

BULLETIN No. 71
Revised August, 1984

SAFETY IN FOREST FIRE CONTROL

Protection Branch
Forests Department
Western Australia



SAFETY IN FOREST FIRE CONTROL

To.....

of.....

Safety on the job is the responsibility of the manager and the employee alike. It is your responsibility. Be mindful at all times of your own safety and the safety of others about you.

Know and follow the safety rules in this booklet. Read it carefully. Retain it and re-read it from time to time.

I hereby acknowledge receipt of this booklet and agree to comply with the safety procedures it contains.

Name.....

Date.....

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CONTENTS

INTRODUCTION	3
PERSONAL PROTECTION	4
Protective Clothing	4
First Aid Kits	4
PREScribed BURNING—HAND METHOD	5
Description	5
Inspection Before Lighting	6
Instructions for Lighting Crews	6
Formation for Lighting Crews	7
PREScribed BURNING—AERIAL IGNITION	9
General Provisions	9
Verex Pistols	9
Transmission Wires	10
CLEARING AND REGENERATION BURNS	11
Safety Measures to be Adopted	11
FIRE FIGHTING	12
Awareness	12
Individual Survival Measures	12
Heat Stress	14
First Aid for Burns	16
WATCHOUT on the Fireline	17

CONTENTS—*continued*

VEHICLE SAFETY	18
FELLING OF BURNING TREES	20
CHEMICALS IN FIRE CONTROL	22
EMERGENCIES INVOLVING HAZARDOUS CHEMICALS	23
SNAKE BITE	24

INTRODUCTION

This booklet deals with the safety measures that are essential to forest fire suppression and prescribed burning activities conducted by the Forests Department.

This booklet supersedes the 1980 edition and has been expanded to include:

- Safety and survival in dangerous fire situations.
- Avoiding and treating heat stress on the fire front.
- Proper use of chemicals used in fire control.

Basic safety rules are listed and must be fully understood and observed by all staff and employees. This booklet serves as a training aid and safety reference for new as well as experienced fire personnel.

It is stressed that the fundamental theme is one of discipline—team discipline in formation and personal discipline. However, responsibility for individual thought and action does not cease with the acceptance of an order from a senior officer. Every man on the job must accept the responsibility for his own safety, as well as the safety of his workmates.

PERSONAL PROTECTION

Protective Clothing

All overseers must ensure that people under their control conform to safe standards of dress and behaviour.

- Protect against falling objects—wear an approved safety helmet adjusted to fit properly.
- Protect body against radiated heat—long sleeved shirts and long trousers. Don't wear synthetics, use wool, cotton drill, or probane treated cotton.
- Protect feet with safety boots in good condition, preferably calf length.
- Wear safety goggles or glasses to prevent eye injury from smoke irritation, wind blown debris, or chainsaw debris.

DO NOT WEAR shorts, singlets, T-shirts, thongs, or sandals in the fire area.

First Aid Kits

All gang vehicles used in fire control must carry a complete, standard first aid kit. Overseers or nominated gang members must check their kits regularly to ensure that the kit is properly stocked with medical supplies.

Each gang should contain at least one qualified first-aider.

PRESCRIBED BURNING HAND METHOD

Description

Most methods of prescribed burning involve strip lighting: spots of fire are lit along parallel lines and at predetermined spaces between the spots and between adjacent lines. This spacing, together with the direction of the lines, is referred to as the lighting pattern and is used to control or influence fire behaviour. Before each burn the officer or overseer will calculate the lighting pattern from the forecasted weather and the "Forest Fire Behaviour Tables".

Lighting is normally done by two or more men moving in echelon formation, as shown in page 8. Where strip width or dense scrub precludes visual or verbal contact between lighters, a compass or other direction finder shall be used to maintain direction, and the lighter shall be accompanied by a compass-man. On no account shall the strip length exceed 2 000 metres.

In karri forest or other areas of very dense understorey, it may be necessary for parallel walking lanes to be constructed, by a bulldozer or other machine, before burning commences. This will be decided by the officer who prepares the prescription.

