to check the operation of all meters, gauges and indication/warning lamps. If there is anything wrong, take the vehicle to an authorised dealer for inspection.

Tyre Condition

Check for damage on the tread and side walls. The inside walls of dual-wheel vehicles (that is, the inside of the outer and outside of the inner) should be inspected for any possible damage. Dual wheels are notorious for picking up large stones that become wedged between the duals and either abrade or fracture the tyre walls, or are often thrown out forcefully, possibly at the vehicle behind.

Check tyres for wear as uneven wear can indicate an alignment or steering problem. Check tyres, including the spare, for minimum legal tread depth. The thickness of a matchstick is usually considered the minimum allowable. All tyres should have 3mm of usable tread depth. Check for any loss of wheel weights or unusual tyre bulges. Check wheel rims as damaged safety rims may allow the tyre to deflate. Wheel nuts/studs should be firm, but not over-tightened. Loose nuts or studs will cause severe damage to the rims or loss of the wheel completely.



Batteries

The most important part of the appliance electrical system is the battery. If the battery is not used it will discharge itself with time. Check the battery once every four weeks and charge with low current as necessary. Run the vehicle engine regularly to ensure that the battery is kept fully charged. Regular inspection and care of the battery are especially important in cold weather.

You should never disconnect the battery while the engine is running or the ignition switch is on. Doing so could damage the vehicles electrical components. First switch the ignition off then disconnect the negative terminal followed by the positive terminal. When connecting the battery, again ensure the ignition is turned off then connect the positive terminal followed by the negative terminal.

Keep the terminals clean and tight. After the battery is connected, apply terminal corrosion protection spray. Dirty or corroded terminals can be cleaned with a solution of baking soda and water or just water. A light spray of battery terminal corrosive protector will help to prevent corrosive build-up. Do not use petroleum jelly as this will affect the voltage to the electrical components.

Do not smoke or use an open flame near the battery; doing so could ignite the explosive gas generated by the battery. The battery electrolyte is extremely caustic. Do not allow it to come in contact with your eyes, skin, clothing or the painted surfaces of the vehicle. Spilled electrolyte should be flushed immediately with ample amounts of water. Irritation to the eyes or skin from contact with electrolyte requires immediate medical attention. If the battery is to be quick-charged, first disconnect the battery cables.

Hinges and Latches

Check all latches and hinges, and lubricate if necessary by first cleaning and then applying multipurpose grease.

Parking Brake

Pull the parking brake lever all the way up to check the number of clicks that the ratchet makes. One click represents a lever movement of one notch. The lever should move the specified number of notches for normal brake application. The parking brake lever stroke should consist of 3 to 5 notches. If the parking brake lever stroke is not within the standard range, have the brake lever adjusted by an authorised dealer.

Air Filter

The air filter has one role and one role only - to ensure pure air for the engine, contributing to the life expectancy of the engine. In the case of paper elements, remove the trapped dust by gently tapping the base of the element on a flat surface to release dust from the membranes. Heavy vehicles usually have pre-cleaners on the air intake pipe. To service, simply remove, empty, wipe out and replace. Remember that any dust allowed to enter the engine will destroy it. Keep it out! Ensure that the air filter is clean and undamaged.



Never use an air compressor to blow out dust particles. The air pressure will damage the fragile paper, tearing holes and allowing dust particles to pass through the engine cylinder chamber. In some vehicles, oil bath filters trap the dust in the oil. The oil must be changed regularly, the bowl washed out with petrol or cleaning fluid and the bowl re-filled to the level mark with a light engine grade (SAE-30).

Electrical System

Ensure that electrical systems are working. Check all lights including head, parking and clearance, tail, brake and indicators. Don't forget those frequently overlooked items like the windscreen washers and wipers, the heater/demister/cooling unit, spot or working lights, and revolving lights.

Brakes

Note any change in braking efficiency. If possible, change drivers occasionally. The regular driver may not have picked up changes that occurred gradually over a long period. If you find that you have to 'pump' the brake pedal, there is air in the line and you need to bleed the brakes. If the pedal sinks gradually to the floor, there is a leak or the master cylinder cups are worn and need to be repaired or replaced.

To test brake free play stop the engine, depress the brake pedal several times, and press down the pedal with your fingers until initial resistance is felt. This distance should be within the specified range (3-8mm). If the brake pedal free play is not within the specified range, have it adjusted at an authorised dealer.

Brake Fluid

The fluid level must be between the MAX and MIN marks on the reservoir. The fluid level falls slightly with wear of the brake pads, but this does not indicate any abnormality. If the brake fluid level falls markedly in a short length of time, it indicates leaks from the brake equipment. If this occurs, have the vehicle checked by an authorised dealer.

The brake fluid is hygroscopic (able to absorb moisture from the air). Too much moisture in the brake fluid will adversely affect the brake equipment, reducing the brake performance. In addition, the brake fluid reservoir is equipped with a special cap to prevent the entrance of air. This cap should not be removed unless necessary.

Take care when handling brake fluid as it is harmful to the eyes and may also cause damage to painted surfaces. Wipe up any spilt fluid as soon as possible. Use only specified brake fluid and refer to the “Lubricant Chart” if available. (Avoid mixing different brands if possible as a chemical reaction could result.) Normally, keep the reservoir tank cap closed to prevent the brake fluid from deteriorating.

Clutch

The clutch fluid in the master cylinder should be checked when performing other under-hood services. Check to make certain that the clutch fluid level is always between the maximum and minimum markings on the fluid reservoir and refill the fluid if necessary. A rapid fluid loss indicates a leak in the clutch system, which should be inspected by an authorised dealer and repaired immediately.

Always use the fluid listed in the Lubricant Chart, avoid mixing fluid brands, and never add any mineral-based oil. To test clutch free play press down on the clutch pedal with your fingers until initial resistance is felt. This distance should be within the specified range (6-13mm). If the clutch pedal is not within the specified range, have it adjusted at an authorised dealer.

Steering and Drive Shaft

Steering system ball joints, tail shaft, universal joints and spline should be greased at service by an authorised dealer. Check the power steering fluid level in the reservoir while the engine is idling. Unscrew the reservoir cap. The level gauge is attached to the bottom of the cap. The fluid level should be between the maximum and minimum lines on the level gauge.

Body and Tray

The inspection can be done quickly to check for any loose body mounting bolts, chassis cracks or body damage. Check that all bolts and mountings are secure, doors open and close easily, the side and tail gate won't fall off and mudguards and bull bars are intact. If fitted to your vehicle, winches should be periodically serviced. Pay particular attention to any frayed sections as fraying wire rope can be extremely dangerous. Rope connections at the winch and hook must be secure. Spliced joints are not allowed on vehicle winch ropes.

Windscreen Washer Fluid

Refill the windscreen washer bottle with clean water, adding windshield washer solvent if so desired. Never use household detergents as damage to the washer motor may result.

Tanks

Maintenance on tanks depends on the type, composition and protective measures taken during manufacture. Check the outside of the tank for damage, especially the anchor points. Steel cracking may occur under rough terrain conditions or simply from being over-tightened or fatigued through age. Check the inside of the tank for signs of rust, baffle plates coming loose, and foreign objects. Check the mounting bed of the tank. Ensure it is sitting flat and the nails are not warped or worn. Check for any protruding bolts or loose items under the tank that may cause damage.

5.5 Pump Maintenance Procedures

The pump together with its motor is one of your most important pieces of firefighting equipment and as such must be maintained regularly. All pump motors are to be checked for oil, water, cleanliness of air filter, condition of muffler and spark arrestor. Where it is relevant, the packing glands are to be checked for tightness and quantity of leak flow. Spark plugs are to be removed, cleaned/replaced regularly and the pump itself run to pump water for five minutes every two weeks.

Periodically inspect motor for chaff and debris build-up. Do not spray with water as this could contaminate fuel and damage electrics. Clean with a brush or compressed air. Run the pump with clean water for approximately five minutes every two or so weeks. This will ensure all parts remain unblocked and problems can be found.

If muffler is equipped with spark arrestor screen, remove screen for cleaning and inspection every 50 hours or every season. Replace if damaged. Clean fuel filter screen. Drain fuel tank and close fuel shut-off valve before cleaning filter. Clean cooling system. Chaff or debris may clog engine air-cooling system, especially after prolonged operation. Internal cooling fins and surfaces may require cleaning to prevent overheating and engine damage.

Although pumps are relatively maintenance free, there are some general maintenance principles that apply.

- After saline or brackish water and after using foam systems, thoroughly flush the pump and all reticulation lines with clean water prior to draining.
- Protect pump and engine gauges from excess water during cleaning. They are designed to breathe air; water may render them inoperable.
- Remove and clean all filters and strainers after use.
- Check pump glands and seals, following the instructions in the operating manuals.
- Do not run pumps against closed deliveries for long periods.
- Clogged air filters of engine driven pumps can significantly reduce pump performance.

Fouling

Fouling is a process where the pistons in a pump wear and use oil. Oil that enters the combustion chamber turns into carbon, which then builds-up and clogs the spark plugs. Replace the spark plug if the electrodes are burned away or porcelain is cracked, or after 100 hours of operation.

Cavitation

Cavitation is a condition resulting in the formation of a mixture of water and water vapour. The vapour bubbles will collapse or implode with tremendous shock on the adjacent walls of the pump. Cavitation can be avoided by not increasing the pump speed past the point where maximum output pressure has been reached. Indications of cavitation can include:

- Vibration
- Rattling sound resembling gravel through the pump
- Fluctuation of the delivery pressure gauge
- An increase in engine revolutions but no increase in pressure

Pump Tests

In most cases pump performance can be monitored during normal operation. In order to monitor the continued efficiency of a pump, a pump test should be performed in accordance with procedures in the operating manual. With an understanding of rated capacities of pumps, any significant reduction on performance will be obvious during normal operations.

Most pumps used in rural firefighting are closely coupled to a petrol or diesel powered single cylinder motor. Single cylinder motors are reliable and long lasting, provided you pay special attention to their care and regular maintenance as outlined in the manufacturers handbook. Regular preventive maintenance such as scheduled servicing and inspection will further enhance the reliability and performance of your pump.



Air Filters

A properly serviced air cleaner protects internal parts of the engine from air-borne dust particles. If the air cleaner maintenance instructions are not carefully followed, dirt and dust, which should be collected in the cleaner, will be drawn into the engine. Once the dust particles reach the internal components of the motor, damage will occur, reducing both the life and the performance of the motor.

Air Cleaner

Air cleaner element/cartridges should be replaced if damaged or blocked. Clean and service cleaner according to manufacturer's guidelines. In general terms, clean cartridge by tapping gently on a flat surface (or your hand). Do not use petroleum solvents such as kerosene, which will cause the cartridge to deteriorate. Do not use pressurised air, which can damage the cartridge. Do not oil cartridge.

Cooling Fins

Grass particles, chaff or dirt can clog the air cooling system, especially after dry, dirty conditions. Continual operation with a clogged cooling system can cause severe overheating and possible engine damage. Cleaning cooling fins should be a regular maintenance procedure.

Spark Plugs

The condition of the spark plug is a major contributor to the performance of the petrol motor. The spark plug gap should be set to 0.030". Replace the spark plug if the electrodes are burned away or porcelain is cracked, or after 100 hours of operation, or every season. In some cases a resistor spark plug may need to be fitted to suppress ignition signals. Where a motor has been equipped with a resistor spark plug, be sure to use the same type of spark plug for replacement. If a resistor plug is not fitted, you may experience ignition signals through your radio.

Oil Alert Systems

An oil alert or oil detection system constantly monitors the oil level in the sump of the pump motor. This will prevent the motor from running out of oil. Once the oil detection sensor in the sump has detected a low oil level, it will automatically shut down the ignition system, thus stopping the motor. You need to be aware that this may happen accidentally if the pump is placed on an angle. This can happen when you are trying to pump water on the side of a hill.



WARNING

Oil alert systems are on the appliance as a safety precaution. Cutting the wires to the system to avoid cut-out when travelling on slopes or hills is not an alternative to repositioning the vehicle.

Recoil Starter Cords

A recoil starter or a pull starter on a pump engine or generator is simply designed to start the engine. Carry out a visual inspection on the cord once a month to ensure there is no fraying or tearing. This is the first sign of deterioration and an indication that the cord should be replaced immediately.

Also check for spring tension. It is the spring inside that winds the cord up after it is pulled to start the engine. To check this, simply pull it slowly all the way out and slowly let the spring wind the cord back in. The handle should end up hard against the recoil housing. If this doesn't occur, then the spring tension needs to be reset.



In the event of the pump motor battery failing, there is a manual start rope. This rope should be facing the operator and not upright, as it is currently positioned on some appliances. Ensure you check this and reposition the shroud if necessary. This involves unbolting the outer casing of the pump motor recoil and moving the shroud 60° towards the rear of the appliance and refitting the bolts so that the cord handle faces the operator. The modification is necessary to prevent arm injury during manual operation.

Diesel Motors

Diesel motors are serviced at similar intervals to petrol motors however, there are two main features of a diesel system that require strict maintenance. These are the air intake system and the diesel fuel system. The intake system includes the air cleaner and the intake manifold. In a diesel motor, the intake system carries only air. A considerable amount of air is filtered through the air cleaner and into the motor via the intake manifold. Without the correct amount of filtered air, the performance of the motor is severely reduced.

The importance of clean fuel for a diesel fuel system cannot be over stressed. All liquid fuel must be clean, but because of very small clearances in the injection pump and injectors, it is vitally important for diesel fuel. Various types of filters are used to protect the fuel pump and the injector components. Some filters can be cleaned while others have a replaceable element that is discarded during servicing, when a new element is fitted. There are three different types of filtering systems; water sediment, pre-filter, and main filter. The fitting or servicing of any of these filters usually requires bleeding of the fuel system.

Petrol Motors

Most motors today run on unleaded petrol. If storing these fuels, be aware that they do have a limited shelf life and may go stale. A fuel stabiliser may be added to the fuel to enhance its shelf life. In a petrol motor, the intake system carries the air fuel mixture to the cylinder.

Turbo Motors

New appliances will be fitted with turbo motors. It is important that you follow manufacturers' instructions strictly when carrying out inspections, maintenance and servicing of these units. Turbo engines are particularly sensitive to oil.

CHAPTER SIX

INTRODUCTION TO FIRE SCIENCE & BEHAVIOUR

6.1 Principles of Fire

The Fire Triangle

The fire triangle is a simple representation of the three elements needed to sustain fire. Heat is the energy from an initial source of ignition, necessary to bring the fuel to its ignition temperature. Fuel is any material that will burn. In wildfire it generally refers to grass, leaves, logs and trees. If fuel is removed, the fire will starve and be extinguished. If air is removed, the fire will suffocate and go out. The removal of oxygen from a fire is a form of attack that is normally only limited to small or easily accessible fires.



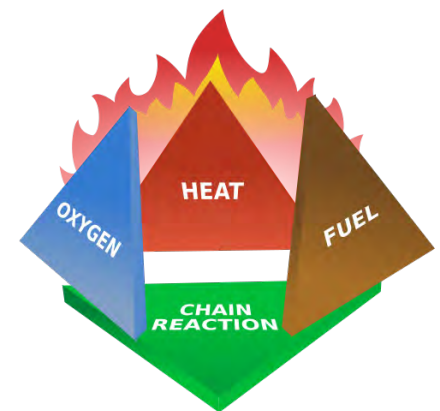
The removal of heat or the cooling of a fire is the most common form of suppression. In most cases, water is used to essentially soak up the heat generated by the fire. This heat turns water into steam thereby robbing the fire of the heat used. Without energy in the form of heat, the fire cannot heat unburnt fuels to ignition temperature and the fire will eventually go out.

Combustion

Combustion is the process by which heated material is consumed in the presence of oxygen. Combustion requires the elements of heat, oxygen and fuel. Combustion is altered dramatically by changes to any of the three elements. Complete removal of any single element causes combustion to cease. Oxidation is the combination of oxygen with any substance. At varying temperatures, most substances will combine with oxygen in the air (oxidise). When a substance is oxidising at such a rate that heat and light are being released, it is described as being alight or on fire.

The Fire Tetrahedron

In a fire, a fourth element is also present during combustion - the chemical chain reaction. In the combustion process, a chemical chain reaction occurs between the fuel and oxygen, and is promoted by heat. This reaction is essential to sustaining a fire. If this process is inhibited or interrupted, the combustion reaction is suppressed and the fire is extinguished.



