

**SAFETY, WELFARE
AND FIRST AID**

10. SAFETY, WELFARE AND FIRST AID

10.1 Responsibility for Safety

Forest fire fighting is always a hazardous activity. In many countries several lives are lost and many men become injured during the forest fire season. The safety and welfare of the entire fire fighting organisation is the responsibility of the fire chief. Each person in authority is also responsible for the safety of the men under his / her direction.

Of course, every fire fighter must work safely and take heed of the fire fighting safety instructions. Safety activities should also include welfare and first aid services in the field.

Most governments have some kind of insurance cover for fire fighters.

10.2 General Safety Measures

Forest fire fighting activities and extinguishing fires is often a very difficult and dangerous task.

Accidents occur due to sliding, rolling or falling branches, lacerations from sharp tools, moving equipment and tools, being trapped by wildfire in the course of fire fighting, and many other reasons.

Based on recent literature, the accident frequency rate in the industrialised countries has stayed steady because of a thorough handling of the safety policy. However, in the developing countries there is an alarming increase in the number of accidents. The frequency of fatal accidents in the developing countries has at least doubled during the past ten years.

Some of the reasons for this sad reality are:

- lack of, or no observance of the safety regulations;
- high unemployment levels;
- ignorance of the dangers; and
- lack of adequate training.

It is important to realise that accidents cause heavy costs and losses. The knowledge of the losses due to accidents is important in order to assess the aims of the organisation for efficiency and to analyse the cost-benefit ratio for implementing the safety policy and regulations.

10.3 Accident Prevention

An accident is defined as an unwanted and sudden occurrence caused by an unsafe action and / or an unsafe situation, leading to death, injury, or damage.

These unsafe acts are influenced by the following factors.

- (i) **The background** - which is also called the indirect or primary cause, concerns questions beyond the influence of the safety plans, such as:

- lack of safety legislation; and
- constructional faults.

- (ii) **Human error** - is, in one way or another, involved in causing accidents. It is the question of attitudes that is difficult to control. It is only through education and safety campaigns that the people can be made more accident conscious.
- (iii) **Unsafe acts or situations** (direct or secondary causes) - are the most important factor that can influence accident prevention. If this factor can be eliminated, the accident will not happen. Extension methods and training could eliminate most of these unsafe acts and situations.

Injury and accidents can be prevented by the wearing of personal protective clothing and equipment. The important items of protective clothing and equipment are shown below.



10.4

Ten Fire Fighting Rules

The Fire Service of America has developed ten special safety rules for fire fighting. These rules are based on an analysis of the causes of accidents and death to wildfire fighters. When death or injury has occurred it is usually because one or more of these rules has been broken. Every person involved in fighting wildfires should know and follow these ten rules:

- (i) Keep yourself informed about the weather conditions and forecasts.
- (ii) Know what the fire is doing at all times, observe it personally.
- (iii) Base all actions on the current and expected behaviour of the fire. For instance, if the wind changes, change the position of the crews to a place of safety.
- (iv) Plan escape routes for all personnel, and inform them where they are located.
- (v) Post a look-out when there is any possibility of danger.
- (vi) Be alert, keep calm, think clearly, and act decisively.
- (vii) Maintain prompt communication with your men, your head of section, and all adjoining forces. The best communication is a radio network.
- (viii) Give clear instructions and commands, and be sure that they are understood.
- (ix) Maintain contact with your men at all times. Stay together as a crew. Never allow anyone to be completely out of contact with the group. Those who do leave the group are the ones prone to injury.
- (x) Fight the fire aggressively, but always place safety first.

10.5

Dangerous Situations

Several dangerous situations may arise during the course of a forest fire. Every fire fighter should know what these potentially dangerous situations are.