Signs warning the public that prescribed burning is in progress, must be erected on all roads associated with the burn. These signs must be removed once patrol work ceases.

Inspection Before Lighting

The officer in charge of the burn must carry out a full inspection prior to the burn. A burn prescription must be completed on the area to be burnt. Amongst other things the prescription must include a plan highlighting those features that may affect personnel safety, such as:

- Burn boundaries.
- Roads: trafficable and non-trafficable.
- Swamps, creeks, and other dangerous areas.
- Private property within and adjoining the burn.

The prescription must be given to the overseer on the morning of the burn. An officer will discuss the burn with him, explaining aspects of the prescription which will help do the job effectively, such as:

- Litter age and tonnes of fuel per hectare.
- Forest and scrub types.
- Fire danger index prescribed for the burn.
- Preferred wind strength and direction.
- Remarks on any dangerous areas or special conditions.
- Departments, organizations or persons it may be necessary to contact on the day of the burn.

Instructions for Lighting Crews

The overseer or officer directly in charge of lighting must brief all members of the gang before starting each strip line. He must ensure that each man knows exactly what is to be done.

All personnel must be familiar with:

- The area to be burnt which should be shown on the plan and on the ground by way of signs or paint marks.
- The roads and tracks in the vicinity and their point of outlet.
- Features on the plan such as swamps, creeks, and steep slopes.
- Wind direction and the likelihood of changes.
- Direction of strip lines, and whether echelon or line-abreast formation is to be used.
- Spacing and placing of men in the formation.
- Action to be taken by individuals if they lose contact with workmates.

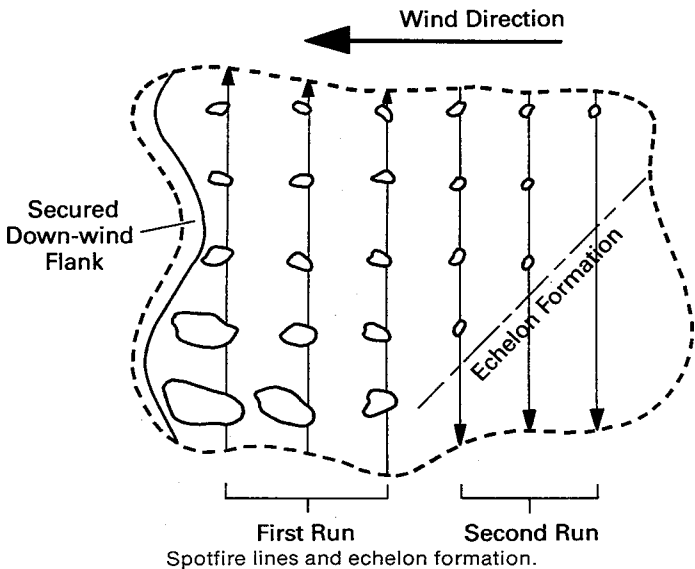
The overseer should place his most experienced and competent men at each end of the formation. It is important that each employee ensures he understands the overseer's instructions to the lighting crew. If uncertain, he should ask for clearer instructions.

Formation for Lighting Crews

The overseer is responsible for seeing that each man starts his strip lines correctly.

After starting the men on their respective lines, he will:

- Check fire behaviour, particularly flame height and rate of spread.
- Contact each lighter on completion of his line.
- Alter spacing for next strips, if necessary.



Spotfire lines and echelon formation.

If a lighter comes upon a dense thicket, swamp, or other obstruction on his line, which he cannot penetrate with safety, he must immediately:

- Stop lighting and extinguish his torch.
- Move around the obstruction and contact a workmate.
- Regain position and recommence lighting if it is considered safe to do so.
- Report the incident to the overseer on completion of the line.

A maximum of five men is allowed in any one formation. This implies that only two, three or four may be used in some situations.

PRESCRIBED BURNING AERIAL IGNITION

The overseer will brief each gang member on the sector to be patrolled and measures needed to secure the edge of the burn, including burning-out of unburnt pockets, suppression of hopovers and mopping up.