Fire Intensity

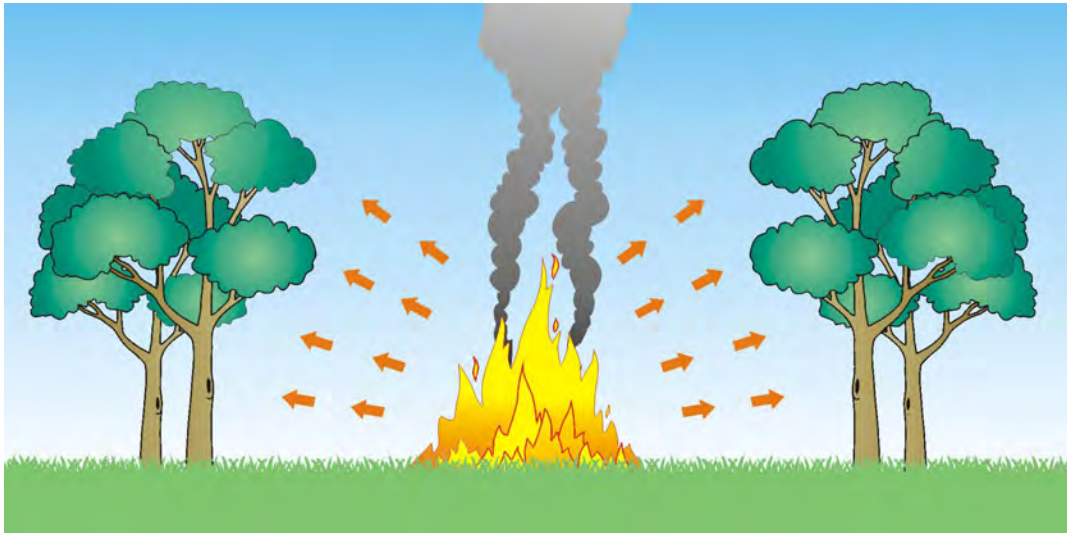
Fire intensity is the measure of the quantity of heat released from a section of the fire perimeter. It is expressed in kilowatts per meter. In simple terms, fire intensity is best recognised as flame height. Flame height is the average height of the flame measured vertically from ground level. It is the most obvious characteristic of a wildfire.

- Low intensity fires have a flame height of less than 0.5 meters.
- Moderate intensity fires have a flame height of 0.5 - 1.5 meters.
- High intensity fires have a flame height of 1.5 - 3 meters.
- Very high intensity fires have a flame height greater than 3 meters.

6.2 Heat Transfer

Radiation

Radiation is a form of heat energy which travels in all directions from its source (the fire) to nearby objects. It is the direct heat you feel from a fire. The intensity of radiant heat will drop very quickly with increasing distance from its source. Radiant heat will directly act upon fuel immediately around the fire and bring it to a temperature where it may burn. The radiant heat comes from the flames and any smouldering fuel. Radiant heat in a bushfire is a killer. Distance and shielding protect you from dangerous exposure to radiant heat. Radiant heat cannot, however, penetrate through solid objects.



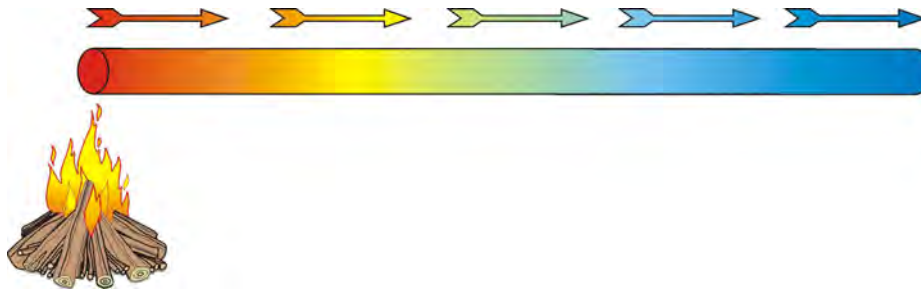
Convection

Convection is the movement of heat through the heating of air. As a fire gains in intensity the temperature of the surrounding air increases and quickly rises. Air must move in towards the fire at ground level to replace it. This process forms the convection column of rising hot air above the fire. It also includes ash, embers and the smoke plume. The stronger the convection, the longer the flames. When the hot air in a wildfire begins to move upwards, it can also lift sparks and burning embers into the air.



Conduction

Conduction refers to the transfer of heat through a solid object from a region of higher temperature to a region of lower temperature. Different substances conduct heat at different rates. For example, metals are more effective conductors of heat than wood. In wildfires, conduction refers to the movement of heat through the fuel itself. Any large piece of burning fuel will conduct heat, but this is generally a slow and minor source of heat transfer.



6.3 Parts of a Wildfire

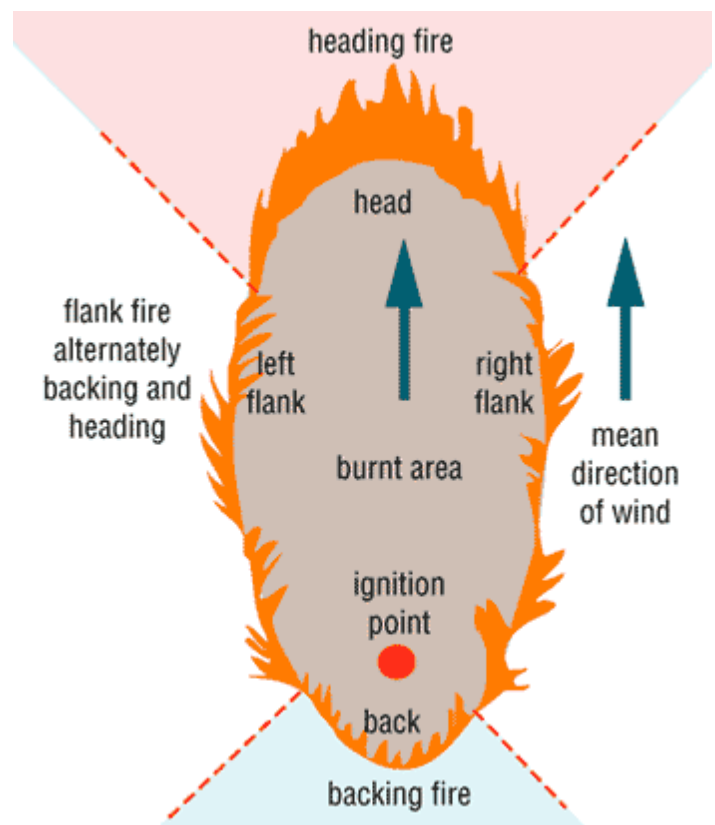
Wildfires can be divided into heading, backing and flanking fires, each with their own characteristics. When a wildfire spreads from a point it forms a roughly oval shape aligned in the direction of the prevailing wind. The perimeter of a wildfire is its outer edge and can be divided into the head, the flank and the back fire. Each part is related to the orientation of the edge of the fire with respect to the wind direction and their speed of travel.

Heading Fire

A heading fire is one where the flames are blown towards unburnt fuel. The fuel bed is ignited at the top and burns progressively down into the lower layers. A heading fire, particularly under extreme conditions, can be quite inefficient in its combustion, resulting in thick black smoke and partially burnt fuel. Large envelopes of burning gas can be often seen as flashes of flame well above the average flame height.

Heading fires are the greatest threat to life and property, so it is important to consider the following:

- Massive fluctuations in intensity.
- Thick black smoke.
- Frontal attack is difficult, dangerous and often unsuccessful.
- Main source for spotting.
- Primary means of fire spread.
- Flame leans towards unburnt fuel.



Backing Fire

A backing fire is one which moves into the wind. The flames lean over already burnt ground and ignite the fuel at the bottom of the fuel bed. The rate of spread of a backing fire is quite slow and independent of the wind speed. Combustion is often very efficient and complete resulting in less smoke than a heading fire, and in some fuel types a fine white ash residue.

Flanking Fire

The edge of a flanking fire is generally aligned parallel to the direction of the wind. Due to the ever changing nature of the wind, slight changes in wind direction means that the flank will become a heading fire and a backing fire in response to the changes in wind direction. Therefore a flank may exhibit the high flames and black smoke of a heading fire one moment, and then low flames and a little smoke of a backing fire the next. When working with a flanking fire, the following should be considered:

- Flanks are described by their orientation as view from the back.
- The length of the flanking fire will influence the suppression difficulty.
- Intensity of the flanking fire is much less at the head.
- Flame tends to burn more upright rather than lean towards unburnt fuel.
- Fingers are narrow slivers that can extend beyond heading or flanking fire front.

6.4 Wildfire Behaviour

Fire behaviour is the reaction of the fire to the environment. The most important behaviour indicators are the rate of spread of the fire and the height of flames (incorporating flame length, angle and depth). A significant indicator of changing fire behaviour is the intensity of the fire. It is the rate of spread, however, that is the main measure of a wildfire. Factors affecting fire behaviour incorporate fuel, weather and topography.

Fuel

Fuel may be rated as one of the most important factors influencing the way fire behaves and travels. Fuel is everything that burns in a wildfire. The most important fuel is the fuel on and near the ground, but the shrubs and even the crowns of trees can contribute fuel to a high intensity fire. Fuel comes in all shapes and sizes. To help you identify the important fuels for managing vegetation fires, you should understand three concepts.

Total Fuel	<i>This is the sum of the fuel quantity of forest litter and scrub available to burn under extreme wildfire conditions.</i>
Available Fuel	<i>This is the fuel that actually burns under the prevailing conditions. Often this is only a small percentage of the total fuel.</i>
Fine or Course Fuel	<i>Fine fuels are the fuels that will burn in the continuous flaming zone of a fire. Course fuels may burn or smoulder for a considerable amount of time behind the main fire front.</i>

Variation in fuel types may mean a difference in general arrangement, bark and fuel size characteristics. This will influence flame heights and the rate of spread of the fire, and hence its intensity. Different fuels will burn with varying degrees of intensity. Grass fires may spread more rapidly than fires in tall dense forests, which generally burn more slowly but more intensely. Eucalypt fuels, in particular bark, are well known for causing spotting.

Fuel Types

In Australia, common fuel components include:

- Grass
- Litter lying on the ground
- Small herbs and shrubs
- Decomposing humus
- Trees
- Material remaining after logging

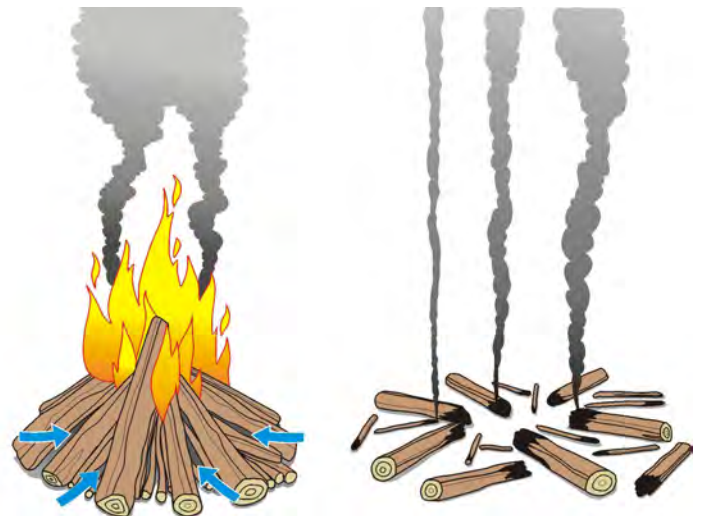


Fuel is normally classified as fine or coarse (heavy). Fine fuels are less than 6mm in diameter and include leaves, twigs, bark, and grasses. Fine fuels burn readily and cause spotting as the burning embers are carried through the air, starting new fires ahead of the main fire. Fine fuels provide the characteristic flame height of the fire front. Coarse fuels are greater than 6mm in diameter and include sticks, branches, logs, and trees. Coarse fuels tend to ignite less readily and burn more slowly.

It is many fine fuels that drive the forward spread of a fire, while the coarse fuels are consumed in the smouldering zone behind the main fire front. The fine fuel is ignited first and then this heats the coarse fuel enabling it to burn. The proportion of fine fuel and coarse fuel affects the rate of spread and intensity of the wildfire. The volume of fuel affects fire behaviour.

Arrangement of Fuel

Depending on the size of the individual fuel particles, the way pieces of fuel are arranged in relation to one another affects how they burn. Fuels that are tightly packed together will smoulder and burn very slowly because of a limitation on the supply of oxygen and generally higher moisture content. Well separated pieces of fuel are harder to ignite than more closely group collections of the same material. This is because radiant heat diminishes rapidly the further it travels.



Ladder fuels occur where a number of fuel components occur at different heights. This leads to the rapid spread of fire upward into the crown of trees. Fuel continuity is the extent to which the surface of the ground is covered. It is the major influence on fire spread, particularly in grasslands.

Fuel Moisture Content

The amount of moisture in fuels determines whether or not fuel will ignite and burn as well as the proportion of the total fuel load that is available to burn. The fuel moisture content will vary depending on factors such as daily humidity cycles, effects of recent rain, moisture content of the soil, and the condition of living vegetation. It is particularly important for you as a firefighter to be able to recognise when fuel moisture content is low. Unfortunately, fuel moisture is not easy to measure directly or to estimate in the field. Some practical methods include:

- Crushing a sample of fuel in your hand (crackling sound indicates very dry fuel).
- Crushing a sample of fuel in your hand and smelling it (a lack of smell of decomposition indicates dry fuel).
- Assessing the curing of the grass; be aware that dry fuels can take up moisture.
- Observing grasses (they are limp when moist and brittle when dry).
- Observing grass heads (falling indicates curing to a level that affects fire spread).
- Watching smoke colour (dark smoke indicates very dry fuel).
- Watching smoke quantity (low moisture content produces less smoke).

Weather

Weather is the second major factor that impacts on the spread of a wildfire. Fire weather is the term given to atmospheric and meteorological processes that affect fires. Simply put, fire weather refers to the hot, dry and windy conditions that will allow a wildfire to spread and build in intensity very quickly. The four key elements of fire weather are:

- Air temperature
- Relative humidity
- Wind speed
- Atmospheric stability

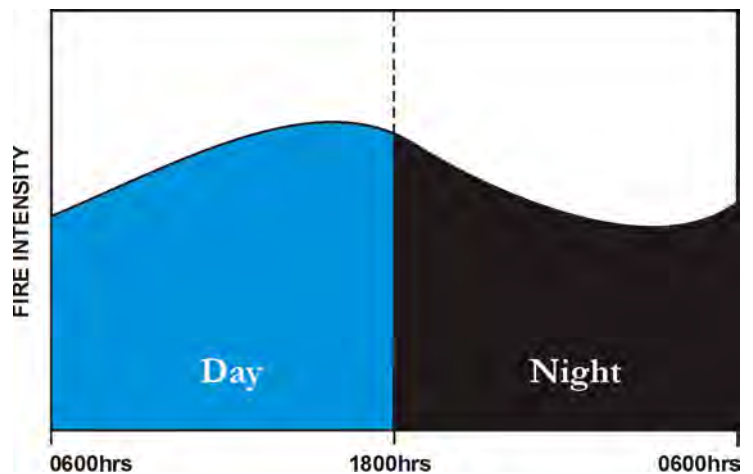
Air Temperature

A simplified explanation of daily temperature changes is that in clear conditions, highest temperatures occur in the afternoon, and the lowest around sunrise. The sun warms solid objects, such as fuels, and the surface of the land. This has the effect of raising the temperature of the fuels and the air. A change in the temperature and the resulting change in relative humidity, will change the fuel moisture content and subsequently the ease of ignition. Therefore higher temperatures normally mean that fuels are warmer, drier and more easily ignited. The Bureau of Meteorology provides the following general information on air temperature:

- Clear nights are usually colder than cloudy nights.
- Cloudy days are usually not as warm as sunny days.
- Temperatures are usually lower on calm nights than windy nights.
- Inland places usually have the greatest daily temperature ranges.
- Island locations have small temperature ranges.
- Summer sea breezes frequently bring relief from heat along the coast.
- High humidity over much of the tropics results in small daily temperature ranges.
- Cloud and haze reduce the effective solar radiation received at the surface.
- Temperatures on mountain slopes facing the sun will usually be the highest.

Relative Humidity

Relative humidity is a measure of the water vapour content of the air, and is expressed as a percentage, with the lower end 0% being very dry and 100% almost raining. In the absence of rain, the amount of moisture in dead finer fuels varies according to the level of humidity in the air. On humid days, fine dead fuels absorb moisture from the air and burn more slowly or may not burn at all. On dry days with low humidity levels, the air will draw moisture out of these fuels and they will ignite more easily and burn faster with more intensity.