- (i) **When building a line downhill towards a fire.** This situation can be very dangerous if the fire makes a fast run and overtakes the crew. The crew must have a well defined and easily accessible escape route.
- (ii) **When fighting a fire on a hillside where rolling materials can ignite a fire below.** If the fire does start below, the fireman can be pocketed between it and the main fire. Patrol for spot fires below and have a definite planned escape route. Maintain a look-out.
- (iii) **When the wind gets stronger or changes direction.** Watch out for spot fires, snags on fire, and a possible mass transport of embers. Be ready for a blow-up, check the escape routes.
- (iv) **When in an area where the topography and/or cover makes travel very difficult.** The fireman must have an escape route planned in case the fire starts to run in his direction. Provide for observation of the progress of the fire. Try to avoid this situation.
- (v) **When in unfamiliar country, or your fire fighters are not familiar with local conditions influencing the fire behaviour.** Know the fire weather forecast and provide for communication. Request and arrange for local information.
- (vi) **When the main fire cannot be seen and there is no communication with anyone who can see it.** Arrange to correct these conditions, or at least to maintain communications. Be certain that a satisfactory escape route is available and known to the crews.
- (vii) **When drowsy and / or tired.** Keep moving. Check your fitness and welfare. Do not go near the fire.

10.6 Welfare of the Crew

Only men in good physical condition should work on wildfires. To be effective, the crew must be kept in good physical condition. Eight to twelve hours work per day is all that should be expected from the crew. An overworked crew is much less productive and becomes accident prone. Experience has shown that the work effectiveness of the men is reduced by about 50% after 6 - 8 hours of forest fire fighting work. A good time to change crews is late in the afternoon and early in the morning since the wind is usually calm and the fire is less fierce.

If the control operations continue past the hours of daylight, provision for a rest is necessary. The crew may be released to return home and be replaced with a fresh crew, or sleeping facilities may be provided. On some operations, bedrolls and eating facilities are provided at camps which have been set up to support the control action.

Food is essential for the firemen. It is sometimes provided in the form of packed lunches or hot meals delivered to the line. Other meals are provided at the camp or at a local cafe. Good nourishing food, and plenty of it, are essential for good fire suppression.

Drinking water is also essential. This is usually provided by individual canteens for crews on the line. Re-supply can be made by water carriers, air drops, or any number of other methods. The important point is that adequate, portable, and safe water must be provided to all the firemen. It has been noticed that if the firemen do not receive any drinking water during the first 1 - 2 hours of work their effectiveness is greatly reduced.

Planned rest periods will maintain the energy of the crew. Line workers should not be overworked, except in emergencies. If to control a hot spot or break-out it is necessary to work under very hot, smoky conditions, the men should be changed frequently and provided with a rest period. The men should also be rotated between tough and easy work.

Wildfire crewmen should wear suitable protective clothing. Heavy, laced leather shoes or boots with nonskid soles are necessary. Rubber boots are unsuitable for wildfire fighters. The most flame resistant clothing should be worn, such as denim, cotton, or wool.

Nozzlemen who are working close to the fire should also have equipment with face shields or goggles. Gloves should always be worn.

10.6.1 Safety briefing

A safety briefing must be given to all fire fighters before they go on the line. The crew leader is responsible for the safety of the men under his command and should conduct the safety briefing. First of all, the crew leader should determine if any fire fighter is too old, too young, or physically unable to fight fire. Secondly, the men should gather in a tight, compact group and the leader should speak with emphasis, and loud enough for instructions to be heard. Thirdly, safety supervision and instruction should be continued on the fire line, where it can be stressed during shift changes.

The following are suggested safety points to be given to fire fighting crews.

- (i) Your leaders are experienced. Stay with them, and do what you are told.