Gang members are not to enter tracks within the burn after lighting has commenced except on specific advice from the fire boss. A patrol within the burn area may be required, prior to lighting, to ensure that no member of the public is unwittingly in the area.

General Provisions

- Observe safe driving procedures—see *Vehicle Safety* section, page 18.
- On all roads forming burn perimeter, erect signs warning the public that prescribed burning is in progress.
- Wear protective clothing as described on page 4.

Verrey Pistols

Marker vehicle crews must be conversant with the safety rules for firing of verrey pistols:

- Verrey pistols may be handled only by personnel who have been fully briefed and are licensed to use them.
- They must be fired only when standing on the ground and at an elevation and direction which projects the flare above the canopy of the forest to be burnt.

- The arm should be slightly bent to absorb recoil.
- Pistols must not be loaded until the operator is in a position to fire. Loaded pistols must not be carried in vehicles.
- The muzzle must be pointed down until ready to fire, and must never be pointed at another person. Do not cock the pistol until ready to fire.
- If there is a misfire, cock the pistol and fire again. If another misfire occurs, wait fifteen seconds to avoid flashback, then “break” the pistol with the breech-opening away from the body, and eject the cartridge.
- Very pistols must be cleaned, oiled and returned to the pyrotechnics store at the end of each day’s burning.
- Flares must be kept in the box provided, and not loose in the vehicle. They must not be jarred or bumped, especially near the detonator cap.
- All unused flares must be promptly returned to the pyrotechnics store.

Transmission Wires

- The Beacon antennae on marker vehicles reach up to 4.5 metres above the ground and care should be exercised near overhead transmission wires.
- Any accident or incident concerning power lines is to be reported to the S.E.C. and the Forests Department Safety Officer immediately.
- On no account should any attempt be made to extinguish a burning pole or cross-arm until notified that the line is electrically dead.

CLEARING AND REGENERATION BURNS

These are usually very intense fires, lit in mid-summer or autumn to promote regeneration in cut-over forests of karri or to dispose of clearing debris for the establishment of plantations.

Different techniques are used in lighting these fires, but hazards common to all include:

- Smoke and ash in eyes.
- Falling limbs and burning debris.
- Uneven ground where it is easy to slip or fall.
- High level of radiant heat.
- Strong indraft winds and fire winds.

Safety Measures to be Adopted

- Always wear full protective clothing, particularly anti-smoke eye protection and helmet flaps.
- When stripping-out across logging tops and debris, lighters must always work in pairs, and each pair must maintain visual contact with those on either side.
- Protect exposed skin from radiant heat, with shirt sleeves rolled down, light-weight gloves, and ~~Barrier cream on face and neck.~~
- Wherever possible, move along snig or dozer tracks in preference to heavy tops. Note the position of open areas such as landings, where temporary refuge can be taken.
- Understand and obey lighting instructions.

FIRE FIGHTING

Awareness

- Insist on a prior briefing on all fire suppression jobs.
- Observe and keep in mind local topography—landmarks, location of roads, clearings and likely safe spots.
- Select escape routes before entering the fire zone.
- Avoid steep slopes above a fire.
- Thickets, swamps and creeks can become traps. Keep out of dense vegetation near the fire zone.
- Plan ahead and anticipate changes in the fire due to wind changes, local topography or fuel types.
- Stay on the edge of the fire, don't wander into unburnt country and don't become isolated from your companions.
- Beware of burning limbs and trees.
- Beware of fallen powerlines—particularly near wire fences.
- Memorize the eight WATCHOUT rules on page 17.

Individual Survival Measures

Radiated Heat. Studies have shown that radiated heat is the main peril leading to exhaustion, collapse and even death. Use any and every means that will shield you from radiated heat—this is important and could save your life. Wear protective clothing as described in page 4.

Conserve Energy. Maintain self control under threat situations—panic is infectious, drains physical and nervous energy, and clouds judgment.

Avoid exhaustion from over-exertion or prolonged periods of effort. Don't run unless absolutely necessary.