The moisture absorption rate for different fuels will vary. Grass fuels in an open area will react to a rise in humidity more quickly than forest fuels. Firefighters can appreciate the biggest fluctuation in relative humidity and therefore dead fuel moisture, by observing the difference between day-time fire intensity and night-time fire intensity. At night when the humidity can approach 100% (when dew forms), the fine fuel is almost saturated, resulting in very low-intensity fires. Light rainfall has a similar effect.

Wind

Wind supplies oxygen for the burning process, removes ash and smoke from the area, and has the effect of increasing the rate of burning. The stronger the wind, the more oxygen is supplied to the fire and the more smoke is removed. Wind slants the flames over the fuel ahead of the fire and causes the flames to be closer to the ground. Wind also bends the convection column through taller vegetation ahead of the fire, causing it to dry out rapidly. This may allow the subsequent ignition of this vegetation.

Grassfires respond almost immediately to changes in wind speed and direction while in forest fires, wind effects on fire behaviour decrease as the density of the forest increases. Wind effects within a forest may cause sudden pulsations, causing the fire to flare erratically. Sudden changes in wind direction can cause shifts in the fire front. Firefighters require information regarding any potential changes in wind direction to help them attack a fire and to ensure crew safety in the event of the fire changing direction. Knowledge of local wind patterns is helpful to firefighters.

A dangerous aspect of wind change is that it can alter the direction of the fire without warning. This can cause long and relatively quiet fire flanks to suddenly become active fire fronts. The wind may also carry burning embers ahead of the main fire starting spot fires. Sometimes, a high-intensity fire with a well-established convection column will create very strong in-draughts, and it appears that the fire is creating its own wind. Firefighters must be aware of this and not confuse these effects with those of the prevailing winds which may be affecting the convection column.



WARNING

Where wind ground speeds are below 15 kilometres per hour current simulations of wildfire behaviour are reasonably accurate.

In the video “Dead Man Zone” you will see that where wind reaches in excess of 15 kilometres per hour current predicted rates of fire spread have been proven to be an under estimation.

BE PREPARED TO EVACUATE.

Atmospheric Stability

Atmospheric stability refers to the vertical movement of air masses which occurs when hot air rises and is replaced by cooler air. Atmospheric stability is important because vertical air motion can affect local wind patterns. Atmospheric stability also determines, to a large extent, cloud development and in particular, the possibility of thunderstorm development.

In stable atmospheric conditions:

- The vertical movement of air is limited.
- Stratus type clouds (layered) are often present.
- Smoke columns drift apart after limited rise.
- There are fog layers.
- The winds are generally light and predictable.
- Fire behaviour is predictable.



In unstable atmospheric conditions:

- Vertical movement of air occurs easily.
- Cumulus (cotton wool) type clouds show noticeable vertical growth.
- Smoke columns can rise to great heights.
- Winds are gusty and unpredictable.
- Lightning strikes and strong winds can occur from thunderstorms.
- Fire behaviour is erratic and unpredictable.

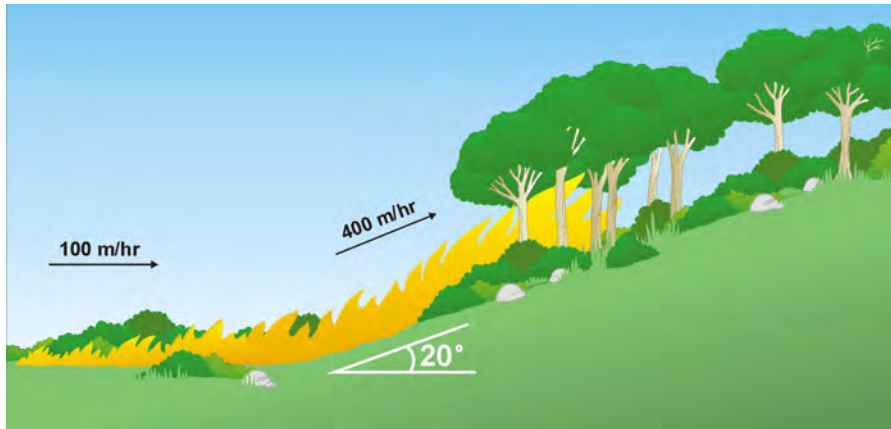
Topography

Topography describes the lay of the land, that is, the shape of the terrain. The topography will affect the direction and speed at which a fire will travel. The effects can be quite complex as the topography will at the same time, modify the local wind speed and direction.

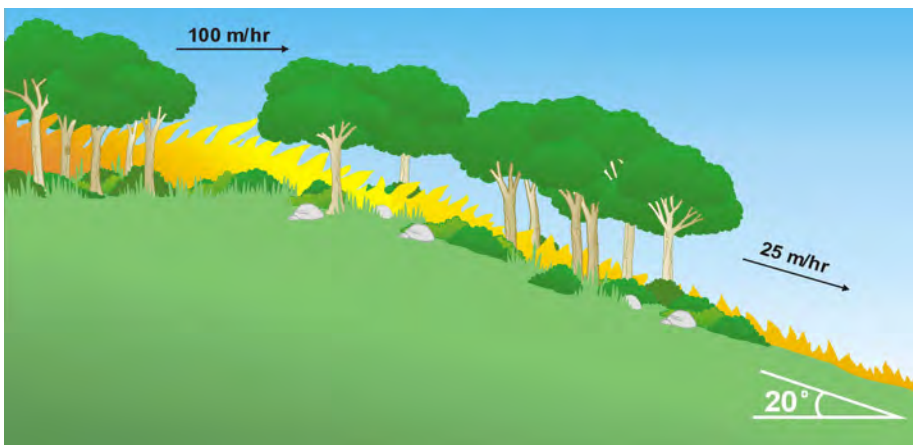
Slope

Fine fuels upslope of a fire are closer to the flames and are preheated by radiated and convected heat faster than fuels on level ground. Flame contact with unburnt fuels upslope is more likely and this accelerates the rate of spread. Correspondingly, a downslope will slow a fire and this may be used to help control it.

The following rule of thumb may be used to help determine the effect slope will have on the speed of a fire. For every 10 degrees of upslope, double the rate of spread. This rule of thumb does not apply for slopes greater than 30 degrees. For example, a fire is travelling at 100 metres per hour on level ground towards a 20 degree upslope; it reaches the foot of the hill and continues to burn in the same direction; as it moves up the slope, the rate of spread will increase to 400 metres per hour (approximately).



On the other hand, a fire travelling at 100 metres per hour on level ground towards a 20 degree downslope reaches the edge of the level ground and continues to burn in the same direction downhill; as it moves down the slope, the rate of spread will decrease to 25 metres per hour (approximately). For every 10 degrees of downslope, halve the rate of spread.



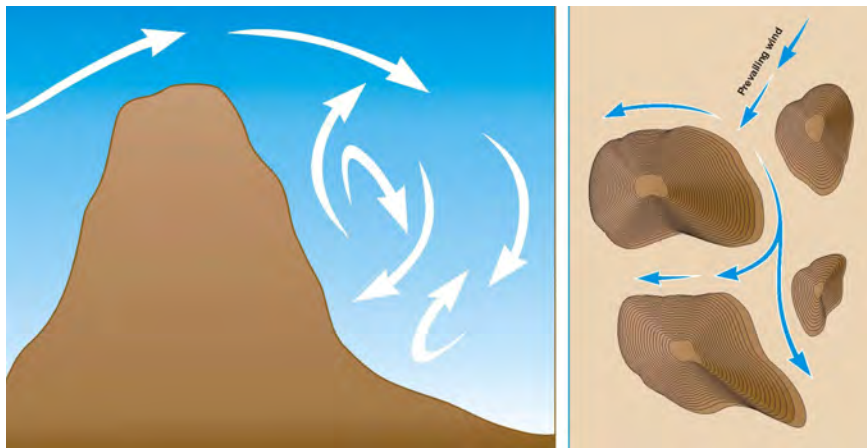
Aspect

Aspect is the direction that a topographic feature or slope faces. This will influence the amount of solar radiation that is received. Northerly and westerly aspects which receive more sun will be warmer and drier than southerly and easterly aspects. This will also influence the nature of the vegetation growing on different aspects. Northern and western aspects generally have drier and more flammable vegetation than southern and eastern aspects, where vegetation tends to be lush and less flammable. As a result fires on northern and western aspects will generally burn more fiercely than fires on southern and eastern aspects.

Terrain

The interaction of wind, terrain and a fire burning in a landscape can produce a variety of unusual yet significant effects on fire behaviour. The slope of the terrain, and particularly its orientation with the prevailing wind direction, is a major factor influencing fire behaviour. The aspect of the terrain and the slope determine the amount of solar radiation reaching the fuel which in turn determines how rapidly the fuel dries out at different times of the year.

The terrain can influence both the speed and direction of the wind. Exposed faces of hills and ridges will have increased wind speeds, while their leeward side may be almost calm. Generally wind speed will progressively increase upslope to the crest of a hill. Under some circumstances the leeward side can have dangerous turbulent winds blowing in the reverse direction.



6.5 Types of Wildfire

Ground Fire

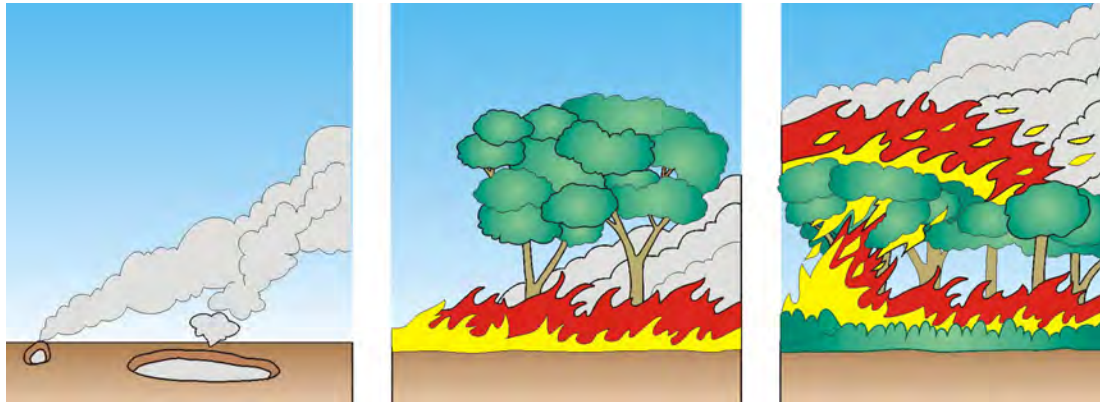
A ground fire can occur in any conditions and is where organic matter, tree roots or other materials ignite and burn under the ground. A fire burning in tree roots often goes undetected except when it follows a root near the soil surface. In such cases, it can emerge, ignite surface fuels, and become a surface fire. Ground fires can often smoulder for days or weeks, producing little smoke and no visible flames. Ground fires occur in only a few parts of Australia.

Surface Fire

Surface fires are low to high intensity fires that burn on the surface of the ground. The tree canopy may be scorched but does not burn to the extent that it will carry a fire. Surface fires produce flaming fronts that consume needles, moss, herbaceous vegetation, shrubs, small trees, and saplings. Surface fires can ignite large woody debris and decomposing vegetation which can burn long after surface flames have moved past. Surface fires can develop into crown fires if ladder fuels connect surface fuels to crown fuels, fuel moisture is low, or weather conditions favour torching and crowning.

Crown Fire

A crown fire occurs during fires of extreme intensity. A crown fire is when fire burns and spreads through the crown or canopy of trees. The influence of wind is greater in the tree canopy and where this canopy is interconnected or continuous, fires can spread incredibly quick. Crown fires are followed shortly afterwards by an intense surface fire. Falling material from a crown fire can start further surface fires below. Crown fires are difficult to extinguish since they tend to consume all the oxygen on the ground and water must be sprayed high into the tree canopy.



Ground Fire

Surface Fire

Crown Fire

Spotting

A spot fire is a new fire which has been ignited ahead of a main fire by embers or a burning object often called a fire brand. Spotting occurs when hot, convected air from a fire lifts the embers and burning material and drops them in front of the main fire. Highly flammable eucalypt trees can explode in the high temperatures found within wildfires. Factors that impact on spot fires are:

- Atmospheric instability, influencing the development of a strong convection column.
- Fuel moisture content of 10% or less in the downwind fuels.
- Breaks in a forest canopy which allow strong air movements.
- The nature of the fuels being burnt.

Some problems arising from spot fires are:

- The effective rate of spread of main fire front may accelerate rapidly if spot fires start ahead of it.
- In a wind of varying direction, the spread of spot fires will be unpredictable.
- Spot fires may start on the wrong side of fire control lines.
- Spotting causes less predictable fire behaviour.



WARNING

If spot fires begin to form in the area around you the situation has become very dangerous. You **MUST** evacuate from the area immediately. Do not attempt to suppress multiple spot fires.

6.6 Wildfires in Queensland

Whilst fire is an essential tool for land management in this state, wildfire often impacts negatively on communities in the urban interface (iZone) and rural areas. Many agencies engaged in forestry, farming, land development, conservation and natural resource management use fire to reduce fuel loadings, remove forest debris and help maintain biodiversity. It is important that these practices continue to ensure reduced threat to life and property.

The landscape of Queensland enables the creation of some unusual weather events. Willy-willies (or mini tornados) are circular wind currents occurring near the ground as a result of intense local heating of the ground. Fire whirlwinds are high intensity circular wind currents occurring near the ground as a result of intense local heating of the air by a wildfire. Fire whirlwinds expose firefighters to the danger of being hit by flying and burning debris.

Forest fire characteristics:

- Fine fuel loads (< 30 tonnes per hectare)
- Large convection columns
- Large quantities of dark smoke
- Restricted wind penetration
- Very high fire intensity
- Moderate rates of spread (< 5 kph)
- Potential for long distance spotting
- Difficult to control

Scrub fire characteristics:

- Moderate to heavy fine fuel loads
- Elevated fuels in the shrub layer
- Moderate wind penetration
- High fire intensities
- Moderate rates of spread (<10 kph)
- Probability of short distance spotting

Grass fire characteristics:

- Low fuel loads
- Fine or very fine fuels
- Moderate to high wind penetration
- High fire intensities
- High rates of spread (>10 kph)



Approximately 95% of Australia's sugar cane is grown in Queensland. Fire has been used for decades to prepare the cane for harvest by removing weeds, leaves and controlling diseases and vermin (such as rats). Fire behaviour in cane fires is similar to that of other tall grasses. At harvest time cane is a tall, partially cured grass and the fuel is dead cane trash, with surface and elevated fine fuels. A hot fire is required to get trash-free cane ready for milling, which creates volatile fires that can spread rapidly. The intensity of a cane fire is influenced by the way in which the fire is lit and allowed to burn.

CHAPTER SEVEN

PREPARE FOR RESPONSE

7.1 Brigade Activities

Normal brigade operations include fuel and land management, designed to reduce the effects of wildfire. The knowledge and information gathered in these activities will be invaluable to you when you respond to a wildfire. Some of these activities that you could be involved in are:

- Hazard reduction burning (reducing the impact of future wildfire).
- Pasture improvement/prescribed burning (using fire as the most effective practice).
- Documentation and mapping of past and recent fire activities in your area (providing valuable information on fuel reduced zones).
- Communication with the local Fire Warden regarding local conditions.
- Frequent monitoring of fuel loading, curing of grasslands and general weather conditions during the year.
- Keeping up-to-date with land tenure use, any change in rural areas as well as newer developments in more closely settled areas.

The Rural Fire Service (RFS) provides an educational service to property owners and rural householders, offering advice and assistance in terms of reduction of fuel and measures that can be taken to protect life and property threatened by wildfire.

7.2 Physical Well-Being

Once the call to respond to a wildfire has been received, you must ensure that your physical well-being is adequate and that you are fully equipped for the task about to be undertaken. During the initial call information given about the fire type, size and activity will assist you as a responding crew member to prepare to respond to a wildfire.

Firefighting is arduous work and you must be physically able in order to engage in it. If you are affected by illness, injury, tiredness (whether as a result of previous firefighting activity, sleeplessness, home activities) or drugs (including prescription drugs and alcohol), you need to evaluate your situation. It may not be appropriate or safe for you to participate.