- (ii) The way to carry fire-fighting tools safely is down at your side (demonstrate). It is dangerous to carry tools on your shoulder.
- (iii) When you walk to and from the fire line, keep at least 6 feet (2 metres) apart in single file (demonstrate).
- (iv) When you are working with tools, keep a safe distance from other fire fighters; stay about 10 feet (3 metres) apart.
- (v) Your feet are your worst hazard. Keep sure footing at all times to avoid injury.
- (vi) Stay with your crew. Men have burnt to death by sneaking off for a nap.
- (vii) Watch out for tree branches which might injure your face or poke your eye. Don't injure someone else by letting a branch fly back in their face.
- (viii) Keep away from old dead trees, especially if they are burning. They may fall.
- (ix) Be alert for rolling rocks or rolling logs when you are walking or working on slopes.
- (x) Avoid stepping in burnt-out stump holes that will be full of hot coals.
- (xi) When you are hot and thirsty drink water slowly and do not drink too much at one time.
- (xii) Sit down when you are travelling in a truck equipped with seats. Otherwise, sit on the floor.
- (xiii) If you cut yourself, blister your heels or hands, or incur any other injury, report it to your leader immediately and obtain first aid treatment.
- (xiv) Safety is a matter of common sense. Use it, and you will keep yourself and others out of trouble.

10.6.2 Hand tool safety

The following precautions should be observed by all fire fighters to ensure the safe use of hand tools.



- (i) Carry hand tools at the balance point of the handle with the hand alongside the body. With one exception, never carry hand tools on the shoulder. Crosscut (ribbon) saws should be carried on the shoulder with the teeth pointing away from the body and preferably with a guard over the teeth.
- (ii) Sharp tools should have guards over the blades when they are not in use (e.g. axes, saws, etc.).

- (iii) Keep tools sharp; blunt tools are dangerous. Hand tool maintenance is described in chapter 7.
- (iv) When they are not in use, place tools so that the blades will not injure passers by. Avoid placing a tool where feet may be cut. Lean tools against a tree, rock, or stump in plain view.
- (v) Keep handles tight in the heads and free of splinters. Do not use tools with damaged or broken handles until they are repaired.
- (vi) Walk at least 2 metres away from others when you are carrying tools.
- (vii) Work at least 3 metres away from others when you are using tools.
- (viii) Use tools only for the purpose intended. Use the right tool for the job.

When using cutting tools such as axes, brush hooks, hatchets, machetes, etc:

- (i) have a firm grip and a firm footing;
- (ii) always chop away from the body and be ready to check a glancing blow (if it is necessary to cut toward your body, have complete control, use lighter blows, and be ready to avoid a glancing blow);
- (iii) remove all underbrush and overhanging limbs that might interfere when swinging a tool;
- (iv) use a natural stance with plenty of room to swing the tool, and never chop cross-handed;
- (v) guard against chips that may hit the eyes;
- (vi) be especially careful on hillsides;
- (vii) do not use chopping tools as wedges; and
- (viii) when using files to sharpen tools, use a handle and a knuckle guard.

10.6.3 Pumper and tanker safety

The following precautions should be observed by all fire fighters to ensure safety when pumpers and tankers are in use.

- (i) Pumpers and tankers must be maintained in top condition at all times. They must be kept clean and free of accumulated grease and oil. Particular care should be given to maintaining fuel and hydraulic lines without leakage. Tight-fitting fuel caps should be used.
- (ii) Crews should be fully trained in the use of the apparatus.
- (iii) Tankers should be kept at a reasonable distance from the heat of the fire. In a pump-and-roll stance, this may require that the nozzleman carry the hose while walking alongside the pumper.
- (iv) Pumpers and tankers should be positioned on the side of the road away from the oncoming fire, to reduce heat on the equipment and to allow passage of other equipment.
- (v) Fire apparatus parked on a highway at a fire should be marked by flags, flares, or red lights at both front and rear.
- (vi) Adequate supervision and communications with the pumpers, including the use of hand signals, should be maintained.
- (vii) Pumper crews should wear protective clothing. Goggles or transparent face shields should be worn by nozzlelemen.
- (viii) If caught in front of a head fire with a pumper, do not panic. Be alert, keep calm, think clearly, and act decisively. Hopefully, each fireman and each officer will operate so that no pumper will ever be caught in front of an oncoming fire. However, in spite

of the best efforts, pumpers have been caught in front of a running fire, and in some instances the vehicle engine has stopped running. Usually, the engine stops because of a vapour lock or because the vehicle becomes stuck. It helps to install an electric fuel pump on pumpers and other fire vehicles.

