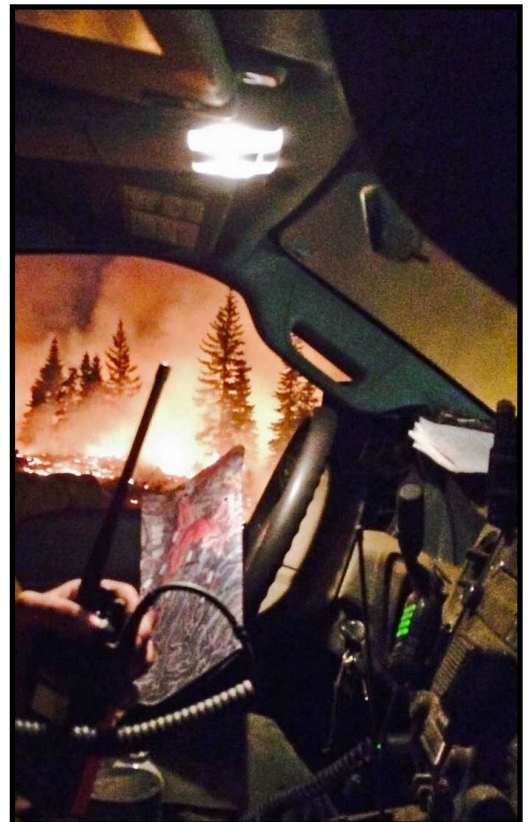


S - 185 (for the
Province of BC)

Fire Entrapment
Avoidance

TRAINEE WORKBOOK

Wildfire Suppression Training



COURSE LEARNING OBJECTIVES

Upon completion of this course, the trainee will develop a basic knowledge of fire entrapment avoidance and safe work procedures including:

- ✓ Having a safety first attitude when working on the fireline;
- ✓ Following the fire entrapment avoidance guidelines while on wildfires;
- ✓ Knowing the role of the supervisor in entrapment prevention;
- ✓ Using proper safe work procedures and the LACES protocol;
- ✓ Understanding situational awareness and why it is critical to stay alert at all times;
- ✓ Surviving in a fire entrapment scenario;
- ✓ Recognizing when it is time to use an escape route and move to a safety zone.

A mark of 70 % on the written exam is required for successful completion of the Fire Entrapment Avoidance course.



COURSE OVERVIEW

Wildfires are a powerful and unpredictable force of nature. Under certain conditions, wildland fire will challenge suppression efforts and may threaten the safety of fireline personnel engaged in suppression activities.

Safe work procedures dictate that all fireline personnel utilize a system of **Lookouts, Anchor Points, Communications, Escape Routes and Safety Zones (LACES)** to avoid fire entrapment and other incidents in which compromise fire fighter safety.

Fire entrapment occurs when fireline personnel are threatened by a sudden change in fire conditions and are unable to utilize escape routes to access safety zones. This is a life threatening situation. Fireline personnel must employ 'last resort' tactics such as emergency escape or fire entrapment survival actions during these incidents.



The British Columbia Wildfire Service fire personnel were trained in fire shelter use and were required to carry fire shelters for a period of 10 years (from 1995 to 2005). Knowledge of fire entrapment avoidance along with the organization's safe work procedures with respect to fire crew deployment and selection of tactics have always been successful in preventing fire entrapments. The fire shelter was an additional last resort option for BCWS personnel during this period. In 2005, a technical review of fire shelters was conducted by the Wildfire Service and, for a variety of reasons; all fire shelter use by BCWS personnel was discontinued. This decision brought the BCWS wildland fire suppression safe work procedures in line with the other Canadian firefighting agencies.

The S-185 Fire Entrapment Avoidance training materials have been revised as of March 2006 and all fire shelter deployment information has been deleted from the course. Fire entrapment avoidance information was also updated to include additional information and technical research on safe work procedures, escape plans and fire entrapment survival actions.

FIRE ENTRAPMENT AVOIDANCE

Fireline Safety: Having a 'Safety First' Attitude

Wildland fire suppression is a hazardous occupation.

The majority of fireline injuries and fatalities, including those resulting from fire entrapments, are the result of fire personnel not following safe work procedures.

A crew's efforts are diverted away from the fire when injuries occur, which may escape and threaten other fire crews or the public.

The first responsibility of all fire personnel is to prevent injury to themselves and the individuals they work with. Firefighters will not take part in any suppression activities that jeopardize personal safety.