Individual firefighters may provide food for their own needs. You can also carry snacks like muesli bars, pieces of dried fruit and fresh fruit to provide nutrition and energy. For hygiene purposes, make sure that the food is sealed and kept in a cool place. Appliances normally carry enough water to meet the needs of firefighters. However, sometimes this supply of water can be insufficient, or may heat up in the sun. To make sure of your water supplies on the fireground, carry your own canteen.



WARNING

You must always protect your body from radiated heat. Do not wear synthetic clothing of any sort, including underwear and socks. Wear cotton undergarments. Make sure that your clothing covers your arms and legs and is buttoned up as high as possible to provide maximum protection.

7.3 Brigade Call-Out

Calls for assistance may come from:

- Fire Communications Centre (Firecom)
- RFS personnel
- Fire Warden
- First Officer of adjacent fire brigade, other brigade or rural fire agency
- Member of the public or private landowner
- Queensland Police Service



When the call does come, crews will respond to a nominated assembly point. Depending on the brigade classification and the resource structure, this may be at the brigade where personnel are assigned to crews and appliances for response direct to the fire, or at a safe staging area near the fire location. It is at this location where strategies and tactics for control are communicated to all relevant personnel. It is the Incident Controller who determines the number of responding vehicles and ensures that the crewing levels are at an appropriate level for maintaining safety standards.

Inform your family/work colleagues that you are responding to the emergency. When driving to or from an incident, you are subject to the Australian Road Rules. Your main concern is reaching the fire as quickly and safely as possible. Local knowledge will be invaluable to you and will provide the most effective route to the fire location.

Greater Alarm Response System

QFES has adopted a system of response resource mobilisation known as the Greater Alarm Response System or GARS. GARS is a system of requesting resources utilised both internationally and nationally. It is used for requesting resources in the initial stages of an incident, not a campaign event. GARS is not related to the wildfire alert levels. GARS will enhance QFES operational response and ensure that sufficient physical and human resources are responded to an emergency incident resulting in a more efficient response and increased safety for the community and firefighters.

Confirm the Location

In many cases, notification of fire will come through FireCom. You may also be told of the existence of a fire by the general public or as a result of a sighting from a fire-spotting tower. In remote rural areas, notification of a fire on large properties may come through satellite imagery, mapped by the QFES GIS/Risk Management Unit, or through notification from commercial airlines via the Area Office. Regardless of how you are notified, your main concern is reaching the fire as quickly and safely as possible. Local knowledge will be invaluable to you.

Local Knowledge

Local knowledge of the terrain, vegetation type, fuel loading and arrangement in which a fire is burning may suggest possible fire behaviour. Knowing these characteristics can help in the preparation of resources for the response. The terrain can impact on the safety of an operation in terms of the deployment of responding vehicles to the fire location. Terrain and the fire location may also affect two-way radio communications.

Local knowledge will provide the most effective route to the fire location. You need to be familiar with the following:

- Roads and tracks not accessible for conventional 2WD vehicles
- Narrow roads with single access and limited passing areas
- Road surfaces (sealed/unsealed/pot-holed/corrugated/impassable with any rain)
- Roads or tracks with locked gates (need to be able to locate keys)
- Train crossings and boom gates
- Topography (lie of the land) including hills and gullies, creeks
- Narrow bridges or causeways with reduced load limits
- Local landmarks
- Days when local user traffic increases appreciably such as market days, cattle sale days, during harvesting and livestock drives
- Quick retreat or escape routes and safe refuges
- Fire breaks (both natural and purpose built)
- Obstacles to responding vehicles

It is this local knowledge that will help you to find the fire quickly, avoiding traps and selecting the safest and most effective route. This is not always the shortest route. When identifying the features in the above list, you will need to consider walking and vehicular access. Keep in mind the space needed to turn trucks around and the potential for them to become bogged or hung up.

Weather

Knowing weather conditions (atmospheric stability) at the time of the call can assist crews to determine the most effective and safe route to the fire. When gathering weather details, responding crews should consider any indications of change (present or future) that may affect their safety and impact on the overall response and suppression strategies and tactics implemented. Crews must be watchful for any changes in wind speed or direction and the effects of local topography. Local weather and fuel conditions may determine the initial level of response.

Consider the difference in resource requirements and urgency of response in the following situations:

- The fire is burning in cool weather, in terrain where fuel loading is low, fuel moisture content is high and there is minimal or no threat to life or property.
- The fire is burning under high fire danger weather conditions, in terrain with high fuel loading and low fuel moisture content and high level of threat to life and property.



7.4 Map Reading

It is important to familiarise yourself with basic map reading techniques. Although many of the fires you attend will not be in a built-up area, some will. Being able to read maps will help you to locate fires that are in towns. RFS provides brigade and Fire Warden maps for use by volunteers in conducting fire management activities. A map is a vital tool used to aid fire operations and can assist with identifying:

- An effective route to the fire
- Topography of the area
- Other land use and features that may influence fire behaviour and travel
- Location and number of properties that may be at threat

In rural areas you should become familiar with local landmarks and referred names, and rural road numbering of property entrances. Your Local Government Shire or Council may have instigated a numbering format that enables responding emergency service personnel to locate a property entrance by an exact distance from a given road intersection or location.

Basic Map Features

Scale

Knowing the scale of the map is important to assess whether it is appropriate for the intended purpose. The scale of a map is the relation between the horizontal distance between two points measured on the ground and between the same two points on the map. This relationship is constant, in whatever direction the distances are measured. The linear scale is drawn to assist in the measurement of distance and is worked out in kilometres.

Direction

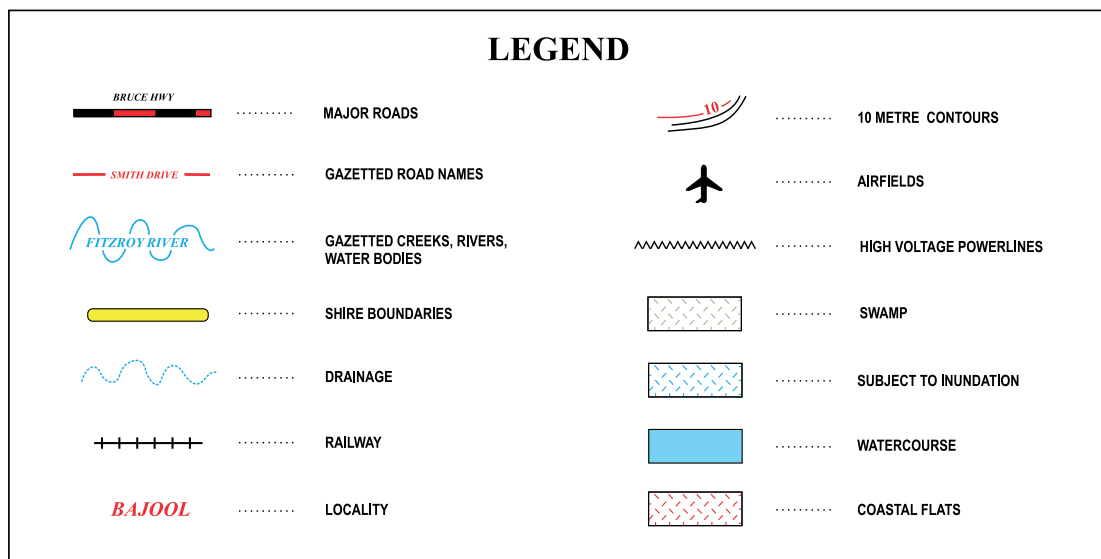
The compass, the sun and the stars have been standard tools for explorers and seafarers for thousands of years. The procedures that they developed are the basis of current techniques including even satellite navigation. Traditionally, all maps displayed a North arrow indicating True North. However, all recently produced maps are always orientated with True North to the top of the page and will not necessarily show a North arrow.

Legend

Map legends list the symbols used on the map and state what they represent. A typical legend for a street directory is commonly found on a page at the beginning of the book of maps. Colour plays an important part in legend symbols, and some international conventions apply to the use of colour. For example, blue for water features, black for culture, and green for vegetation.

Index to Adjoining Maps

Street directories normally use a key map that shows the relationship of all maps within the directory's area. Information relating to immediate adjoining map is also provided on the border of each individual directory map.



Geographical Information Services (GIS)

The QFES GIS Unit provides a range of mapping products and services to assist with fire preparation and management. Direct requests for maps are to be made through your Area Office. Many maps are available through the Volunteer Portal Map Shop with updates and new areas being added constantly.

Measuring Distance on a Map

There are many ways of measuring distance on a map using dividers, a length of string, or a ruler. Two simple methods using a strip of paper can be used for measuring straight distance or distance along a road. To measure the distance in a straight line between two points on a map, lay the straight edge of a piece of paper against the two points and mark the distance on the paper. Then lay the paper along the linear scale with the right-hand mark against the zero and the left-hand mark against the divisions to the left. The total distance is the distance to the left of the zero.

If it is often necessary to measure a distance that is not straight. To calculate the distance from A to B consider the road as a number of straight or nearly straight sections. Lay a piece of paper along the first section and make two marks; the first at A and the second at the end of the straight section. Pivot the paper about the second mark until it lies along the second section. Mark the end of the second section and continue this method until B is reached. Record the total distance by road as a straight line on the piece of paper and read it off against the linear scale.

Map Coordinate Systems

A location on a map can be expressed using the geographic coordinates of latitude (north to south or horizontal lines) and longitude (east to west or vertical lines). Topographic maps predominantly use the grid system however, latitude and longitude can also be plotted on topographic maps. Latitude and longitude coordinates are shown at each corner of the face of a topographic map. On some maps, short black lines along the edges of the map face indicate the minutes of latitude and longitude. Note that in the Southern Hemisphere longitude coordinates are always negative.

Superimposed over the entire map sheet of a gridded map are vertical and horizontal lines. These lines are known as grid lines and are numbered at each end. The distance between the grid lines can usually be related to the measurements on the map scale, normally equivalent to a ground distance of 1,000 metres. Maps are normally printed so that the north is at the top of the sheet. Therefore the grid lines are printed so that the one set of lines run north to south and the other set of lines run east to west.

The position of a point within a square is thus indicated by its distance east of a north south line and north of an east west line. To assist the user when giving grid references, grid lines are further defined as follows:

- Easting - The vertical grid lines which run from bottom to top and divide the map from west to east. They are numbered from west to east.
- Northing - The horizontal grid lines which run from left to right and divide the map from south to north. They are numbered from south to north.

Using a Street Directory

Most street directories have information relating to the location of suburbs and street names. All of this information is found in the index, located in either the front or rear of the street directory. It is vital when locating a street name that you identify the correct spelling of the street name because some can be spelt in more than one way and you may find yourself in the wrong street. Also ensure that the suburb is correct.

To find a street, look in the index and identify the street name and suburb in the alphabetical listing. Note the map number and reference (letter and number) and turn to the appropriate page. Trace down from the letter on top of the page, then across from the number at the side of the page. The street is located inside the square.

In Queensland, the responsibility for implementing rural addressing lies with Local Government Authorities (LGA). Rural addressing is a distance-based measurement system that allocates each rural property a unique address, based on the distance of the property entrance from the assigned starting point of the road. Rural addresses are continuous for the full length of the road irrespective of LGA boundaries.

The rural address number is determined by dividing the distance to the property entrance (measured in metres) by ten. Odd numbers are allocated to properties on the left with even numbers being given to properties on the right as you proceed away from the starting point of the road.



7.5 Initial Observations

You need to use your observation skills when you arrive at the fire. You will not only need to look at what the fire is doing but also be alert to any surrounding evidence and/or activity. Be sure to note the following:

- Colour, quantity and direction of the smoke
- Nature and behaviour of the fire
- Vehicle and personnel activity near the fire
- Gates on access routes to the fire (closed, open, locked)

Remember that the direction of the smoke will be influenced by prevailing winds. Consider the variation that local elevation and topography may have on wind direction. The colour of the smoke can indicate the location of the head of the fire. The greater the intensity of the wildfire, the darker the colour of the smoke. Once the fire has been physically located, your Incident Controller will confirm the fire location, type and activity with either the brigade's base radio operator or FireCom.

Approach

Vehicles should be positioned in a safe area where observations can be made and a timely exit can take place in the event of a rapid development in fire intensity. The approach may be determined by the terrain. The issue of safety is a prime consideration and care needs to be taken to avoid damage to personnel, vehicles, and the environment.

Wind direction is all-important in your approach to the fire. In the case of an active wildfire, the Incident Controller will try to approach from upwind (avoiding a frontal approach) and downhill (fire travels more slowly downhill). The Incident Controller will also take into consideration the location of roads and tracks around the fire, making sure that there are refuge points if they are needed.

Size-Up

If you are part of the first crew at the scene you will be involved in the size-up, where all the characteristics of the fire that can be noted will be taken into account. You are the eyes of the Incident Controller for your area of the incident. The IC is only interested in facts and not opinions. The situation summary you pass onto the IC will be collated with other information and used to identify the overall incident objectives and strategies. Some questions to be asked at size-up include:

- How large and intense is it?
- What colour is the smoke?
- What is the direction of fire spread?
- What is the rate of fire spread?
- What is the size of the area already burnt?
- What lives or property are under threat?
- What condition is the fuel in? Dry, high loads?
- What assistance/resources are needed?
- Where are water supplies located?
- Where are local dams, creeks, tanks, swimming pools, bores?
- Where did the fire start? Possible point of origin?
- Are there any environmentally sensitive areas?

Evidence of Cause

You will still be using your observation skills when you arrive at the fire. You will not only need to look at what the fire is doing, but also be alert to any evidence of the cause of the fire. Be conscious of the fact that the area that is burnt should not be disturbed any more than can be avoided. This applies to the entire duration of firefighting operations, particularly in the case of a small fire. Crucial evidence of the origin of the fire could be lost if not protected. You may be tasked with cordoning off the area. In the case of large-scale fires, investigators will be looking for patterns of fires in the area. Your job is to pass any relevant information or observations to your Incident Controller.



CHAPTER EIGHT

COMBAT WILDFIRE

8.1 The Response Sequence

Following the size-up, the Incident Controller will use a set procedure to make a decision on how to suppress wildfire. At this stage, you need to know only that decisions are being made and priorities determined, and that many of your observations will contribute to the decision-making. The following diagram shows one possible sequence of decisions and actions.

The first priority is an obvious one - protecting life. The safety of the firefighter and the public is paramount in any operation; protecting property is the second. Property covers more than houses, buildings and structures. It includes electrical, telephone and gas installations, fencing, livestock, crops and forests. Priorities for property protection are considered in the light of each situation, taking into account the economic, social and environmental consequences of loss.



Identification of priorities will influence the choice of management techniques and associated strategy for suppression. Protection of life, as an example, normally means an immediate direct attack with water to extinguish the fire, whereas a fire in open bushland could call for an indirect dry firefighting approach to contain the fire, or to let it burn itself out. The decision to adopt this last strategy can be for a number of reasons, such as insufficient resourcing, knowledge of a fuel-reduced zone in the path of the fire, and consequential burning as part of the natural ecological process for the area.

8.2 Suppressing the Fire

With an understanding of the fire triangle, you know that fire can be suppressed by the removal of any one of the sides of the triangle that represents elements of fire - the fuel, the heat, or the oxygen.



Removing Fuel

There are many ways of removing/reducing fuel. One method is the use of fire to burn a fire break or to burn out fuel in the path of a wildfire. The use of fire in this way is dealt with in later units. Common methods adopted by rural fire management agencies are creating a firebreak using hand tools, removing fuels using heavy equipment, or removing fuels by slashing.

Creating a Firebreak Using Hand Tools

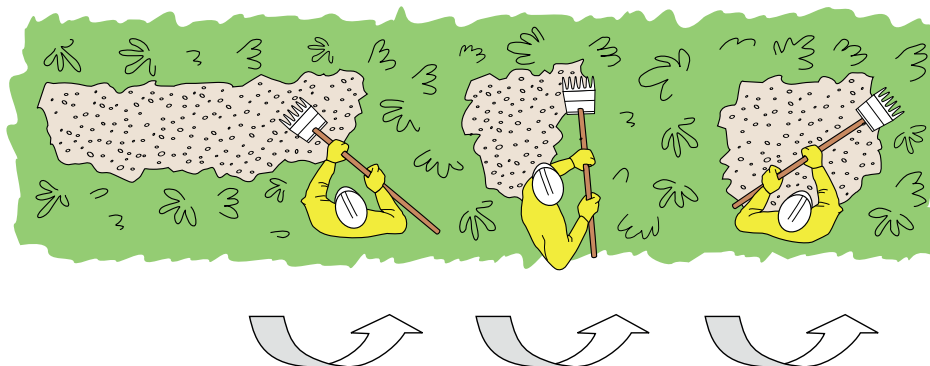
Fire breaks can be created by the use of hand tools or heavy equipment. Hand tools cause less damage to the environment than heavy equipment. Another advantage of using hand tools to cut a fire control line in front of the fire is that they can be used in areas that are not able to be accessed by vehicles or heavy equipment. Constructing a fire control line by rakehoe is normally a group exercise and it is necessary to work in a planned manner if the group is to work safely and efficiently. There are two recognised methods of group working when constructing a narrow fire control line - the step-up method, and the one-lick method.