- (ix) It is strongly recommended that any wildfire pumper have a separate engine for the pump; the pump should never be driven by the truck engine alone. A separate engine doubles chances that the pumper will continue to pump water in an emergency.
- (x) If caught and water can be pumped, wet down the area around the truck and the truck itself. Use backpacks or gravity flow if the pumps are inoperable. Then, as the head fire approaches, use fog streams to protect you from the heat and flame and to punch a hole in the oncoming front. Even if only a small area around the truck has been wet down, firemen have been known to survive in the cab of the truck in grass fuel fires. Do not try to outrun the fire, unless you are positive that you are very near one flank. Stay together to assist one another.
- (xi) Protective coats have several good breaths of air between them and the body. As a last resort, get your nostrils, eyes, and mouth under the coat and make a run through the flame front. On reaching the burnt area, help each other put out any flames on clothing. Running is a last resort. Usually, it is best to stay with the truck if possible.
- (xii) The best air is closest to the ground. High heat and flame are the killers; it takes a while for protective clothing to catch fire. It is important to think your way out by using what you have to the best advantage - wet down or burn out the area you are in. The burnt area is the safest escape route if it can be reached.

10.6.4 Tractor safety

The following precautions should be observed by all fire fighters to ensure safety when tractors are used.

- (i) Guides, spotters, or helpers for dozers should be selected for their physical fitness as well as their other abilities. At least one helper should be assigned to each tractor.
- (ii) Anyone working around tractors should be specifically instructed on their job requirements.
- (iii) At night, men on the ground assigned to tractors should wear two head lamps, one shining forwards and one shining backwards, so that the tractor operator can see them at all times. Tractors must be furnished with lights for night work.
- (iv) All men in the vicinity of a tractor should be well aware of the tractor's movements instead of depending on the tractor operator to keep away from them.
- (v) In dozer operations in advance of the fire, a safety strip should be built for a retreat in case the fire makes a run. This strip is especially necessary when you are working along a ridge top above a fire in the valley below.
- (vi) Machines must not work directly above each other or in close proximity when lines are being constructed upslope or downslope.
- (vii) Men should never sit or bed down near a tractor.
- (viii) When the tractor is idling or stopped, the blades should be on the ground.
- (ix) No one should ever get immediately in front of or behind a tractor in operation.
- (x) No one but the operator should be allowed to ride on the tractor, except a spotter or a tractor boss when they are necessary in heavy brush.
- (xi) Men must not work directly above or below a tractor on a slope.
- (xii) Tractor hand signals should be learned and used for direction and safety.
- (xiii) All tractors should have approved spark arresters.

- (xiv) Long sustained grades on the fire line should be broken in order to avoid excessive erosion.
- (xv) Tractors should be equipped with safety canopies in wooded areas.
- (xvi) No one should ever get on or off moving equipment.

10.6.5 Foot travel safety

The following safety precautions should be observed by all fire fighters travelling on foot.

- (i) Travel at a sensible pace. It is useless to arrive at the fire worn out from hiking. Avoid steep up-and-down travel as much as possible.
- (ii) Stay at least 6 feet (2 metres) apart and carry tools properly at your side.
- (iii) The crew must keep together.
- (iv) Communications should be maintained.
- (v) Lights should be provided for night travel.
- (vi) Pass burning fire-weakened trees, or “leaners,” on the side uphill or opposite to the lean, watching it closely while doing so.
- (vii) Stay away from snag-felling areas. Only a qualified snag-felling crew should be allowed in these areas.
- (viii) Watch for rolling rocks and logs.
- (ix) Watch for rock slides, cliffs, outcrops, and other hazards to travel, especially at night.
- (x) Fast travel through dense unburnt brush is practically impossible.
- (xi) In fast-burning fuels, watch out for fast spread of the fire in any direction. Communicate with a lookout and have an escape route planned at all times.
- (xii) Travel far enough apart so that swinging branches will not slap the face of the person behind.