Refuge. If you are trapped in a motor vehicle during a bushfire, stay in it. Look for bare ground; close all windows and vents; cover yourself as much as possible; and lie on the floor. Remain in the vehicle as long as possible until the fire front has passed (usually a matter of 3-4 minutes).

If you get caught on foot in a bushfire, follow these guidelines:

- Try to stay on bare or burnt ground, e.g. gravel pits, clearings, roads.
- Move across the slope and out of the path of the fire and work your way downslope towards the back of the fire; do not run uphill or away from the fire unless you know a safe refuge is near.
- Do not attempt to run through flames unless you can see clearly behind them.
- Move through flames onto burnt ground where flames are small (less than 1.5 metres high). Select a path that is least obstructed by logs, dense growth or uneven ground.
- Use clothing to best advantage as a shield.
- Beware always of the danger from burning limbs and trees in burnt country.

If conditions become severe, use every possible means to protect yourself from radiation.

- Cover yourself with dirt or sand and use wheel ruts, depressions, large rocks, or logs to give protection. Take refuge in ponds, running streams, or culverts, but avoid elevated water tanks.
- Carry matches and if trapped, light up an area and use burnt country as a refuge. Do this only if there is time for the back-burn to spread sufficiently (20 metres or more) before main fire front reaches the area.

Heat Stress

Heat stress occurs when humidity, air temperature, radiant heat and too little air movement, combine with heavy work and clothing to raise the body temperature beyond safe limits. Sweat, as it evaporates, is the body's main line of defence against heat. When water lost through sweating is not replaced, the body's cooling system breaks down and body temperature climbs dangerously, subjecting the body to heat stress. Firefighters should learn how to recognize and avoid heat stress, and how to give immediate first aid.

Recognizing Heat Stress

Any of the following symptoms and signs may be present:

Symptoms—

- Feeling hot, exhausted, nauseated, short of breath.
- Muscle cramps of limbs or abdomen.
- Thirst.
- Headache.
- Giddiness, lack of co-ordination.

Signs—

- Pale, cool and clammy skin.
- Profuse sweating.
- Rapid breathing and pulse.
- Muscle twitching.
- Vomiting.
- Possible confusion, irritability, aggression.

Preventing Heat Stress

- Aim at keeping fit.
- Adjust to hot weather activity gradually—set a sensible pace and have frequent breaks.
- Cease working when affected by heat cramps or exhaustion.
- Drink water often, and more than your thirst demands.
- Wear loose-fitting, porous clothing made of natural materials.
- Conserve your energy—you may need it later for an all-out effort.
- Replace salt at mealtimes. Avoid salt tablets as excessive salt can lead to distress and illness.

First Aid for Heat Stress

- Keep casualty lying down in a cool place.
- Loosen tight clothing.
- Replace lost fluid and salt—water or lemonade with added glucose and ½ teaspoon salt per litre—encourage small quantities frequently.
- Apply icepacks to cramped muscles, but do not massage.
- Seek medical aid if casualty:
 - vomits and cannot keep fluids down;
 - does not recover promptly.

First Aid for Burns

- As soon as possible gently pour clean, cold water onto the injured area to cool it.
- Do not touch the injured area.
- Do not apply lotions of any kind.
- Do not remove burned clothing and do not break blisters.
- Remove the casualty for medical aid as quickly as possible, except where the burn is very small and only superficial.
- Place the casualty in a lying position, dependent on injuries.
- Loosen any tight clothing.
- Cover the injured area with a clean, non-stick dressing and, if necessary, bandage lightly to protect from infection and to minimise fluid loss.
- If thirsty, the casualty should be given sips of tea, water etc., but NOT alcohol.

“WATCH OUT” on the Fireline

Eight commandments for firefighting crews.

- | | |
|---------------------|--|
| W—WEATHER | affects fire behaviour, so watch for changes in wind strength and direction. |
| A—ACTIONS | must be based on current and expected fire behaviour. |
| T—TAKE CARE | by conserving energy and avoiding dehydration. Drink water frequently, even if you don't feel like it. |
| C—CONTACT | to be kept at all times with your leader(s) and workmates. |
| H—HAZARDS | to watch for are flashy or heavy fuels, dense thickets, steep slopes and burning trees. |
| O—OBSERVE | marked changes in fire behaviour, and suitable escape routes. |
| U—UNDERSTAND | your instructions and make sure yours are understood. |
| T—THINK | clearly, remain alert and act decisively. |

Memorize these for your own and your workmates' safety.