Both methods are designed to make sure that people do not have to pass by other people who are using hand tools. Observe the correct procedures, but, if you are required to pass close to someone using a hand or powered tool, give a warning, “Coming through!” so that person knows you are there.

Step-Up Method

The step-up method is based on the idea that a group of workers in a line will each complete individual sections of the fire control line. The workers should be spaced out approximately three metres apart with each worker clearing a small section of the ground, raking the fuel away from the fire. The first person to finish a section calls out “STEP-UP” and all workers in front of that person step up, then move on to the next unprepared section.

This method is more often used with large crews and where there is considerable distance to cover. It is also more useful where people have not worked together before and where close supervision is not always possible. The crew leader usually works at the head of the team, selecting the route for the control line. It is normal practice to have one worker at the end of the line checking to make sure that the fire control line is properly cleared (to 100% bare earth). He/she does not join in the step-up routine but works as required to ‘polish’ the fire control line.

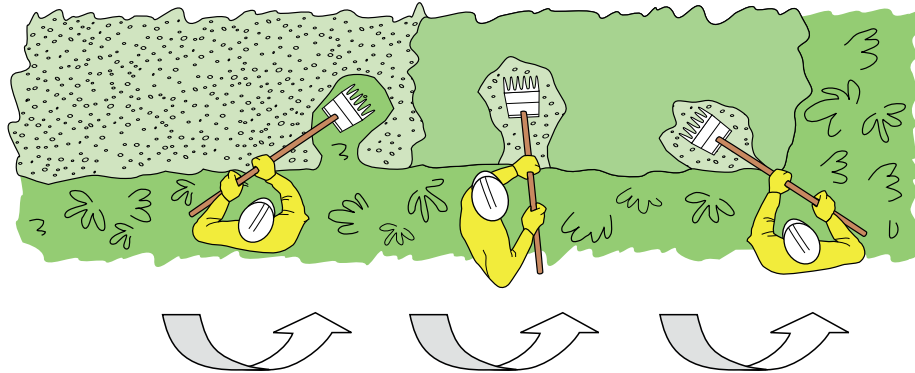


TAKE NOTE

Time permitting, pre-fire planning and preparation of areas that may cause spotting problems (such as around stumps and stags) will reduce the chance of spot fires occurring. These actions will also reduce the effort and time spent during the mop-up stage.

One-Lick Method

The one-lick method is based on the idea that each individual worker merely removes a portion of the vegetation until the mineral earth is exposed. The group should move forward at a slow walking pace with each worker removing vegetation as they go. The crew can be spread further than with the step-up method and will tend to cover the ground at greater speed. This method is particularly useful where a variety of tools such as chainsaws, axes, brush hooks and then rakehoes is being used, or there are large numbers of untrained workers.



Fire Control Line Construction

Always plan the fire control line carefully. Valuable time and effort will be lost if you find that you have to backtrack because of unforeseen obstacles. Make the maximum use of natural fire breaks such as exposed rock shelves, open ground, creek beds, etc. Keep the fire control line as straight as possible. This will allow a good view along the fire control line, enabling firefighters to communicate and move along the fire control line with greater ease. Avoid heavy concentrations of fuel as the fire may tend to 'flash over' in such fuels.

Widen the fire control line corners, as the fire will tend to increase in intensity where it is driven into a sharp corner. Remember that people may have to walk the fire control line at night. Remove all stumps or any objects protruding from the ground. Pay particular attention to areas where there may be a build-up of fuel, such as the base of a tree, and make sure that there are no places where the fire could creep across the fire control line.

Always look up when cutting a fire control line to make sure that the fire will not be able to cross the fire control line by burning through upper-storey vegetation. The area above the fire control line must be clear as well as the fire control line itself. Keep fire control lines clear of dead trees and trees with rough bark. Bark can spread burning embers across the fire control line.

Removing Fuels using Heavy Equipment

In open country, earth-moving equipment may be the most effective means of containing or suppressing wildfire. In a direct attack, the fire intensity is low to moderate with flame heights less than 1.5 metres. The earthmoving equipment pushes the earth onto the fire, smothering it and creating an earth bank (known as the rill). Working close to the burnt out area provides for safe refuge if required. The placement of the fire break or control line is critical for operator safety when machinery is used in a parallel attack. Safe refuges must be created at frequent intervals. The debris should be swept outside the fire line.

Removing Fuels by Slashing

Slashing is a broad term used for mechanically altering the fuel composition and arrangement. The width of the cut area depends on the fuel height, arrangement, loading and/or curing rate. These devices do not remove the fuel, but rearrange it in a format that can be used to control a fire edge. The fuel is cut, then laid down and in part compacted, reducing the aeration of oxygen flow to the standing fuel. This can contribute to lower flame height and reduced fire intensity and rate of spread.

The rearrangement of fuel structure allows for more effective and economical use of other suppression media such as water and A Class foam. Water and foam can penetrate into the remaining standing fuel much more effectively. Some landowners maintain slashed fire control lines on a regular basis. This produces 'green fire breaks'. Green fire breaks contribute to a reduction in soil erosion. When aligned to property fencing, they also allow for clear access, assisting protection of property assets.

Removing Heat

Cooling is the method most frequently used in the suppression of grass fires. Suppression can be carried out from equipment fixed on the vehicle, or in fires of less intensity, from the ground using a knapsack spray. In fires involving forest fuel, extreme caution is required when supplying water from an appliance located on a track where a hose lay is used any distance into the bush. Always work from a blackened edge or burnt area. For low-intensity fires and smaller grass fires, firefighters use knapsack sprays, often as first attack equipment when vehicles are not available.

Suppression From the Appliance

In any fire situation it is essential to get water onto the fire as quickly and as safely as is practical. This is usually achieved by means of a firefighting appliance that carries firefighters, water, pumping equipment and other safety equipment to the fire location. The on-board water supply carried on the appliance enables firefighters to take action quickly whilst supplementary supplies are found. The on-board supply is the main source of water delivery for small fires, fires in remote locations where water supplies are limited, or road crashes as a standby for protection from grass fires.

Removing Oxygen

This may be the quickest and most efficient form of attack with some small fires. However, cutting off the oxygen supply of a large fire in the open is usually too difficult. Firefighters can use the following methods to cut off the oxygen supply to a small fire.

- Stamping out and beating out the flames along the edge of a control line at a grass fire.
- Shovelling soil onto a fire. In most cases, this will help to put the flames out but embers may continue to burn slowly.
- Laying foam on burning fuels.
- Using a fire extinguisher that applies a smothering substance to a fire.
- Using a fire blanket to extinguish a small cooking fire or a fire involving a person's clothing.



Bulldozers or graders may be used in a direct attack on low intensity grassland fires where earth is turned onto the fire edge, smothering the fire in the earth rill. This method is used mainly in western Queensland. Rakehoes are used in direct attack in forest fuel low-intensity fires with flame height of less than 0.5 metres where earth is pushed back onto the flame. In both applications, the flame is smothered and a clear earth break is produced between the fire and unburnt fuels.

8.3 Backburning & Burning-Out

A backburn involves burning a strip of land ahead of a main fire in order to remove fuel from between the advancing fire edge and the established fire control line. A backburn must be lit from a prepared control line and should never be lit without appropriate approval and supervision. Backburning is often the only practicable means of dealing with rapidly moving, intense wildfires or fires that are spotting freely over short distances. Aerial ignition is used in some situations to burn out remote, unburnt islands of fuel that could promote spotting across fire control lines.

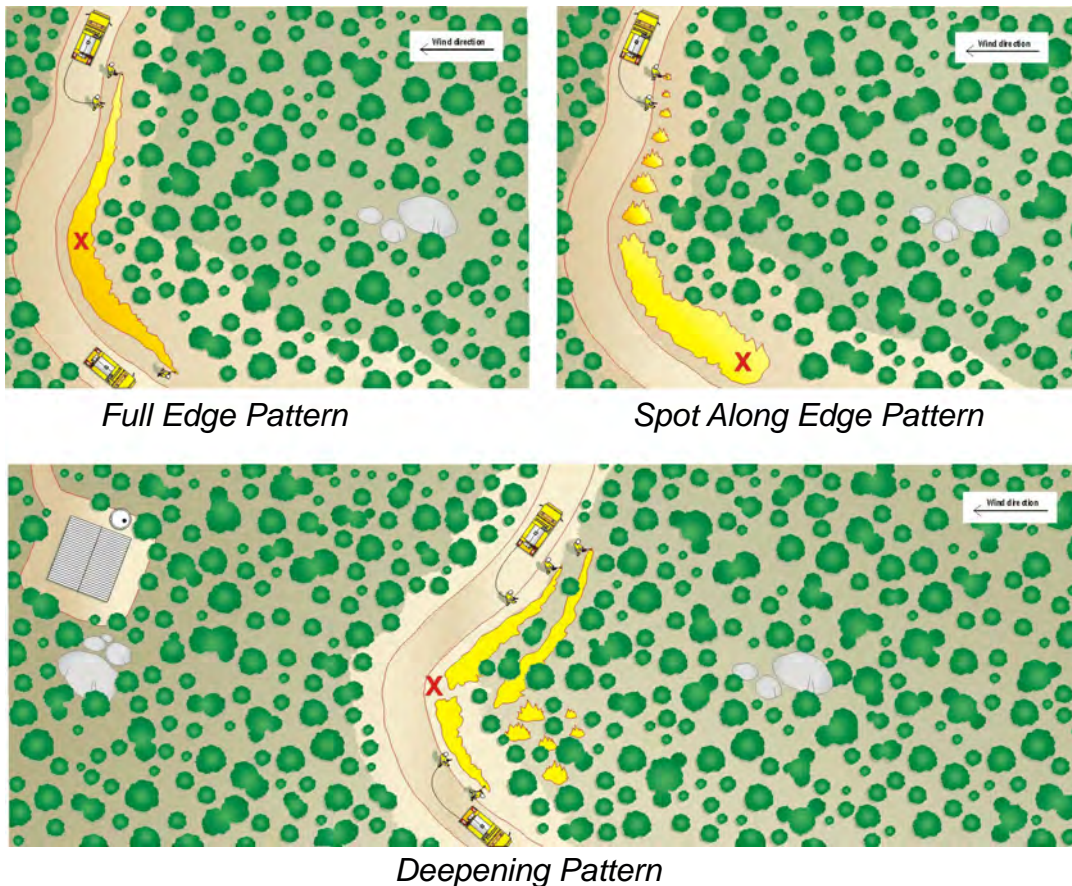
Because of the complexity of backburning operations, be aware that you may encounter many difficulties. You will need to exercise skill, timing and coordination to manage the risks involved with backburning. Avoid backburning when the fire is running under extreme conditions, the location of the main fire edge is not known, there are no adequate or existing control lines, there are insufficient resources to light and continue the backburn, and forecast weather conditions will lead to extreme fire danger.

Lighting Patterns

The method of lighting influences the way a fire develops and spreads, and determines how easy or difficult it is to control. Maintaining control of the lighting pattern is the most powerful tool available to the person in charge of the burn. The lighting pattern is influenced by topography, fuel load, location and strength of control lines and the weather.

The full edge lighting pattern establishes a continuous line of fire along the edge of the control line. Using a full edge pattern will result in a continuous line of flame and a proportionally higher intensity close to the control line in comparison with other lighting patterns. Spot along the edge involves separate spots being lit along the control line. The head fire of individual spot fire is less intense and travels a distance in from the control line before the flanks of each spot fire join.

When a perimeter of burnt ground has been established, a variety of ways can be adopted to accelerate the progress of the backburn away from the control line. Spot strings involves crew members lighting a distance in from the edge either using spot ignition points or strips, in conjunction with edge lighting. Firefighters can also light the edge using strings of fire away from the edge at regular intervals. Ignition launchers use devices such as incendiary capsules that are shot into the area between the control line and the fire.



8.4 Strategies & Tactics

Alternative strategies need to be developed to cover changing circumstances. Fire suppression is seldom limited to one method. Every fire has its own problems and will require different techniques. A good strategy will take into account the safety of the firefighters, available resources, available time, possibility of escalation of the fire, and economy of resources. Techniques involved in suppressing a wildfire fall broadly into two categories:

- Offensive strategies where the fire can safely and effectively be attacked or extinguished. These types of strategies usually include a direct attack, parallel attack, or indirect attack.
- Defensive strategies where the fire is too remote or too intense to be safely or effectively attacked or extinguished.

Direct Attack

A direct attack is used mainly on low intensity fires that can be easily and safely reached by firefighters. Firefighters work directly on the edge of the fire, which then becomes the established control line. There are a number of ways in which this can be done such as using:

- Water from a tanker or knapsack spray to extinguish the fire.
- Earth-moving machinery to push the burning fuel into the burnt area.
- Hand tools to rake the burning fuel into the burnt area.

The advantages of a direct attack are:

- Less area is burnt.
- The fuel is removed from the immediate path of the fire allowing the earliest possible control.
- Parts of the fire edge that may have gone out may be quickly incorporated into the fire control line.

There are two basic approaches when knocking down a fire; using either a head attack or a flank attack. When mounting a head attack of a fire, strike at the front of the fire from the burnt ground and then move around the flanks, gradually extinguishing the cooler, slower moving flanks of the fire. If the situation is such that access can be gained from in front of the fire, it should also be possible to approach the head from behind it (a safer option).

From the point of view of firefighting conditions, approaching the head from the black means that you are working in the fresh air that is feeding the fire from the heel. Approaching from in front of the head puts you in smoke and at risk if the wind strengthens or the ground rises up so gradually it is deceptive. This approach allows for efficient use of water, where the 'overshoot' lands in the unburnt fuel, cooling the fuel in front of the fire.

It will often happen that the fire is too intense or resources are insufficient for a head-on attack. When this is the case, begin with the cooler flanks and move around to the head, pinching out the fire as you go by narrowing down the head of the fire. It is safer to work from burnt ground. As more resources arrive they can be tasked further along the flanks. Unless life or property is being protected directly, the preferred strategy is to contain the fire.



Head Attack



Flank Attack

Parallel Attack

The difficulties relating to the direct method can be overcome by raking a path parallel to the fire front. The technique is used for low to medium intensity fires. It has the advantage of allowing firefighters to work away from the head of the head-fire while still minimising the burnt area. The preferred methods in a parallel attack are either to work directly on the fire, generally working from the black, or as near as possible to the flank, giving consideration to flame height, terrain, fuel load and rate of spread.

The parallel attack is the strategy adopted when using a Brompton Rat. When using the parallel method, plan your fire control line carefully and continually watch the fire front. Parallel attack requires the line to be burned out as the work proceeds. The more fuel between you and the fire, the greater the chance of you being overrun in the event of a wind change.

Indirect Attack

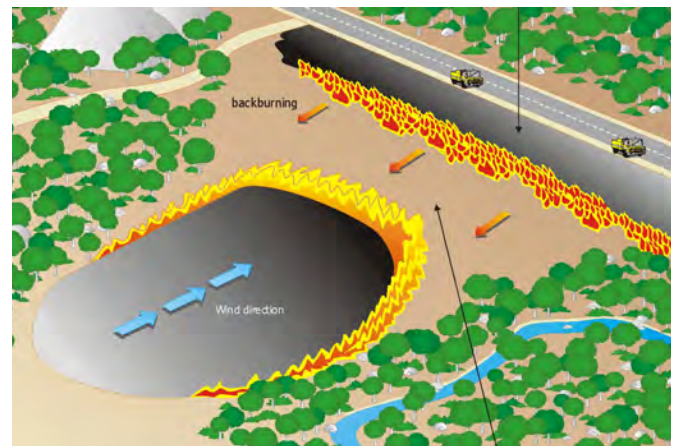
This method is used where the fire is very intense and it is necessary to work well back from the fire front. Basic techniques may involve any or all of the following.