10.6.6 Safety on the line

The following precautions should be observed regardless of fire size or the number of fire fighters.

- (i) Officers (squad boss or fire boss) should instruct crews on area hazards and safe working practices before they start work. The men in charge must have experience and/or training in these practices. Each person in charge should be identified to all crew members. The crew must understand this person's authority to issue instructions and must follow instructions at all times, particularly in emergencies.
- (ii) Escape routes should be chosen to avoid traps. Each crew should be thoroughly instructed in escape route use. Lookouts should be posted where necessary. If it is obstructed, the escape route should be cleared in advance to make it usable.
- (iii) A safe place should be provided for resting, lunching, or bedding down. If necessary, a lookout should be posted.
- (iv) Night crews should arrive on the line in daylight to familiarize themselves with the area. They should be advised of unsafe working conditions by the crew that they are relieving.
- (v) Every fire fighter should be alert to the action of the fire, since it can overtake them day or night.
- (vi) Individuals on the line should work at least 10 feet (3metres) apart.
- (vii) Reasonable rest periods should be provided. Shifts should not exceed twelve hours. Some reserve energy should be saved for emergencies.

- (viii) Immediate first aid must be administered to the injured. First aid equipment and knowledgeable first aid people should be at the fire. If it is a large fire, an emergency medical technician or a physician should be immediately available.
- (ix) Fire weather information should be used.
- (x) Men or machines should not work directly above one another.
- (xi) Extra fuses should be packed in the hand, not in clothing. Use a stick in the fuse ferrule to get the flame close to the fuel. Keep falling slag off clothing.
- (xii) If possible, power lines in the fire area should be cut off by the power company. If they cannot be cut off, men should not work underneath a power line when fire is producing any appreciable amount of heat or smoke under the line. Back off 30 metres or so until the main heat and smoke have passed. Nozzlemen must not direct a straight stream toward the electric wires. Never approach a broken line, since it can whip over a wide area. Do not consider either end of a broken line dead until the power company has grounded both ends and has advised that it is safe. Fence wires can become charged by broken power lines coming in contact with them. Be aware of this possibility and keep everyone away from the fences until the situation is corrected.
- (xiii) Do not place drip torches or flame throwers where they will get hot, and never open them while hot. Use only the recommended mix of fuel.
- (xiv) Avoid stepping on hot ashes; there may be a hole burnt underneath, and it may be full of hot coals. Check around stumps for concealed burning roots. As a general rule, do not walk on ashes unless the spot is checked with a stick or a tool.
- (xv) Be alert for sudden flare-ups that may scorch hands or face.
- (xvi) Only experienced crews should be used in snag felling; the area must be cleared of other workers.
- (xvii) Unauthorized persons should not be allowed on the fire line, especially underaged boys. They can be used on mop-up or in the camp but not on the hot fire line.
- (xviii) Observe **the ten fire-fighting rules** (section 10.4) and avoid situations that shout, "Watch out!"

10.6.7 Advising civilians

Objectives

The first priority at any fire is to save life, and the second is to save as much property as possible, particularly the more valuable and important property. The third priority is to prevent panic. The fourth is to permit un-hampered fire-fighting operations.

Property owners can aid in the protection of their homes and property. Water supply, earth-moving and water-dispensing equipment, and hand tools should be made ready. Fire fighters should advise property owners how their actions can aid fire-fighting operations.

Action by property owners

Property owners can aid operations by taking the following actions:

- (i) Close all doors and windows on the outside of the structure and all doors inside to slow room-to-room fire travel.
- (ii) Connect garden hoses and leave them loosely coiled in plain sight. Conserve water and fill any large containers, such as tanks, swimming pools, etc. Place available ladders against buildings.