VEHICLE SAFETY

This section outlines safety procedures involving vehicles at prescribed burns and in firefighting work.

Parked Vehicles. More often than not, vehicles will be parked for a greater part of the time, and so should be:

- Parked so that they can move directly out of the area on a known, safe route.
- Left with the ignition key in the lock.
- Parked on a cleared or previously burnt area.
- Parked so that other vehicles may pass easily and safely.
- Left with cab windows closed and all inflammable material stowed away.

If a man is left with the vehicle he should know the outline of the whole operation, what other members of the gang are doing, any rendezvous with the others, and communication schedules.

Driving Through Fire and Smoke. Should it become necessary to drive through a burning area or one heavily covered with smoke, the following procedure should be observed:

- Drive at a safe speed.
- Keep cab windows closed.
- Switch on headlights and sound horn occasionally.
- Remove exposed inflammable material from truck.
- Men travelling on truck tray should have water available, through a powered pumper, tank or knapsack sprays, and must wear all available items of protective equipment.

Caught With No Escape Route. Should you be trapped in this situation, the vehicle does offer you the best chance of survival, provided you follow these basic rules:

- Park the vehicle on the area that has the least amount of flash fuels. Where possible use road cuttings, large logs or similar objects to protect the vehicle from the oncoming fire. This will also provide you with extra protection against radiant heat.
- Use any time available to remove flash fuels immediately adjacent to the vehicle. Do not completely exhaust yourself in doing so.
- Do not attempt to back burn unless you are *absolutely certain* of enough time for success.
- Ensure all windows and doors are shut to keep out smoke, heat and burning embers. Wait outside, using the vehicle as protection for as long as possible.
- When it becomes impossible to remain outside, enter your vehicle quickly on the lee side and shelter yourself from radiant heat by remaining on the floor and covering the body with rugs, floor carpets, etc.
- Remain in the vehicle for as long as is humanly possible. The flaming or flash period rarely exceeds three to four minutes in a forest fire or 30 seconds in a grass fire.

Contrary to popular belief fuel tanks do not “just explode”. Even in the worst situation it will be some minutes before the vehicle catches fire and becomes intolerable. Remember those “few minutes” will probably save your life.

FELLING OF BURNING TREES

Burning trees located on the perimeter of a fire break can start new outbreaks. However, before the decision to fall a burning tree is made, the Sector Boss or Overseer should first consider other options for dealing with this problem. These include:

- Allowing limb(s) to burn out and contain and patrol any outbreaks.
- Burn out small area surrounding the burning tree(s).
- Push over tree with dozer.

If it is decided to fell a burning tree, the following precautions must be taken:

- Chain saw and associated tools must be appropriate for the task and maintained in top condition.
- Ensure safety equipment is in good condition and is worn at all times.
- Sector Boss or Overseer to inspect and mark each tree before felling commences.
- Only experienced fellers should be used when felling burning trees. The FELLER reserves the right to refuse to fell any tree.
- Inspect nearby trees (within 2½ times height of tree) for dangerous conditions, e.g. burning hollow butts and burning crowns.
- Do not fell trees with multiple burning limbs.
- Ensure debris is removed from work areas to provide space for safe working conditions and give a firm footing.

- Prepare a suitable escape path and clear it of obstructions into a safe area. Do not leave equipment on the path.
- Felling not to be attempted after dark.
- Avoid felling directly into the sun when it is low on the horizon.
- Before making back cut, STOP MOTOR, give audible warning to swamper, who must acknowledge area clear before continuing.
- Beware when using hammer and wedges on a tree, as burning limbs are likely to be shaken free.
- When felling is being done near road or track, prominent signs must be displayed each side of danger zone. Lookout men should be posted on track.
- Refuelling or maintenance of saw must be carried out away from danger zone.
- Check with Sector Boss or Overseer if you consider rest period necessary.