- Fall back to a natural fire break or a barrier such as an area of previous hazard reduction and deploy resources to patrol for 'spot-overs'.
- Prepare a fire control line or use an existing break such as a road, or use a natural break such as a stream, non-flammable vegetation or well defined cliff line. Backburn towards the main fire, thus depriving it of fuel.
- Protect property/structures while letting the fire burn itself out.

Make sure that you know when and how a backburn is to be lit and obey all instructions of the person responsible for the burn. Remember, too, that you must know exactly where backburn lines will start and finish so that the ends can be tied in. The person in charge of the backburn is responsible for seeing that the burn is kept at a level where it can be contained. The task of firefighters is to ensure that the fire does not cross the fire control line. This work is often carried out at night, when conditions have eased.



Parallel Attack



Indirect Attack

Remember these safety considerations when using an offensive attack:

- There is always a danger from the flanks of the fire. Consider the normal shape of a fire being drawn by wind along flat terrain.
- Wind change during a parallel attack can cause a flank to become the new fire head.
- Be aware that the fire is continually moving when using the parallel attack method.
- Remember that backburning is a task for only experienced firefighters.

8.5 Fireground Communication

Your role at an incident is not simply following instructions. You have a very real responsibility to remain alert and aware of changes that are occurring around you, communicating any relevant factors to team members and your supervisor. The Incident Controller (IC) cannot be aware of all things at all times, so team members have a responsibility to each other and to the IC to pass on information about the wildfire situation that could impact on the tactical plan or affect the safety of firefighters.

As an incident develops it may become necessary to change the communications network. For example, having all operational personnel using one channel may become unworkable due to the amount of communications taking place. If a change in communications is to be effected, then it is essential that all personnel are made aware of the change, when it will take place, and who is to be using what channels, etc. Any changes must also be rectified in an updated Communications Plan.

Incident operations require both a disciplined radio procedure and a communications plan designating system participants, frequencies and radio control arrangements. The same protocols that control the chain of command using radios still apply to all forms of communication including mobile phones. The use of computers on the incident ground will increase as the ability to network increases.

Because working on the fire front at wildfires can be extremely hazardous in terms of lack of visibility, rapidly changing conditions and subsequent changes in tactics, fireground communication is essential to operations. Clear, well defined procedures underpin the communication process. Communication occurs along a number of paths, including:

- From Operations to Firecom
- From Firecom to Operations
- From the Incident Controller to the fireground
- From the fireground to the Incident Controller
- Between members of the fireground crews
- Between brigade base communications and Operations
- Between fireground operations and aerial support
- Between attending agencies



As general broadcasting is not possible on mobile phones, their use is not supported for general fireground operations. Safety can be an issue when crucial information passed between two people via mobile phone is relevant to other crew members as well. The implementation of a communications plan at the onset of an incident establishes a framework where communication processes and procedures can be adapted/expanded as the incident changes/develops. It is determined, agreed to and approved by all members of the Incident Management Team. The Operations sector has its own special communication needs which are identified in the plan.

Remember to continually monitor your radio and radio traffic to ensure that you are operating on the correct channel. Observation and communication are your responsibility. Below are some examples of timely and effective communication. Instances such as these reinforce the need for on-going communication throughout operational activities, constant awareness of your environment, and alertness to changes around you.

Briefings

A briefing is a process to inform people - a process of giving instructions or preparatory information to an individual or team. Briefings and debriefings are used to outline requirements for the standard content and order for operations and the transfer of appropriate information. Briefings occur at the start of an activity or shift to provide the team with information on the tasks ahead. Debriefings occur at the end of an activity or shift and provide the team with the opportunity to give information to management in regard to the planning process.

The purpose of a briefing is to ensure that individuals required to undertake a task or manage a project, have sufficient information to do their work effectively and in a timely manner. A well-structured briefing prepares people for their job role and gives them the information they require to do their work safely and effectively. Safety issues for incident personnel shall be clearly identified during all briefings.

Operational briefings include those for:

- Initial deployment
- Deployment
- Start of shift
- Situation reports
- Delegation
- Handover brief
- Changeover
- General information

QFES uses the SMEACS briefing format.

S	SITUATION
M	MISSION
E	EXECUTION
A	ADMINISTRATION & LOGISTICS
C	COMMAND & COMMUNICATIONS
S	SAFETY



A well-managed changeover will re-energise the control effort without a loss of direction. A poorly managed changeover can have a significant effect on morale. The decision as to when the changeover takes place is the responsibility of the Incident Controller. Any changeover may unavoidably interrupt the progress being made towards the achievement of the control objective.

Multi-Agency Response

At an incident, interaction will not only be between firefighters and, but also with other personnel from QFES (SES volunteers) and QPS and QAS. It is essential to establish professional relationships with such agencies to ensure that interaction is effective and efficient. It is also important to be made aware of the responsibilities of other agencies and individual limitation. For example, while firefighters have the authority to close a road, it is the Police who direct traffic. At fire incidents where SES are in attendance, the SES may play a role in the provision of resources in the areas of community education, catering, shelter or transport. While operating in areas where other agencies have authority, all instructions and directions must be followed.

8.6 Introduction to AIIMS

The Australasian Inter-Service Incident Management System (AIIMS) was developed in Australia during the mid-1980s. It is a robust incident management system that will enable the seamless integration of activities and resources from multiple agencies when applied to the resolution of any emergency situation. It will operate effectively for any type of incident, imminent or actual, and the many other situations in which emergency management organisations will be involved.

AIIMS is a structured approach for the management of emergency incidents and is underpinned by a relationship between individuals, entities and sections. It has been adopted by QFES to underpin its incident management system for all emergency incidents. The Queensland approach or system of implementing AIIMS is termed Incident Management System (IMS).

The QFES framework is a command/control system to manage emergency incidents, including wildfires, from small, simple incidents to large, difficult or multiple situations, in a systematic and logical manner. It is designed to develop and expand from the ground up ensuring that the appropriate level of management is applied at each level of incident response.

The AIIMS concept for incident control is based around five functional areas:

1. Incident Control
2. Planning
3. Public Information
4. Operations
5. Logistics

It is mandatory that there is a systematic approach to manage an emergency incident. Using the AIIMS model there is:

- One Incident Controller
- Management by objectives
- Span of control for resources
- Delegation of functions



Incident Classifications

There are three levels of incidents dealt with under the Incident Management System, ranging from Level 1 to Level 3. These are basically defined by size, duration and complexity and can be applied no matter what an incident involves. The procedure for determining the incident level is based on established criteria. Incidents are classified by either duration or complexity. Complexity may be through tactical/operational issues, logistical considerations, community impact.

Level 1 Incident

A level 1 incident is characterised by being able to be resolved through the use of local or initial response resources. It is generally small in area and short in duration, with minimal threat and impact to the general community. The Incident Controller may have the capacity to undertake more than one role and delegate others.

At a level 1 incident the major function is operations, which is to resolve the incident. Examples of a level 1 incident would be a small bushfire with little threat to property or a large wildfire in a low risk environment. A level 1 incident is one where the initial responders are sufficient and control is likely within one to two hours, however this time may expand due to the nature of the incident.

Level 2 Incident

Considerations for a level 2 incident may include any or all of the following:

- Deployment of resources beyond initial response.
- Sectorisation of the incident.
- Allocation of strike teams and/or specialist resources.
- The establishment of functional roles/sections due to the level and complexity.

A level 2 Incident Controller may choose to designate support roles. The impact on the community and environment can expand beyond the immediate incident depending on the nature of the wildfire.

Level 3 Incident

A level 3 incident is large, complex and of an extended duration due to its nature. Level 3 incidents will be divided into sectors with possible divisions being formalised. The threat or impact to the community will be large from the local level to possibly state, national or global area. A large incident is one where there are major complexities, there are a large number of resources required and it will be a long term operation.

The IMT will have the majority of roles filled with shift rotation for those roles established. The Incident Controller will have designated a large number of functional roles. Numerous other agencies will be involved significantly depending on the nature of the incident.

CHAPTER NINE

MOP-UP & PATROL ACTIVITIES

9.1 Mop-Up Activities

Once the fire has been suppressed, mopping-up or blacking-out must be used to secure the perimeter. Firefighters must extinguish all smouldering material from which embers could start a new wildfire in unburnt fuel. Mop-up should be carried out in such a way that fire investigation activities are not hindered.

Mopping-up is arduous work that has to be carried out very cautiously and thoroughly. To do this you must consider current and future fire weather conditions. The work carried out in suppressing a wildfire is not completed unless the mopping-up phase has been conducted successfully. Flare-up of fires previously declared to be out occurs mainly as a result of poor mopping-up practices and the failure of the Incident Controller (IC) to consider future fire weather conditions.

The mopping-up phase can take many hours or days (even weeks) depending on the fire and fire danger conditions. For example, where one hour is spent in containment and suppression, a further four hours can be spent mopping-up, ensuring that reignition does not occur. Firefighters need to be disciplined to ensure that this aspect of firefighting is carried out thoroughly. Reignition CAN occur.

How to Mop-Up

The process of mop-up involves 'blacking out' a strip inside the perimeter. The width of the strip will vary. You may be tasked with creating a wide strip if:

- The fire has covered a large area.
- The fire has involved hilly terrain (smouldering material can fall down the hill onto the strip).
- Conditions are dry and hot.
- The vegetation type and arrangement near the burnt area constitute a great fire risk (eg long, dry cured grass or high fuel loads).
- High winds are being experienced or are expected.

The extent of mopping-up varies. In normal to mild fire conditions where available fuel has been consumed, mopping-up focus is on extinguishing mostly coarse and some fine fuels that have been affected by the fire. In high to extreme fire danger conditions where total fuels are involved, there will be significant numbers of standing and surface coarse fuels that require extinguishing. This process is long and intense.

Mopping-up after a wildfire is a dirty, time-consuming task. You are likely to be tired by the time this task comes around, but you must not treat it lightly. In rural and I-Zone areas, large fires may require mopping-up for days. If mop-up is not carried out effectively, the fire will certainly start up again. Carry out mop-up and patrol activities under the direction of your IC following established QFES practices and procedures. Your IC will indicate how far inside the control line work should be taken and the depth of the area to be mopped-up.



Actions to Take

Effective mopping-up aimed at securing a fire-affected area may be achieved by:

- Starting mopping-up activities as soon as possible.
- Where appropriate, using water or foam to cool down burning material.
- Separating piles of burning fuel to reduce heat and allow more effective use of water.
- Opening up smouldering dirt piles as they can burn for days.
- Allowing fine fuels to burn out if it is the safest and most effective way of getting rid of this fuel.
- Dragging small branches and logs well back inside the fire line.
- Rolling longer and heavier logs so that they are going upslope, not across the slope.
- Digging trenches for, or chock with rocks, large burning logs that are too heavy to move.
- Paying particular attention to stags, logs and stumps close to the fire line, especially those stumps that have burn below ground level.
- Where necessary, splitting logs to penetrate and suppress the area where combustion is occurring.
- Felling or pushing burning stags threatening to fall across the control line.
- Using only accredited chainsaw operators for tree-felling work.
- Digging out roots burning under ground near the control line.

You may be instructed to conduct a patrol along the fire control line and prioritise hot spots that require attention. You may have to pay special attention to these areas before continuing with extending the depth of the mopping-up strip from the fire control line. Always watch for trees and branches that may fall due to wind conditions. Be aware that rocks heated from fire may explode. Mopping-up is critical in high to extreme fire conditions. Many outbreaks kindle from poorly blacked-out fires.

After major fires or storm events, the community can receive some damage from fallen trees. Trees fall over roads, power lines and access tracks. Trees may also need to be felled to prevent embers from travelling great travelling great distances and starting spot fires. To assist, qualified brigade members may be required to remove trees to enable access or in some events, generally assist the community in cleaning up.

When mopping up, undertake the following:

- Black-out a sufficient distance to prevent ignition of nearby unburnt fuel. A minimum distance of 30 metres or 1.5 times the height of any trees is recommended. In extreme fire weather conditions, it is not unusual to increase these distances up to 100 metres.
- Check for hazards. Significant hazards might be posed by falling trees, rolling logs, thick coal beds and stumps burning below ground level.
- Clearly identify unsafe areas and keep firefighters away.



Mop-Up Tactics

Tactics used in mopping-up may vary and the decisions on which tactic to use may have to be made considering:

- Amount, size and arrangement of course fuels burning.
- Proximity of fuels to the fire control line (wind direction and spotting).
- Amount and type of resources and access to those resources.

Here are some examples of mop-up situations:

1. A number of standing fibrous trees are alight near the fire control line. Mopping-up would be done using water or foam from nearby response appliances.
2. A stag is alight and too dangerous to fell with a chainsaw. The tactic here would be to use a dozer to push the tree over, have a crew stand by until it falls by itself or create a break and burn the fuel where the stag is likely to fall.
3. Hot spots are inside the control line. Mopping-up would be done using a number of knapsacks, rakehoes or both.
4. The control line has been breached by burning fuel in pipes under a road. Mopping-up would include checking for such situations and extinguishing the fire.



As a crew member involved in mopping-up, you must maintain your safety and that of others. When mopping-up still work from a safe anchor point - the fire control line. As you work away from the control line, address safety issues to eliminate the risk of injury to yourself or to any other member of your team. Remember the memory jogger LACES.

Use of Extinguishing Media

Water should be used sparingly during the mopping-up phase. Many firefighters make the process longer by pouring too much water on the burning material when less water would have been sufficient and achieved the same result. Alternatively, if there are plenty of resources, complete depth mopping-up could be carried out prior to extending along the fire control line. A Class foam is a great aid in the mop-up phase, assisting penetration of water into the fibres of burning vegetation. The foam bubbles have a cooling effect on the fire as well as offering a wetting effect to aid the release of moisture on to the fuel. This conserves water use.

Very similar to water, soil can help cool and smother fires. The soil should be thrown in a swinging motion to scatter it in a thin layer at the base of the flames along the fire edge. A fast continual action will provide the best results. In some instances you can use green tree branches to cool the edge of a fire in advance of fire line construction. The method is to swing the branch toward the fire so that any embers or sparks are thrown back into the burnt rather than the unburnt areas. These techniques are commonly called dry firefighting and are only suitable on fires of low intensity or mopping-up operations.

9.2 Fire Investigation

Wildfires may be the result of:

- Deliberate malicious intent (arson)
- Accidental ignition (spark from machinery)
- Negligence (burn off, campfire escape)
- Natural means (lightning)

Determining the cause of fires puts fire management agencies in a better position to reduce the number of fires and thus limit the damage caused by these incidents. For fire investigation to succeed evidence has to be gathered. As a firefighter you have a vital role in ensuring that evidence at an incident is not lost.

Investigation of the cause of a wildfire should start with the approach and arrival of the first attending appliance. It is essential for those firefighters fire on the scene to take note of the many details that may later provide an explanation of the cause of fire.



Observe any people in the area. People near the fireground may have seen who or what started the fire, where the fire started, or they may have started the fire themselves. Obtain and records names and descriptions. Take note of vehicles leaving the area. Record vehicle registration, colour, make, model, distinctive features such as panel damage or bullbars. These details may help to identify the driver or vehicle at a later date. Restrict access to the area of origin so that any evidence of the cause of the fire is not destroyed. Tape off the estimated area of origin and keep machines, vehicles and spectators out.

Maintain security of the suspected area of origin and any other areas that might be significant for fire investigation (eg campfires, camp sites). Preserve evidence of fire cause (eg burnt match, lighter, fuel container). Advise the IC of the location of the area of origin and any need for specialist investigation. Minimise fire suppression activities to leave the area as undisturbed as possible. Report suspicious fires to Firecom who will contact Police and the relevant Area Director/Area Commander.

9.3 Patrol Activities

Patrolling the perimeter is carried out during and after mopping-up operations. This can be done on foot or in a vehicle. While patrolling is basically a process of making sure that there are no problems on the perimeter of the fire, you will have to carry out a range of tasks when you find something amiss. The frequency of patrols should be based on all factors present including fire intensity, fuel loading, current and future weather conditions. Frequency should be gradually reduced if weather conditions are favourable.

If you are patrolling from a vehicle do not block access or escape routes. When travelling in smoke or dust, reduce speed, switch on lights and occasionally sound the horn. When travelling along fire breaks, take note of the nearest turning areas and refuges, and be aware of other vehicles and firefighters on foot. If you are required to assist in patrolling a wildfire, you must look out for:

- Burning material within the fire area that could threaten the control line (especially overhead tree tops and branches).
- Spot fires beyond the control line.
- Weak spots in the control line where further work is required.
- Trees and overhead limbs in trees which may fall and endanger firefighters.