Wildfire personnel must approach every fireline situation with a 'safety first' attitude and remember that no fire suppression tasks are considered sufficiently urgent enough to justify any risk taking or shortcuts of the safe work procedures.

The purpose of this section is to re-emphasize safe work procedures on the fireline and the importance of using these procedures in avoiding fire entrapment incidents.

Fire Entrapment Avoidance: Basic Practices

What is Fire Entrapment?

Fire entrapment is a life-threatening situation where personnel on the fireline are threatened by a sudden change in fire conditions and are unable to use escape routes to access safety zones.



What is Fire Entrapment Avoidance?

Fire entrapment avoidance is the use of fire suppression strategies and tactics that take current and predicted fire behaviour into consideration in order to avoid fire entrapment scenarios.

Fire entrapment avoidance requires that fire personnel recognize the fuels, weather and topography that can cause hazardous fire behaviour and use **LACES** to prevent fire entrapment. All wildfire personnel must not fight fire in any situation that compromises safety. These personnel need to remain alert and be aware of changing conditions.

Hazardous Fuels - *fuels that fire can spread through quickly include:*

- Fine fuels - grass, needles, twigs, small trees and logging slash.
- Dead or diseased fuels - cured grasses, dead standing or downed trees and 'red needle' branches.
- Closely spaced fuels - dense forest, ladder fuels from ground, large amounts of dead and downed fuels on the forest floor.
- Unburned fuels between personnel on the fireline and the fire's edge or below firefighters on steep slopes.

Hazardous Weather - *weather factors that contribute to unpredictable and/or high rates of fire spread include:*

- Wind increasing or changing direction.
- High temperature and low humidity.
- Prolonged drought in the area with low fuel moistures.
- Thunderstorms can cause strong and gusty winds, wind shifts and extreme downdrafts.

Hazardous Topography - *topography that increases rate of fire spread includes:*

- Steep slopes that preheat fuels above while burning material rolls downhill.
- Aspect - south or southwest facing with high temperature and light fuels.
- Chimneys, gullies and canyons that funnel fires.



Fire Behaviour Cautions		
Weather	Watch For	Fire Behaviour
	90° shift in wind direction	Flank of fire becomes the head.
	Humidity < Temperature	Dry, light fuels have increased ignition potential and spread rates.
	30 - 30 - 30: relative humidity, temperature and wind speed	Potential for rapid rate of spread.
	Slope winds	Increased spread rate and intensity upslope with daytime heating and downslope at night.
	Valley winds	Potential fire spread up valley with daytime heating and reversing direction at night.
	Approaching thunderstorm	Potential for downdrafts with increases in wind speed and rate of spread.
	Approaching dry cold front	Potential for low level jet at the height of the convection column, increasing convective circulation and faster surface spread.
Fuels		
	Light, open fuels	Potential for rapid initial spread.
	Dead trees or tops	Long range spotting and falling trees.
	Fuel type change	Change in spread rate and fire intensity.
Topography		
	Complex topography: ridge tops, gullies and canyons	Turbulent winds funnel in gullies and lee waves or eddies at ridge tops both cause an increase in fire spread.
	Steep slopes > 50 %	Flame attachments (distance to upslope fuels) and rapid spread. Burning debris rolls downhill.
Effects of Fire Behaviour		
	Smoke and haze layer	Greater spread and fire intensity above the smoke than below the inversion layer.
	Increase in smoke venting	Atmospheric inversion lifting - increases in fire spread and intensity.
	Dust devils and fire whirls	Surface level instability and erratic fire spread.
	Black smoke above surface fire	Torching potential that may transition into a crown fire.
	Towering convection column	Fire whirls and long range spotting

Who is Responsible for Fire Entrapment Avoidance?

Fire entrapment avoidance is the responsibility of both supervisor's and firefighters because everyone on the fireline must maintain a constant awareness and monitor weather conditions to anticipate potentially hazardous fire conditions that could lead to entrapment. This is known as situational awareness. The constant monitoring of the wildfire environment is critical for making decisions about whether or not to fight the fire, and whether to stay engaged or disengage from the fire and escape to safety zones.

Fire Entrapment Avoidance: The Supervisor's Role

Supervisors are trained to manage crews and make sure that all fire suppression tasks are accomplished safely and effectively. Fire entrapment avoidance is critical and supervisors will ensure that all fire personnel follow the established entrapment avoidance procedures.