The Swamper. Must be experienced and have a good knowledge of felling techniques.

- Must be in reasonable proximity to the faller at all times during felling operations.
- Must be on the lookout for any overhead dangers that may occur during felling operations.
- Give audible warning to any persons entering the danger area.
- Arrange with the feller a method of communication in the case of an emergency during felling operations.
- Must liaise with lookout men when felling is being done near roads or tracks.

- If the feller needs to leave the tree to re-fuel or maintain his saw, the swamper must remain at the tree and give audible signal to the feller before he returns to the tree. The faller must acknowledge before returning.

CHEMICALS IN FIRE CONTROL

Below is a brief list of chemicals used in fire control, their main risks to health, appropriate precautions and first aid. More comprehensive information is available in Part 18 of the Foresters' (Chemical Users') Manual.

Glycol (mono-ethylene glycol)—oily, odourless liquid used for igniting the potassium permanganate in incendiary capsules.

Store away from acids and other reactive chemicals, e.g. potassium permanganate because of risk of ignition.

Avoid contact with skin and eyes. If splashed in eye, flush with water for 15 minutes, cover eye with pad.

Potassium permanganate— KMnO_4 , dark purple crystalline granules, strongly oxidizing. Used in incendiary capsules to ignite on contact with glycol.

Toxic by ingestion and inhalation and a strong irritant to tissue.

If spilt, clean up and dispose of immediately to prevent possible reaction with other materials. Best deactivated with plain water.

Amgard (di-ammonium phosphate)—water soluble, whitish granules. Used dissolved in water as a fire retardant.

Avoid contact with skin and eyes. If splashed in eye, flush with water for 15 minutes, cover eye with pad.

Sodium hypochlorite—liquid solution, generally sold at 12.5% strength (of available chlorine) as a water purifier for home swimming pool. Used, greatly diluted, in fire pumpers to kill spores of jarrah dieback in the water.

The undiluted 12.5% solution is highly toxic if swallowed and irritating to the skin. Avoid contact with skin and eyes. If splashed in eye, flush with water for 15 minutes and cover with eye pad.

EMERGENCIES INVOLVING HAZARDOUS CHEMICALS

Any incident attended by the Forests Department in which hazardous chemicals have been spilled or are on fire must be treated with the utmost caution. Water can react violently and explosively when it contacts certain chemicals.

A set of HAZCHEM notes has been provided for all Forests Department vehicles equipped for firefighting, to minimize the risk of further danger and injury to firefighters and the public.

A Forests Department firefighting unit attending an incident should immediately:

- (i) Interpret the HAZCHEM code on the Emergency Information panel of the transport vehicle and act according to the procedures laid down in the HAZCHEM notes.
- (ii) Pass relevant information to the Local Authority.

It cannot be stressed too strongly that Forests Department forces should take **NO** action concerning the load itself, or the vehicle, until they have received specialist advice.

SNAKE BITE

Remember

Nearly all bites are by venomous species.

Appearance of Bite

Usually two puncture marks about a centimetre apart with swelling, reddening, bruising.

Symptoms and Signs

First symptoms appear 15 minutes to 2 hours after bite, these may include:

- Double vision.
- Drowsiness.
- Nausea and vomiting.
- Sweating.
- Faintness.
- Diarrhoea.
- Headache.
- Pain in chest or abdomen.
- Breathing difficulties.

First Aid

Keep the casualty at rest and allay any fear. Apply a broad, firm bandage around the limb, beginning at the bitten area (as much of the limb should be bandaged as possible). Do not bandage so firmly as to restrict blood flow to the limb below the bandage.

Keep the limb as still as possible by splinting it with any rigid material that may be available.

Leave bandage and splint in position until medical aid is reached.

If possible, alert doctor and hospital ahead and have a trained first aid person stay with the victim continually to watch pulse and breathing, and apply resuscitation if necessary.

Don't cut or excise bitten area.

Don't apply an arterial tourniquet.

Don't wash bitten area—the snake involved can be identified by venom on skin.