Patrols also give you the opportunity to observe the result of fire behaviour, intensity and travel by identifying common indicators. While on patrol, you should also pay particular attention to persons or vehicles visiting the area. Part of your role here is to brief landholders on how to patrol and extinguish small fires and on how to contact their local brigade if you need to leave the area.



9.4 Debriefing

Debriefings have been developed in order to create an avenue for feedback, to stimulate evaluation and to develop cohesiveness. They constitute a valuable tool in professions such as firefighting where the risks are great and small mistakes or miscalculations can result in loss and disaster. As incident reviews, debriefings can be used to measure the effectiveness of:

- Organisational policy and procedures
- Pre-incident planning
- Training
- Communications
- Safety procedures
- Equipment




Debriefings attempt to discover why things happened. They focus directly on the tasks and goals that were to be accomplished. They have a unique role in that they bring the actions of an incident into the learning arena. By moving from what was intended to what actually happened and why it happened, debriefings can lead participants to consider what could be improved. Learning is the objective of the debrief.

The operational debriefing should be conducted as soon as is practicable after the conclusion of an operation or incident. It is logical to do this while details of the incident are fresh in the minds of the firefighters. At a protracted incident, debriefings should be conducted prior to the release of personnel at changeovers. What is important is what happened, not who did what.



CHAPTER TEN

FIREFIGHTER SKILLS & DRILLS




10.1 Bowl a Coil of Hose

Training Objective	
Performance: Conditions: Standards:	<p>The firefighter shall be capable of bowling a coiled hose.</p> <p>A length of 64mm coiled hose (dutch roll).</p> <p>The firefighter shall demonstrate in sequence all stages and key points of this skill without error.</p>
	STAGE 1.1 - Grasp coil of hose <ol style="list-style-type: none"> Position coil of hose with couplings nearest body. Ensure female coupling is lowermost. Hold hose behind tail of couplings with one hand. Span top of coil with other hand, thumb facing body.
	STAGE 1.2 - Bowl coil of hose <ol style="list-style-type: none"> Face direction in which hose is to be bowled. Take step forward with outside foot and swing coil of hose forward. Maintain grip with hand holding couplings. Release grip of other hand. Ensure couplings do not contact body.
	STAGE 1.3 - Draw back on couplings <ol style="list-style-type: none"> Draw couplings back towards body as coil nears end of roll to uncoil hose completely.
Firefighter Information:	<ul style="list-style-type: none"> Coiled hose is bowled out on the fireground for the following: <ul style="list-style-type: none"> to provide a feed line from hydrant to pumper to add or replace hose in delivery and/or feed lines to allow a hose to be taken aloft, flanked over a firefighter's shoulders Before bowling out hose the firefighter must ensure the couplings are in line. This will reduce the possibility of couplings striking the body. Firefighters bowling out 64mm hose may not be able to span the top of the coil with the hand as detailed in Stage 1.1. In this situation firefighters will need to adopt an alternate method such as sliding the hand between the top two layers of hose.

10.2 Under-Run a Hose

Training Objective	
Performance: Conditions: Standards:	The firefighter shall be capable of under-running a hose. A previously charged length of 64mm hose. The firefighter shall demonstrate in sequence all stages and key points of this skill without error.
	STAGE 1.1 - Prepare Hose <ol style="list-style-type: none">Check hose is clear of debris.Lay hose out straight removing all twists.Proceed to coupling at highest elevation.
	STAGE 1.2 - Under-run hose <ol style="list-style-type: none">Pick-up coupling.Raise hose and hold at waist height.Using hand-under-hand action keep hose raised from ground.Ensure all water drains from hose.
Firefighter Information:	<ul style="list-style-type: none">Hose is under-run to remove excess water prior to coiling.An alternative method of under-running hose is performed by holding the hose at shoulder height and using hand-under-hand actions. This method is not recommended when the hose is suspected of being contaminated with hazardous materials.



10.3 Make-Up a Coil of Hose on the Bight (Dutch Roll)

Training Objective	
<p>Performance:</p> <p>Conditions:</p> <p>Standards:</p>	<p>The firefighter as part of a team shall be capable of performing these tasks.</p> <p>Two firefighters in a team and one length of 64mm hose.</p> <p>The firefighter shall demonstrate in sequence all stages and key points of this skill without error.</p>
	<p>STAGE 1.1 - Prepare hose</p> <p>a. Firefighter 1 - Lay hose out straight removing all twists.</p>
	<p>STAGE 1.2 - Lay out hose</p> <p>a. Firefighter 1 - Take male coupling to female coupling.</p> <p>b. Firefighter 1 - Ensure female coupling is lowermost.</p> <p>c. Firefighter 1 - Place female coupling between heels.</p> <p>d. Firefighter 1 - Grasp male coupling with both hands.</p> <p>e. Firefighter 2 - Take up position at bight.</p>
	<p>STAGE 1.3 - Align hose</p> <p>a. Firefighter 1 - Remove all twists from top layer.</p> <p>b. Firefighter 1 - Overlay and align hose.</p> <p>c. Firefighter 1 - Place male coupling 0.4 meters from female coupling.</p> <p>d. Firefighter 1 - Tension both layers.</p> <p>e. Firefighter 2 - Remove all twists from bottom layer.</p> <p>f. Firefighter 2 - Tension both layers.</p>
	<p>STAGE 1.4 - Roll hose</p> <p>a. Firefighter 1 - Proceed along hose to within 3 meters of bight and tension top layer.</p> <p>b. Firefighter 1 - Maintain alignment and tension.</p> <p>c. Firefighter 2 - Call "CLEAR BEHIND".</p> <p>d. Firefighter 2 - Maintain alignment and roll hose tightly.</p> <p>e. Firefighter 2 - Ensure couplings are even.</p> <p>f. Firefighter 2 - Check washer is in position and serviceable.</p>

**Firefighter
Information:**

- Fire hose is made up in a Dutch Roll for ease of storage and to facilitate instant layout in a fireground action.
- When rolling canvas hose a 0.3 meter fold is to be placed at the bight formed in the hose prior to rolling. The fold is not required for Duraline hose.
- Care should be taken by firefighters to ensure they are not injured by the sharp metal edges of the hose ties and couplings.
- Hose may also be rolled on the female or male coupling. Rolling hose in this manner can be performed by one firefighter. This allows firefighters to carry out other fireground duties.
- Hose rolled on the female coupling indicates the length of hose is damaged and unserviceable.
- Hose rolled on the male coupling indicates the hose is serviceable and requires testing on return to brigade.
- Hose made-up on the male coupling should never be bowled out as damage may occur to the thread of the male coupling. By grasping the lugs of the male coupling the hose can be rolled out if required.
- Overhand knots tied in a length of hose near the couplings indicate the hose had been damaged.


10.4 Ship a Standpipe

Training Objective	
Performance: Conditions: Standards:	<p>The firefighter shall be capable of shipping a standpipe.</p> <p>Ground hydrant, hydrant bar and standpipe.</p> <p>The firefighter shall demonstrate in sequence all stages and key points of this skill without error.</p>
	<p>STAGE 1.1 - Check standpipe</p> <ol style="list-style-type: none"> Check pressure disc is flush with base. Check rotating collar is fully down. Check washer is in position and serviceable.
	<p>STAGE 1.2 - Remove plate</p> <ol style="list-style-type: none"> On arrival at hydrant call "HYDRANT". Insert hydrant bar in place recess, use a lever action to lift plate. Check hydrant pit is clear before inserting hand. Remove any obstructions. Remove ball cover.
	<p>STAGE 1.3 - Position standpipe</p> <ol style="list-style-type: none"> Grasp spindle shaft with hand below T handle. Grasp tightening handle with other hand. Place standpipe in ground hydrant and hold vertically. Rotate clockwise one turn to engage lugs of rotating collar. Raise sharply to ensure lugs are engaged.
	<p>STAGE 1.4 - Tighten standpipe</p> <ol style="list-style-type: none"> Maintain grip on spindle shaft. Hold standpipe in a vertical position. Rotate tightening handle clockwise until firm. Go down on one knee. Tighten standpipe fully using both tightening handles.
	<p>STAGE 1.5 - Operate standpipe</p> <ol style="list-style-type: none"> Turn T handle clockwise until water flows unrestricted. Allow standpipe to flush.


**Firefighter
Information:**

- It may be necessary to give the hydrant plate a sharp hit with the weighted end of the hydrant bar to break the grit seal formed around the rim.
- The standpipe water head must always be rotated clockwise to prevent unshipping of the standpipe.
- Always turn the standpipe T handle fully down to ensure maximum water flow from hydrant.
- When one outlet of the standpipe is used that outlet must be rotated to face the fire / pumper and a blank cap placed over the idle outlet.
- Where both outlets are used the water head should be rotated so as to face at right angles to the fire / pumper.
- The initial checks on the standpipe are to be performed before leaving the pumper as the pumper may be some distance from the hydrant.
- The standpipe is carried to and from the hydrant by grasping a tightening handle in one hand and resting the standpipe barrel against the shoulder with rotating collar facing uppermost.
- When shipping a standpipe at night the firefighter needs to take a torch to conduct a thorough check of the hydrant pit.
- Some RFS appliances may require a QRT to Storz adaptor to be fitted to the standpipe.



10.5 Unship a Standpipe

Training Objective	
Performance: Conditions: Standards:	<p>The firefighter shall be capable of unshipping a standpipe.</p> <p>A shipped standpipe.</p> <p>The firefighter shall demonstrate in sequence all stages and key points of this skill without error.</p>
	<p>STAGE 1.1 - Prepare standpipe</p> <p>a. Turn standpipe T handle anti-clockwise until water is off.</p>
	<p>STAGE 1.2 - Loosen standpipe</p> <p>a. Go down on one knee.</p> <p>b. Grasp tightening handles in both hands.</p> <p>c. Turn tightening handles anti-clockwise until standpipe rotates freely.</p> <p>d. Support spindle with one hand, continue rotation with other hand.</p> <p>e. Remove standpipe when rotating collar lugs disengage.</p> <p>f. Replace ball cover and plate.</p>
	<p>STAGE 1.3 - Reset standpipe</p> <p>a. Turn rotating collar fully down.</p> <p>b. Check washer is in position and serviceable.</p> <p>c. Return pressure disc flush with base.</p>
Firefighter Information:	<ul style="list-style-type: none"> To prevent possible damage to reticulated water mains through water hammer a standpipe must never be turned off harshly. On removal of the standpipe always check that the hydrant ball valve has reseated. The washer at the base of the standpipe must always be inspected for serviceability after use. The standpipe is to be carried to and from the hydrant by grasping a tightening handle in one hand and resting the standpipe barrel against the shoulder with rotating collar facing uppermost.

10.6 Couple a Branch to a Delivery Hose (Fixed Collar Branch)

Training Objective	
Performance: Conditions: Standards:	The firefighter shall be capable of coupling a branch to a delivery hose. Fixed collar type branch, one length of 64mm delivery hose. The firefighter shall demonstrate in sequence all stages and key points of this skill without error.
	STAGE 1.1 - Prepare to couple <ol style="list-style-type: none">Grasp tail of male coupling in one hand holding thread uppermost.Grasp branch by barrel with other hand.Check washer is in position and serviceable.Hold branch vertically.
	STAGE 1.2 - Couple branch <ol style="list-style-type: none">Place branch on male coupling.Rotate branch clockwise.Hand tighten coupling.
Firefighter Information:	<ul style="list-style-type: none">Fireground variables may require this skill to be carried out while moving hose towards the objective. Firefighters should therefore practice carrying out this skill on the double.Couplings must be spanner tightened when required.Before coupling the branch operate controls through a full range of movements to check serviceability.

10.7 Hold a Branch

Training Objective	
Performance: Conditions: Standards:	<p>The firefighter as part of a team shall be capable of holding a branch.</p> <p>Two firefighters in a team, one charged length of 64mm hose fitted with a branch.</p> <p>The firefighter shall demonstrate in sequence all stages and key points of this skill without error.</p>
	<p>STAGE 1.1 - Prepare to hold</p> <ol style="list-style-type: none"> Firefighter 1 - Grasp branch in one hand. Firefighter 1 - Pass other arm around hose and support underside of branch with hose and hand. Firefighter 1 - Place forward hand on topside of branch barrel.
	<p>STAGE 1.2 - Brace for reaction</p> <ol style="list-style-type: none"> Firefighter 1 - Stand with front foot braced forward and rear leg braced back. Firefighter 1 - Bend knees slightly and angle body forward. Firefighter 1 - Exert downward and forward pressure.
	<p>STAGE 1.3 - Backing-up</p> <ol style="list-style-type: none"> Firefighter 2 - Remove kinks from hose. Firefighter 2 - Lay hose straight three to five meters behind Firefighter 1. Firefighter 2 - Take up position behind Firefighter 1 and face hose line. Firefighter 2 - Support the hose with both hands. Firefighter 2 - Place front foot against Firefighter 1 rear foot. Firefighter 2 - Provide support by placing shoulder against Firefighter 1.
	<p>STAGE 1.4 - Brace for reaction</p> <ol style="list-style-type: none"> Firefighter 2 - Stand with front foot braced forward and rear leg braced back. Firefighter 2 - Bend knees slightly and angle body forward. Firefighter 2 - Exert downward and forward pressure. Firefighter 2 - Assist Firefighter 1 with all movements.

**Firefighter
Information:**

- To light up both firefighters will slide their feet forward in unison, ensuring both feet are in contact with the ground at all times. The forward foot of Firefighter 2 supports the rear foot of Firefighter 1 by moving in time.
- To light back a similar procedure is followed with the delivery line moved to the rear. Where possible the branch should be shut off to reduce water damage and prevent jet reaction which could endanger the firefighter at the branch.
- An alternative method of lighting up and lighting back is termed the 'military step'. To light up Firefighter 2 positions the front foot inside the rear foot of Firefighter 1. On the given command "LIGHT UP" Firefighter 1 slides forward the front foot followed by the rear foot. Firefighter 2 slides forward the rear foot followed by the front foot. Firefighters working as a team carry out this action in unison.
- When lighting up or lighting back steps no greater than 0.3 meters at a time should be taken.
- When firefighters are providing assistance with lighting back of fire hose the first three to five meters of hose behind Firefighter 2 remains on the ground at all times to prevent jet reaction affecting the light back operation.
- Words of command used when lighting up or lighting back will be initiated by the Officer-in-Charge of Firefighter 1. These are as follows:
 - "PREPARE TO LIGHT UP / LIGHT BACK". A cautionary order telling firefighters to position themselves for lighting up or lighting back actions.
 - "STEP". An execution order telling firefighters to move forward or back on step.
- When using large diameter hoses at high pressures additional firefighters may be required to assist with lighting up and back. Firefighters assist by providing support for firefighters holding the branch or move back along the hose line to haul hose forward or clear hose away.