Supervisors are taught to recognize critical fire behaviour and these individuals are required to monitor fire conditions on an ongoing basis. Supervisors need to regularly communicate information regarding the fire behaviour conditions to all personnel on the fireline.

Supervisors will make the decision to disengage from the fireline and will determine if and when emergency escape efforts are required.



Supervisors are responsible for issuing clear instructions and ensuring that fire personnel understand these instructions. Fire crew members must follow these instructions at all times, and every firefighter is responsible for asking questions for clarification when feeling unsure, uneasy or unsafe.

The supervisor will provide a pre-work safety briefing and continuous updates to make sure that firefighters are kept informed about specific information including tactics, weather conditions and hazards.

Fire personnel should expect the following key information to be included in a crew leader's pre-work safety briefing:

- The Chain of Command.
- Designated lookouts (if any).
- Communications plan outlining communications between firefighters and an immediate supervisor.
- Anchor points to keep the crews and equipment safe.
- Determine at least 2 tested escape routes that lead to adequate safety zones, which will be used in case fire personnel are threatened by sudden changes in fire behaviour.
- All known fireline hazards. Every firefighter is responsible for alerting other fire personnel about any fireline hazards. Note and make coworkers aware of any possible danger areas such as flare-ups, burning dead trees or any other hazards to safety.
- Safe work procedures to be used.
- Current and expected fire behaviour.
- Fire suppression strategies, current fire activities and progress.
- Suppression tasks the crews will be accomplishing.
- Individual work assignments.



Safe Work Procedures and **L A C E S**

LACES - Lookouts, Anchor Points, Communications, Escape Routes and Safety Zones

Fire entrapment avoidance involves continuous assessment of the wildfire environment. Use of the LACES safe work procedures will assist firefighters in continuously assessing and monitoring fire conditions (Lookouts), ensuring that anchor lines are well established (Anchor Points), updating all fire personnel on fireline hazards (Communications) and moving quickly out of potential entrapment situations (Escape Routes and Safety Zones).

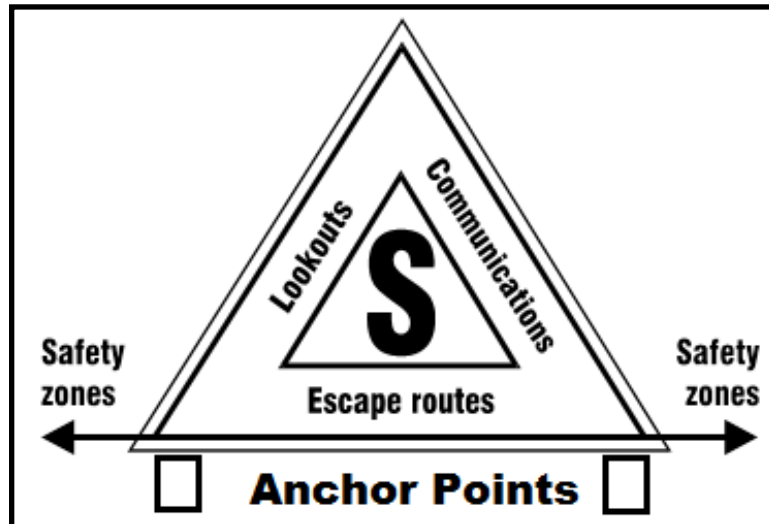
The elements of LACES form a safety system used by firefighters to protect against fire entrapment and work as a team with all fire personnel. The LACES system is put in place before fire suppression begins. The LACES are a self-triggering mechanism. Lookouts assess and reassess the wildfire environment and communicate safety hazards to all personnel on the fireline. Firefighters secure anchor points and use escape routes to move to safety zones as needed.

The LACES system has 2 basic guidelines built in:

1. Every firefighter needs to be informed about how the LACES system will be employed while on a wildfire.
2. The LACES system must be continuously re-evaluated as fire and weather conditions change.

Situational Awareness and Fire Entrapment Avoidance

- Situational awareness is being **AWARE** of everything that is happening around you and the relative importance of what you observe. It is a continuously evolving picture of the state of your environment.
- Situational awareness requires firefighters to observe not only the fuel, weather and topography factors that can cause hazardous fire behaviour, but to consider how other factors including suppression tactics, aircraft and heavy equipment use and involvement of structures or hazardous material may influence fire behaviour.
- Situational awareness is challenged by many factors including fatigue, insufficient information, task overload and a group mentality that will reduce the ability of firefighters to remain aware of important changes in the wildfire environment. When high or extreme levels of fire activity occur then this further challenges personnel on the fireline in maintaining effective situational awareness, which is critical for fire entrapment avoidance decision making.