- (iii) Wind up car windows and back the car into the garage.
- (vi) Cars left in the open should be placed in cleared areas and located so that they will not obstruct fire apparatus.
- (v) Leave the lights on in buildings. In case of general evacuation, leave the front door unlocked.
- (vi) Consider tearing down and removing combustible objects (wooden fences, wood piles, light patio furniture, bamboo screens, etc.) that present an exposure hazard to adjacent structures. Seal up attic and ground vents.
- (vii) Chop down highly combustible shrubbery and place it where it will not become hazardous to adjacent structures. Examples are cypress hedges and dead trees.
- (viii) Remove combustible fences and leaves from roofs and rain gutters. Remove dry grass from around structures, butane tanks, etc.
- (ix) Lower and close Venetian blinds. Remove inflammable window curtains and other readily combustible items (newspapers, furniture, rugs) from rooms where heat and draughts might logically break windows.

10.6.8 Personal safety

To ensure personal safety, civilians should observe the following precautions:

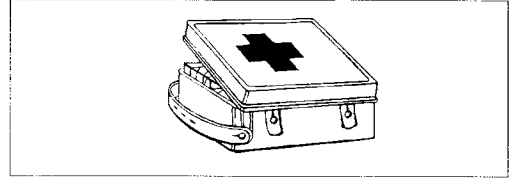
- (i) Keep the family together in a safe place, such as a large clearing or burnt area, or stay in the house.
- (ii) Stay away from hillsides above brush fires. Remember that smoke and heat draughts may be fatal.
- (iii) If it becomes necessary to drive through a brush or grass fire or through a smoky area, wind up car windows, close vents, and drive slowly with the lights on.
- (iv) Be aware of congestion on narrow roads. Do not drive down steep and unfamiliar roads.
- (v) Carry a shovel, an axe, and a water bucket in each car.
- (vi) If retardant drops have been made across roads, use extreme care because the retardants are slippery.
- (vii) If you are caught in an emergency, stay in your car with windows wound up and vents closed.
- (viii) Usually, it is safer to stay in the average residence than to flee uphill from a sweeping fire. A house may eventually be destroyed but before it becomes untenable a great amount of mass heat will have swept by so that later a person can survive outside even though the structure is eventually lost. Wetting down the roof and eaves enhances the probability of survival.
- (ix) Be alert, keep calm, think clearly, and act decisively.

10.7 First Aid

Immediate first aid must be administered to the injured. First aid equipment and a knowledge of first aid should be given to each and every fireman.

In every fire suppression organisation there must be a named person responsible for all first aid activities. In large fires there should be several trained first aid people or crews. All regular fire fighters, both permanent and volunteer, should have completed a standard Red Cross first aid course. Supervisors should also have completed the Red Cross course, or a more detailed course, in order to qualify for the wild fire service.

A good first aid kit should be carried with each wildfire backpack pump and should be checked and replenished before and after every fire.



The following is a first aid reminder list, and is not intended to be a substitute for completing a basic first aid course.

(i) Examine the victim thoroughly. Treat all injuries immediately in the following order.

Stoppage of breath

- Give artificial respiration.
- Treat the victim for shock (see shock below).

Serious bleeding

- Elevate the injured part, unless it is broken.
- Remove clothing from the wound.
- Apply pressure in order to stop the bleeding.
- Bandage the injury.
- Treat the victim as for shock.

Burns

- Remove all clothing from the burn, **if it has not stuck to the skin.**
- Cover the burn with a sterile dressing.
- Treat the victim for shock.
- Give the victim frequent small drinks of water.

Broken bones

- Immobilise the injury (using splints or padding) before moving the victim.
- Treat the victim for shock.

Shock

- Keep the victim lying flat, preferably with legs higher than the head.
- Keep the victim warm enough to prevent shivering.
- Give the victim a cup of warm water, tea, or coffee unless he is exhausted, unconscious, or internally injured (in the stomach).
- Reassure the victim.

Heat exhaustion

- Place the victim in the shade and loosen clothing.
- Keep the victim warm and lying down.
- Stimulate circulation by rubbing the victim's body briskly.
- Use an ammoniac inhalant.

(ii) Get help immediately. Report all injuries to the fire chief.

(iii) Arrange transport to a first aid station, or find an ambulance.

(iv) No less than fifteen men should be assigned to carry a stretcher in turn through rough timbered country.