10.8 Drill Case One - Taker

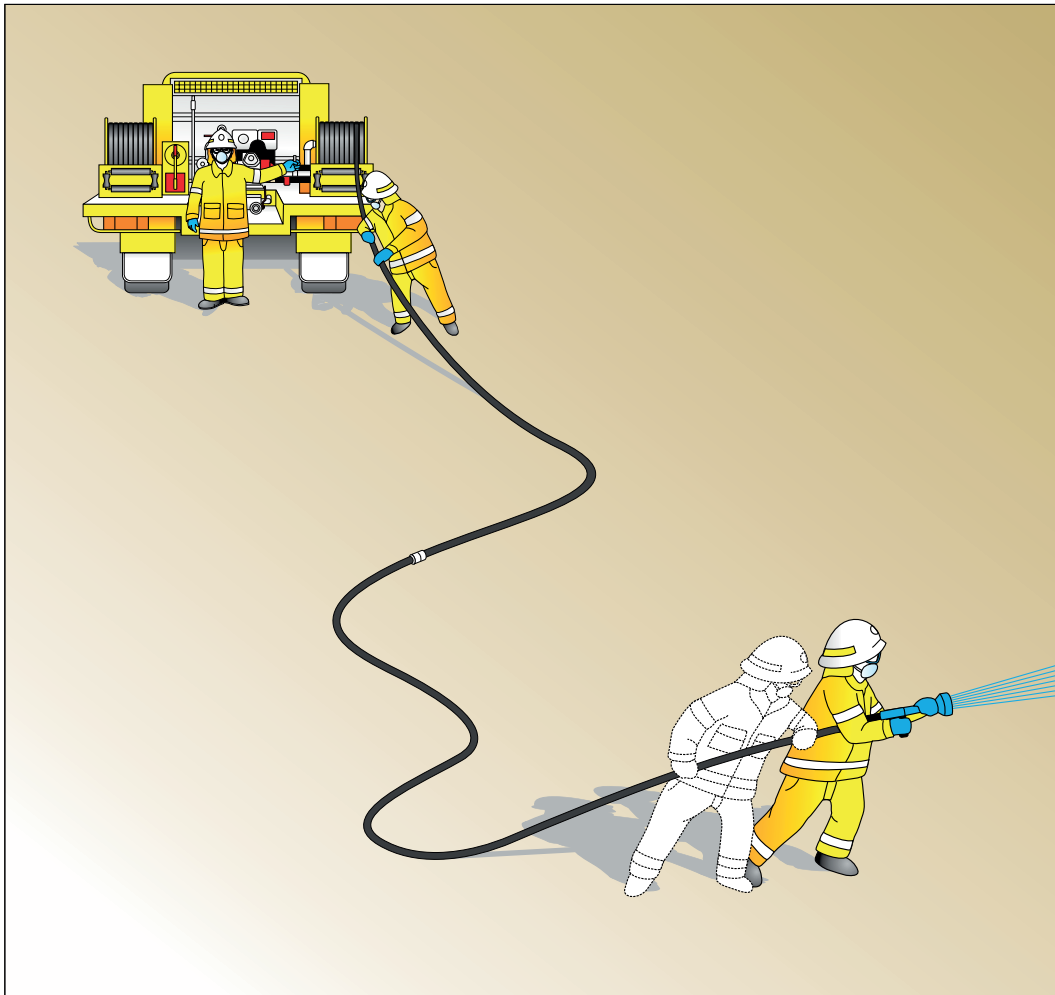
Case One is a sequence of skills which allows the water carried in the pumper on-board a water tank to be pumped to the hose reels of the pumper. The quantity of water carried on the pumper will determine the duration of this operation. The type of Case One action on the fireground depends on whether the pumper is fitted with a low or high pressure pump. On arrival at your assigned brigade check which type of pump and hose reel are in use on the pumpers you will crew.

Before taking the nozzle/branch to the fire the hose reel valve must be opened. This is performed by the branch operator if the valve is fitted at the hose reel, or by the pump operator if fitted at the pump panel.

Training Objective	
Performance:	The crew will provide and maintain an effective firefighting stream using the pumper hose reel.
Conditions:	Simulated fire 20 meters from the pumper.
Standards:	The drill shall be carried out efficiently and safely in accordance with the laid down procedure.

Firefighter No.	Action
1	a. Take nozzle and sufficient hose to fire b. When set call and signal "READY".
2	a. Engage handbrake. b. Position pumper and engage / start pump. c. Open tank valve. d. Tend hose reel and ensure hose runs clear. e. Operate pump when "WATER" signal is given. f. Provide feeds, couple to inlets, call and signal "READY AT PUMP". g. Operate pump.
3	a. Assist in running out sufficient hose. b. Back-up Firefighter 1.

Firefighter Information:	<ul style="list-style-type: none"> Sufficient hose is considered to be enough hose to allow firefighters to light up and extinguish the fire or to protect exposures within range. Firefighter 1 initially draws off a large bight of hose from the hose reel (approximately 5-7 meters), grasps the bight formed in the hose, and runs out the hose towards the fire. The hose is not coiled over the arm. Firefighter 1 lays the hose out in S bends with the last 3-5 meters laid straight ready to light up. Firefighter 3 ensures sufficient hose is drawn towards the fire to allow Firefighter 1 to light up. This is done before backing-up Firefighter 1. The hose reel valve is opened by Firefighter 1 if mounted at the hose reel or by Firefighter 2 if mounted at the pump panel. On the make-up the hose reel is made-up first, allowing the pumper to response if required.
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10.9 Drill Case Three - Taker

Case Three tanker is a sequence of skills which allows the water from the water tank on the pumper to be introduced into the pump of the pumper. The water is then delivered by delivery hose and branch to the fireground at pump pressure. There are two options when considering this action. Case Three is an action used to set-up an initial rapid attack utilising the on-board water supply fitted to the pumper.

Fireground factors to consider for Case Three tanker are:

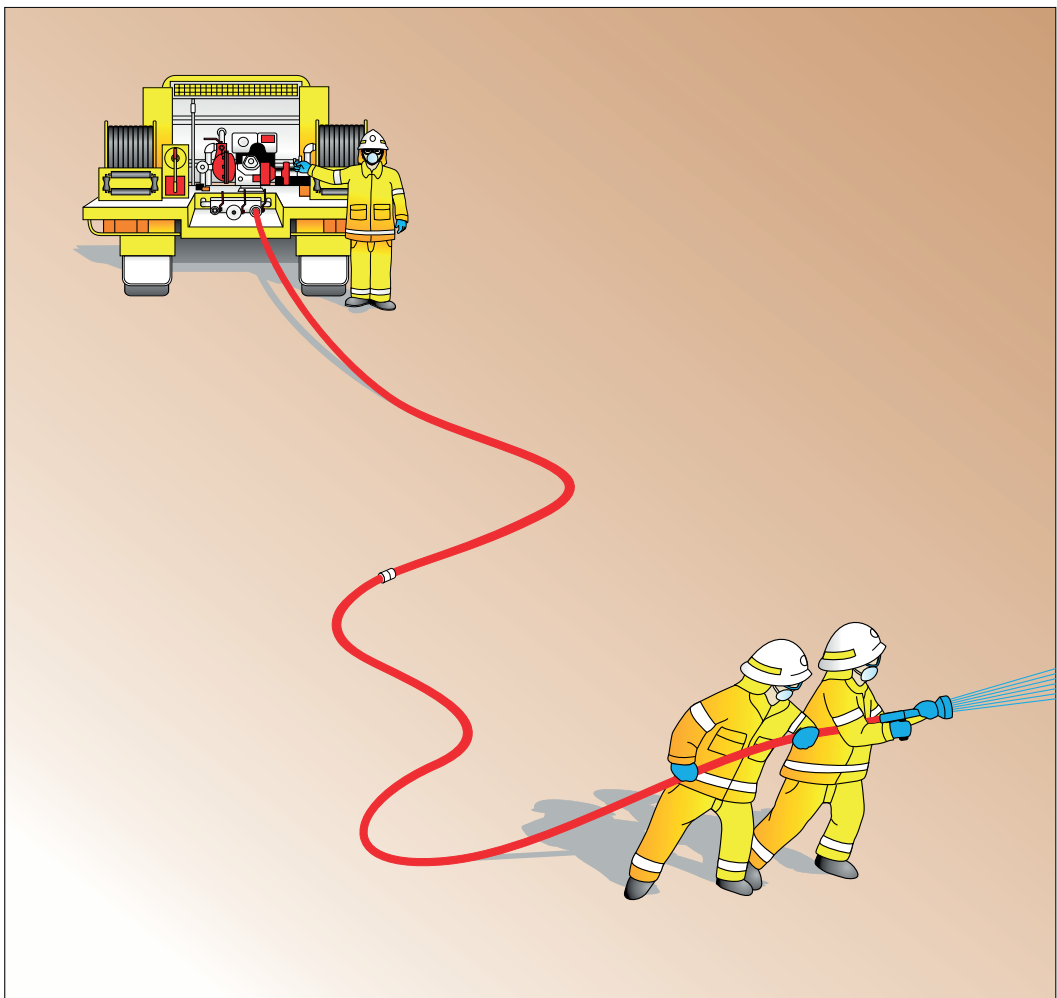
- Endangered life
- Reduction of rapid fire spread
- Quantity of water carried by individual pumpers
- Need to establish an initial fireground attack pumper
- The distance of the reticulated water supply from the fireground

Training Objective

Performance:	The crew will provide and maintain an effective firefighting stream using a branch, delivery hose and pumper.
Conditions:	Simulated fire 40 meters from the pumper. Bowled hose to be used.
Standards:	The drill shall be carried out efficiently and safely in accordance with the laid down procedure.

Firefighter No.	Action
1	a. Take branch and sufficient hose to fire. b. When set call and signal "READY".
2	a. Apply handbrake. b. Position pumper and engage / start pumper. c. Open tank valve. d. Couple hose to outlet. e. Operate pump when "WATER ON" signal is given.
3	a. Back-up Firefighter 1.

Firefighter Information:	<ul style="list-style-type: none"> • This drill indicates a minimum of two lengths of hose to be run-out in the delivery line.
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10.10 Drill Case Four - With Nominated Lengths of Suction Hose

Case Four is a sequence of skills which allows the water from a static supply to be introduced into the pump fitted to the pumper through suction hose and strainer. The water is energized by the pump and delivered by delivery hose and branch to the fireground at pump pressure.

When the pumper is to be committed to pumping from a static water supply some distance from the fire, the required equipment for the job at hand (eg foam and equipment) will be left adjacent to the fireground before the lay-out of hose commences.

Other relevant information required for Case Four drills include:

- Pumper positioning
- Notes on suction lines
- Notes on suction hose

Training Objective	
Performance:	The crew will draught water from a static water supply and provide and maintain an effective firefighting stream using a branch, delivery hose and pumper.
Conditions:	Simulated fire 40 meters from the pumper. Bowled hose to be used. Two, three or four lengths of suction hose to be nominated.
Standards:	The drill shall be carried out efficiently and safely in accordance with the laid down procedure.

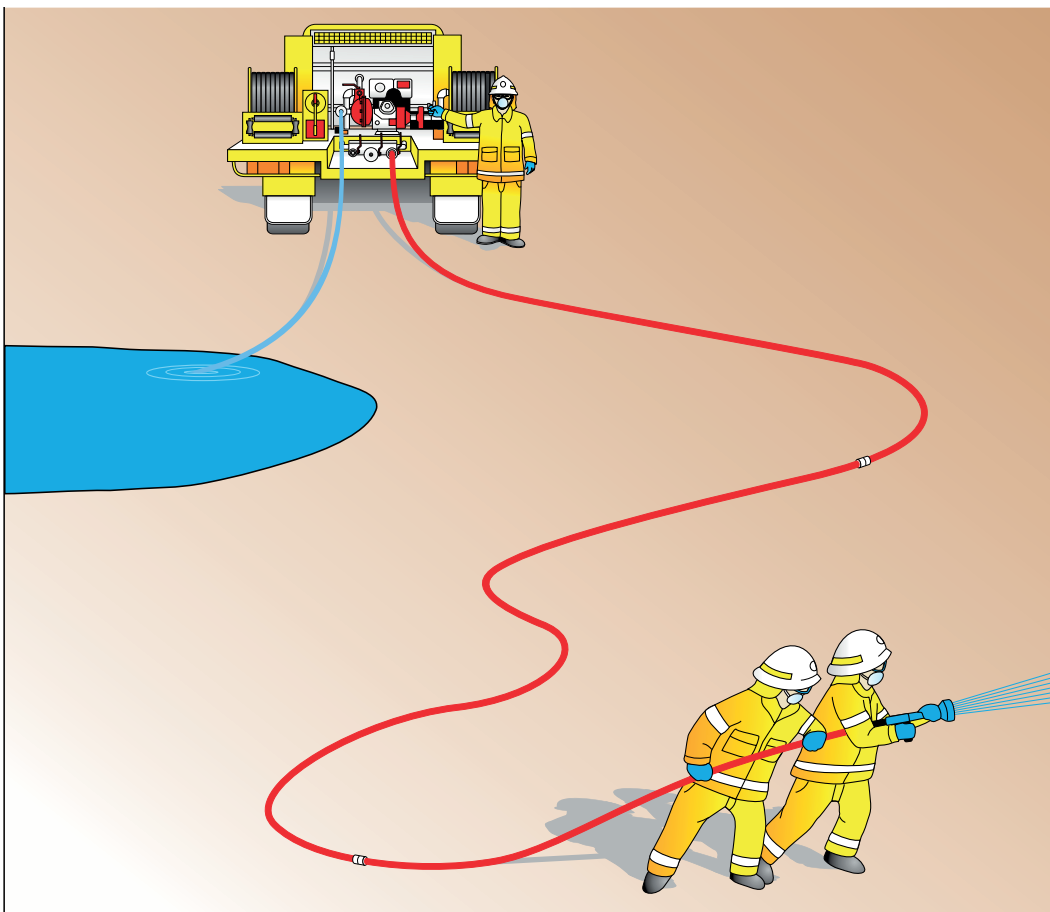
Firefighter No.	Action
1	a. Leave branch and sufficient hose adjacent to fire. b. Bowl out sufficient hose. c. Assisted by Firefighter 3, provide required lengths of suction hose. d. Couple suction strainer. e. Make all joints and assist Firefighter 3 to couple suction hose to pump inlet. f. Direct lowering of suction hose into water. g. Return to branch and when set, call and signal "READY".
2	a. Drive to fire and allow crew to dismount. b. When Firefighter 3 calls "RUN UP / RUN BACK" drive to the static water supply. c. Engage pump. d. Loosen Case Four black cap (Camlock). e. Provide suction line, strainer, chafing gear, and spanners. f. Remove Case Four blank cap (Camlock). g. Attach suction line to hose. Make line fast to rear of pumper. h. Assist to lower suction hose into water. i. Prime pump. j. Break coupling and couple to outlet. k. Operate pump when "WATER ON" signal is given.

3

- a. Call "RUN UP / RUN BACK".
- b. Call "HALT" at static water supply.
- c. Apply handbrake.
- d. Assist Firefighter 1 to provide required lengths of suction hose.
- e. Assisted by Firefighter 1, make all joints and couple suction hose to pump inlet.
- f. Assist to lower suction hose into water.
- g. Place chafing gear.
- h. Remove kinks and bends from delivery hose.
- i. Back-up Firefighter 1.

Firefighter Information:

- A locking hitch will be used to make fast the suction line to the rear of pumper. A round turn and two half hitches may be used to tie off the suction line to the pumper.
- When the pumper is initially driven to the fire, firefighters unload required equipment for the job at hand.
- In some cases it may be appropriate to locate the pumper at the water supply before laying out hose to the fire.
- Suction hose will be coupled as follows:
 - **Firefighter 1:** fit suction strainer; straddle all male couplings; check all sealed washers; align couplings; clamp coupling by locking in with tabs.
 - **Firefighter 3:** straddle all female couplings; align couplings; align and couple female coupling to pump; clamp coupling by locking in with tabs.



UNIT EVALUATION & REVIEW

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It is important that we receive your comments on the accuracy, currency and relevance of the learning material of the study guide. Your response assists in the evaluation and enhancement of the study guide, and is integral to our continuous improvement system.

To this end, there are two forms following – a Review Form and an Evaluation Form.

The Review Form is to be completed if you believe there are inaccuracies within the document. If you do see any inaccuracies, please complete this Review Form, and send to:

**Volunteer Training
School of Fire and Rescue Service Training
QCESA
GPO Box 542
BRISBANE 4001**

The Evaluation Form is to be completed when you have finished the study guide.

Any constructive feedback you supply becomes a valuable resource for course developers and/or assessors. There is no requirement to provide personal contact details with your Evaluation Form comments. However the provision of these details will allow us to obtain further clarification of your comments if required.

Review Form

Name of Unit / Course: _____

Please photocopy the relevant pages from the unit and attach them to this form. Write your comments with regard to diagrammatic, photographic or script inaccuracies in the space provided. (Attach extra pages if the space is not sufficient.) You may also comment on inaccuracies in grammar, format, etc.

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

You may need to be contacted for further clarification. Please provide the following contact details.

Name: _____

Contact Ph: _____ **Vol ID:** _____

Brigade Name: _____

Type of Brigade Member: _____

Evaluation Form

Date: ____ / ____ / ____ Name: (optional) _____

Name of Unit / Course: _____

Please indicate by circling your response (wherever applicable)

1	Excellent	2	Good	3	Satisfactory	4	Poor
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The quality of the facilities provided	1	2	3	4
The quality of the instruction provided	1	2	3	4
Your response to the training techniques	1	2	3	4
The suitability of the unit materials	1	2	3	4
The support provided by Rural Fire Service Queensland	1	2	3	4
The suitability of the written assessment	1	2	3	4
The suitability of the assessment tasks	1	2	3	4
Relevance of unit content to your workplace	1	2	3	4
Increasing your ability to perform tasks in the workplace	1	2	3	4
Other (please provide details)	1	2	3	4

What additional facilities would have aided your learning experience?

What can our instructors do to improve their delivery of the unit?

What aspects of the unit were most beneficial?

What areas (if any) of the unit could be improved?

Additional comments:

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