Lookouts

Lookouts are experienced firefighters who continually size-up a fire while keeping crews and equipment advised of all fire behavior and weather changes. Lookouts are located at a good vantage point with a view of the entire fireline where personnel are located including the escape routes and safety zones. More than 1 lookout may be required. Wildfire environment characteristics and fire behaviour are used to establish an effective lookout system. Lookouts need to be good communicators with a solid knowledge of fire behavior and various environmental hazards.

The basic requirements for a lookout include:

- The supervisor must appoint a competent lookout to monitor fire behaviour and threat of entrapment where there is potential for extreme fire behaviour (e.g. fire intensity ranking 4 or higher).
- The lookout must immediately communicate increased fire behaviour and changes in weather to the supervisor or crew.
- The lookout must report to the supervisor or crew at least once per hour, but a higher frequency is preferred if conditions change.



- Lookouts perform designated lookout tasks only. This cannot be accomplished if other tasks have been assigned.
- The lookout should be equipped with a radio and extra batteries, a compass, binoculars, a belt weather kit and a copy of the Incident Action Plan (IAP) with a map of the area.

Lookouts - Key Notes

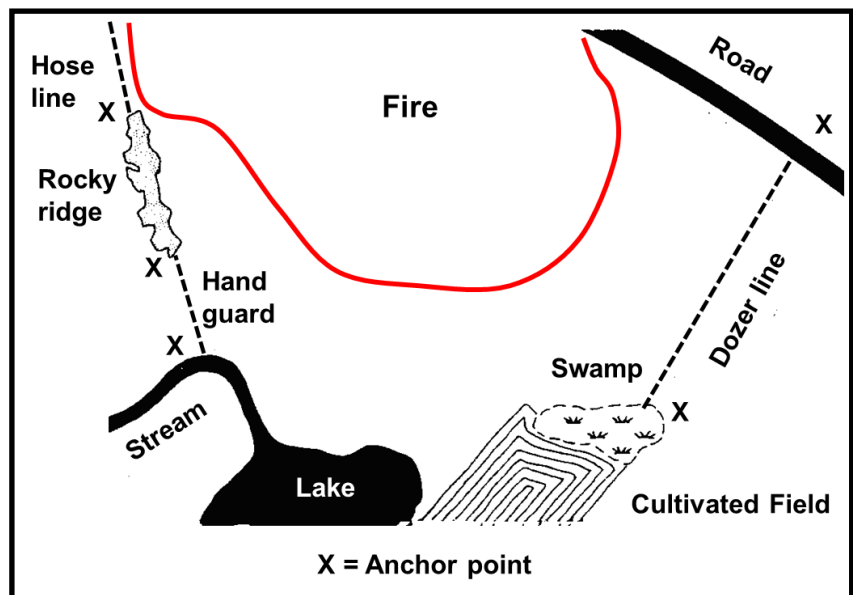
- ✓ Must be posted anytime there is possible danger.
- ✓ Are experienced, competent and trusted.
- ✓ Needs knowledge of crew location.
- ✓ Needs to know the escape routes and safety zones.
- ✓ Have a map, a weather kit, a watch, an IAP and spare batteries.

Anchor Points

An anchor point is an advantageous location from which a fire control line can be constructed and secured by fire crews. These areas usually provide a barrier to the fire's spread. Anchor points can be natural fuel breaks or existing fire barriers such as burned over areas, roads, rivers, lakes, swamps and areas of bare rock.

All control lines need to start and finish at an anchor point to ensure crew safety at all times.

Any anchor point must be maintained during the control line construction process by suppressing the fire's edge while progressing with dozer or hand guard. Firefighters can accomplish this by cooling the active edge with water or by conducting burn operations to eliminate all unburnt fuels adjacent to the control line. This will reinforce the control line and add an extra safe area for firefighters in the black.



Anchor Points - Key Notes

- ✓ A barrier to the spread of the wildfire.
- ✓ Can be a lake, river, swamp, road, burnt area or rocky opening.
- ✓ Must be secured by fire crews as the control line progresses.
- ✓ Control lines start and finish at anchor points.

Communications

Effective communications are critical to safe and effective firefighting operations. All supervisors are trained to give clear instructions and ensure that these messages are understood by all personnel of the fireline. The pre-work safety briefing is a critical component of good communications procedures.

The supervisor will ensure that any changes in weather conditions or predicted fire behaviour that may increase the fire intensity or risk of fire entrapment are communicated without delay. Fire personnel will confirm that they have received and understood these messages.

Firefighters must remain in constant communications with the entire fireline organization and ensure that all information is understood and passed on. All firefighters are responsible for warning the remaining personnel on the fireline of any newly identified fire hazards. Working alone or out of earshot of other fire personnel is not allowed.



Any firefighter on a fireline has the right and a responsibility to use their judgement and disengage from suppression activities if the risks of fire entrapment or other significant hazard such as loss of communications occurs. Fire personnel must immediately communicate to the supervisor that they are disengaging from the fireline due to safety concerns.

Effective radio communication depends on an understanding of how to use a hand held radio unit. This includes being familiar with tone and frequency selections, line of sight restrictions and antenna positioning.

Good radio communication procedures require that fire personnel be clear and concise when transmitting messages and confirming that the information is fully understood. Background noises that cause transmission interference (from pumps, chainsaws, helicopters, etc.) should be minimized if possible. Fire personnel must follow check-in guidelines and understand emergency communications procedures. Spare batteries should always be carried in case the operational period is extended.

Communications - Key Notes

- ✓ Ask if you do not understand a transmission.
- ✓ Know the radio frequencies being used.
- ✓ Establish and complete necessary check-ins.
- ✓ Communicate all hazards to other fire personnel.
- ✓ If fire activity is too intense, signal to withdraw from the fireline immediately.

Escape Routes and Safety Zones

Escape routes provide for rapid access to safety zones for firefighters who are retreating from a threatened fireline position.

The effectiveness of escape routes change continuously due to fire behaviour. The most common escape routes are the control lines. A fire that jumps over the control line can severely reduce the escape route options available to fire personnel during parallel and indirect control efforts. Retreat may not be possible for fire personnel unless safety zones have been identified ahead of as well as behind the work area.

There must always be more than 1 escape route that leads to an effective safety zone. All escape routes need to be scouted, flagged, bucked out and timed to ensure viability. A single escape route may be cut off by an advancing fire.



Safety zones are planned and established locations where fire personnel who are threatened by any fire hazards can find adequate refuge from this danger. The effectiveness of a safety zone is dependent on its ability to allow all fire personnel to shelter from flames, radiant heat, smoke, rolling debris, falling timber and any other fireline hazards.

A previously burned area may be the best and simplest safety zone. If a safety zone is 'located in the black,' it must be a 'clean burn' where the majority of aerial and surface fuels have been burnt off. Large areas clear of flammable vegetation, which can be natural or man-made, are also excellent safety zones. Good secondary or emergency safety zones include large bodies of water.

The minimum distance between **fire personnel and the flames must be at least 4 times the maximum flame height**. This distance has to be maintained on all sides if the fire has the ability to burn completely around the safety zone. Convective heat from wind or terrain factors will increase the minimum distance required. The size of the safety zone needs to be adequate for all of the resources present on the fireline.

Avoid establishing safety zones downwind from the fire in chimneys, saddles or narrow canyons, or in locations that have a steep uphill escape route. The hazard level around the safety zone has to be reassessed continuously in relation to line work progress, fatigue, changes in fire behavior and arrival of additional resources.

There are techniques used to reduce the size requirements of a safety zone including reduction in flame height by thinning or burning operations, shielding the safety zone from direct exposure by constructing it on the lee side of ridges or reducing flame temperatures by applying fire retardant to the area around the safety zone.



The escape time and the safety zone size requirements will change as fire behaviour changes. Every firefighter is responsible for knowing the location of escape routes and safety zones. Fire personnel must confirm escape routes and safety zone locations with their supervisor. If there are no escape routes in place, firefighters must withdraw from the fireline to a safe location.

Possible Safety Zones

- Large water sources, marshes and bogs
- Large rocky areas
- Large clearings
- Large areas with sparse fuel
- Large deciduous patches
- A large burned over area
- Downslope from the fire

Escape Routes and Safety Zones - Key Notes

- ✓ There must always be more than 1 escape route that leads to an effective safety zone because a single escape route may be cut off.
- ✓ Escape routes must be scouted, flagged, bucked out and timed.
- ✓ Safety zones include the burned area, large bodies of water or large areas cleared of vegetation.
- ✓ Safety zones located 'in the black' must be 'clean burned.'
- ✓ The minimum distance between **fire personnel and the flames must be at least 4 times the maximum flame height.**
- ✓ Safety Zone upslope = more heat impact = larger safety zone required.
- ✓ Safety Zone downwind = more heat impact = larger safety zone required.
- ✓ Safety Zone in heavy fuels = more heat impact = larger safety zone required.

Safety Margin (SM) and Critical Distance (CD)

Fire personnel need to be aware of the fire hazard at all times. Caution must be taken while working near the fire's edge due to the extreme fire behaviour experienced in recent years. The **safety margin** is the cushion of time in excess of the time needed for firefighters to use an **escape route** to get to a **safety zone** before a fire gets to that location.

A safety margin should be established to ensure that fire personnel have enough time to return to a safety zone if fire activity increases unexpectedly. A supervisor will need to establish the rate of spread of the fire and determine a **critical distance** trigger point that results in a crew withdrawal if the fire reaches this point. The critical distance represents a point where the fire challenges the safety margin. The following are examples of these calculations:

Safety Margin = Escape Time - Fire Arrival Time

e.g. Escape Time: 30 min. - Fire Arrival: 20 min. = **10 min. SM**

Critical Distance = Rate of Spread x (Escape Time + Safety Margin)

e.g. ROS: 20 m/min. x (Escape Time: 30 min. + SM: 10 min.) = **800 metre CD**

Firefighters in this scenario need to be heading back to a safety zone before the fire is 800 metres from the control line as these conditions are extreme.

Fireline Disengagement Procedure

A supervisor may decide to disengage from the fireline due to increased fire entrapment potential or other hazards, and firefighter will have to move along an escape route to a safety zone.

As stated previously: any firefighter on a fireline has the right and a responsibility to use their judgement and disengage from suppression activities if there is a risk of fire entrapment. Firefighter will immediately communicate this information to a direct supervisor and explain that they are disengaging from suppression activities due to safety concerns.

The following procedures will be used by all fire personnel during fireline disengagement:

- Stay with your crew and follow the supervisor's instructions.
- Take hand tools and packs (unless ordered to drop them by the supervisor).
- Do not panic.
- Do not run (unless ordered to or emergency escape is required).

If you become separated from your crew, then first attempt to locate the crew. If unsuccessful, find an effective safety zone and remain there until the fire danger has past or you are found.



NOTES:

[illegible]

FIRE ENTRAPMENT SURVIVAL

Fire Entrapment

Fire entrapment occurs when personnel on the fireline are threatened by a sudden change in fire conditions and are unable to use escape routes to access established safety zones. This is a life threatening situation. Fire personnel have to use 'last resort' tactics such as emergency escape or fire entrapment survival methods during a fire entrapment incident.

Emergency Escape - Move to Safety Rapidly

The first decision you must make in a potential entrapment scenario is whether or not escape to your safety zone will be possible. This decision is based primarily on fire behavior and the availability of a safe escape route.

A supervisor should recognize when a potential entrapment situation requires emergency escape efforts. Follow your supervisor's directions. If you are not part of a crew or have become separated from it, you must rely on your own judgement.

An emergency escape requires fire personnel to drop packs and tools and run along an accessible escape route to the safety zone as quickly as possible. If emergency escape is employed firefighter must immediately advise their supervisor of the crew's status and location if this individual is not aware of the situation.

Research has discovered that firefighter travel rates over escape routes can vary significantly. The following results should be considered:

- Traveling uphill dramatically decreases a firefighter's rate of travel. Assuming the advancing fire is below the firefighter, the fire's rate of spread increases on a slope. The net result is "bad for the firefighter versus good for the fire."
- Use of improved escape routes with rough trail constructed by removing or cutting large deadfall and flagging can increase firefighter travel rates by up to 40 %.
- Dropping packs and suppression equipment can increase a firefighter's rate of travel by up to 20 %.

Summary: Fire personnel using an improved escape route and dropping packs and hand tools can travel up to 2 times faster than if they attempt to travel over an unmarked and unimproved route with full suppression gear. The precious seconds gained by these actions could mean the difference between life and death on the fireline.

In a potential entrapment or emergency escape situation firefighters will be running towards the safety zone, but may find their escape route blocked by smoke and flames. Fire personnel need to determine if fire intensity is moderate enough to allow them to quickly move through and access the safety zone.

The number 1 priority is airway protection in these situations; 1 breath of hot, toxic gases can fatally burn a firefighter's lungs and airway.

Survival Zones and Fire Entrapment Survival Actions

If fire entrapment appears likely, then stay calm and do not panic. You need to locate a survival zone and take fire entrapment survival action. A **survival zone is an area where firefighters**, who are unable to access a designated safety zone, **can avoid flame contact and prolonged exposure to heat and smoke.** Use of fire entrapment survival actions will be important to avoid injury while sheltering in a survival zone.

Survival zones feature the same characteristics as safety zones, but due to the smaller size and compromising factors these areas cannot be considered a safety zone. Examples include previously burned areas, rock slides, road beds, clearings, knobs, ridges, benches, cat guards, wet areas and cleared areas in light or deciduous fuels. A supervisor may decide to burn out a survival zone in adjacent fuels prior to the approach of a flame front and retardant or water drops on the area around the survival zone may be requested.



A firefighter's personal protective equipment provides important protection from radiant heat, and all fire entrapment survival actions prioritize lung and airway protection while attempting to minimize radiant heat and smoke exposure.

Fire entrapment survival actions:

- Maintain a low profile by staying close to the ground (within 1 foot) will reduce radiant heat exposure.
- Shelter yourself in a large area that has light fuels or is free of fuels (rocky area, wet area, ploughed field, a burned area, bulldozed clearing, etc.).
- Find a fuel free depression or trench. Preferably behind a rock or dirt pile to block radiant heat.

- Watch for flames that can 'wrap' around the sides of any objects you are sheltering behind. Try to remain mid-object, stay low and move behind a larger object if necessary.
- Protect yourself with clothing by keeping sleeves down, collar up and gloves, goggles and hard hat on.
- Lie flat, facedown and parallel to the flame front.
- Stay face down and protect your airway by taking shallow breaths while close to the ground.
- Dig a depression with your hands to make a well for breathing.
- Curl your arms and hands around head and ears.
- Cover yourself with dirt if possible.
- Wet down clothing if possible.
- Do not wear synthetic clothing or packs that may burn and stick to skin.



Fire Entrapment Survival - Key Notes

- √ Escape routes and travel times to safety and survival zones must be known and recognized by all fire personnel.
- √ If faced with potential fire entrapment, decide whether or not escape seems possible. If escape is doubtful, then drop your pack and hand tools and run as fast as possible towards the safety zone.
- √ If fire entrapment appears likely, stay calm and do not panic. Attempt to shelter in a survival zone by staying low, flat on the ground and protect your airway at all costs.

Vehicle, Heavy Equipment and Building Entrapments**Vehicle Entrapments**

If you are forced to retreat from the fire and cannot access your safety zones, consider (as a last resort) taking refuge in your vehicle. If you are in a good location, **stay put and do not risk a worse entrapment situation** by driving through smoke and heavy roadside fuels. If you are not in a good location, then keep moving.



The following factors should be considered:

- Turn lights on in smoky conditions.
- Look for a place where the fire is less intense. Avoid saddles or draws and areas of heavy fuels below the road.
- Look for rock outcroppings, ridges or wide spots in the road. Try to park behind a natural barrier or structure.
- Do not park on the downhill side of road, under power lines or under over hanging vegetation.
- Position vehicle in a direction which provides the area occupied by crew with maximum protection from approaching flame front. Burn out around vehicle if there is time.
- You may be forced to stop in very thick smoke. The engine may stop working suddenly because of the hot air and smoke. It is not likely to restart so do not spend much time trying.

If you are forced to stop in a fire entrapment situation:

- Advise immediate supervisor of the situation. Request retardant or water drops on fuels surrounding your location.
- If your vehicle has a pump, keep it running and use the engine protection line to deploy a fog pattern over the cab (if available).
- Maintain control of your people. Keep calm, display a positive attitude and maintain communications. Do not make a bad situation worse by panicking.

Research has discovered the following:

- If fuels are light, survival chances inside a vehicle are fair.
- If fuels are heavy, survival chances inside a vehicle are poor.
- A vehicle that sits higher has a greater exposure to heat for occupants in the cab.
- Heat is retained in the vehicle after the fire front passes due to the heat sink effect of the metal the vehicle is made up of.
- Under lower temperature conditions, large volumes of smoke seep into the cab even when windows are tightly rolled up. Under higher temperature conditions, the cab interior will melt and give off toxic gases. Both smoke and gases will force fire personnel without respiratory protection to leave the cab.

Fire personnel should do following:

- Wear all personal protective equipment and cover all exposed skin. If available, take SCBA into the cab and use as necessary to protect yourself from smoke.
- Set parking brake, leave the motor running at a high RPM and keep the vehicle lights on.
- Roll up windows, but do not lock doors. Someone else may need to get in or the occupant may need to get out rapidly.
- Cover windows with reflective sunshades.
- Never attempt to wet down the cab interior or take a charged hose into the cab.
- **You must protect your airway.** Remain as low in vehicle as possible by getting on the floor and face the door away from the fire. Use a dry bandanna to cover your nose and mouth. Pull coats or floor mats over your body for extra radiant heat protection.

While inside vehicle expect:

- Temperatures may reach 95° C. Smoke and sparks may enter the vehicle. Plastic parts may melt and give off toxic gases. Windows may start to crack. Exposed skin may receive radiant heat burns.



If the vehicle catches fire or windows blow out and you have to exit before the fire has passed, then:

- Exit the vehicle from the side away from the greatest heat.
- Stay together and as low to ground as possible while moving away from vehicle.
- Locate a survival zone. Consider using the 'uphill' ditch of the road and follow fire entrapment survival action training.
- Check for and treat injuries after the fire passes.



Vehicle Entrapments - Key Notes

- ✓ If unable to drive out of the entrapment area, **stop**.
- ✓ Avoid draws, areas of heavy fuel below the road. Look for rock outcroppings, ridges or wide spots in the road.
- ✓ **If fuels are light, survival chances inside a vehicle are fair.**
 - Remain inside the vehicle, stay low and cover up.
- ✓ **If fuels are heavy, survival chances inside a vehicle are poor.**
 - Exit the vehicle. Locate a survival zone and follow fire entrapment survival action training.

Heavy Equipment Entrapments

Heavy equipment resources are often in a good position to survive fire entrapments because they can create fuel free areas that are good safety or survival zones.

It is crucial that equipment operators use fire entrapment avoidance safe work procedures and start escape actions when any fire entrapment threat is perceived. If fire entrapment appears likely, heavy equipment groups should retreat from the fireline to a more favourable site nearby or start clearing a safety zone (survival zone where time is critical).



If you are forced to stop with heavy equipment and are in a fire entrapment situation, then:

- Advise immediate supervisor of the situation. Request retardant or water drops on fuels surrounding your location.
- If water is available deploy a fog pattern over the cab.
- Never stay on the machine during an entrapment since intense radiant heat and flames are more likely higher off the ground.
- Maintain control of your people. Keep calm, display a positive attitude and maintain communications. Do not make a bad situation worse by panicking.
- Use equipment to dig a trench behind the machine.
- Park equipment sideways to the flames. Lower all attachments to the ground and turn off the engine. The machine will block radiant heat and some flames. Move into the trench behind the machine away from oncoming flames and follow fire entrapment survival action training.
- Watch for flames wrapping around the machine, stay low and move to a better location if necessary.

Heavy Equipment Entrapments - Key Notes

- ✓ Park the machine sideways to the flames and get off.
- ✓ Lower all attachments to the ground and turn off the engine.
- ✓ The machine will block radiant heat and some flames.
- ✓ Move to the side of the machine away from oncoming flames.

Building Entrapments

Fireline personnel may be deployed on a wildland/urban interface fire with structures nearby. Like vehicles, structures can provide protection even if they are later destroyed by fire. Structures used to protect firefighters in entrapments must provide enough protection to warrant use as a temporary barrier. Surrounding fuels, structure size and flammability are all critical factors.

**If you are in a fire entrapment situation with structures nearby:**

- Advise immediate supervisor of the situation. Request retardant or water drops on fuels surrounding your location.
- If you leave your vehicle, park it in as safe a place as possible.
- Move combustible materials (lawn furniture, wood piles, etc.) and vegetation away from structure if time permits. Shut off propane tanks. Burn out around the structure if appropriate.
- Bring hand tank pumps, extinguishers and charged hose (if available) into structure.
- Remove light material (curtains) from windows and cover the windows with heavy materials (tables).
- Close all windows, doors and vents with the exception of a fireplace vent.

- Fill all sinks, bathtubs and any available buckets with water. Soak towels, rags and spare clothes for use later in putting out fires, or to place against exterior door jams.
- Stay on the ground floor and maintain access to a door or window that is on the side of the structure away from advancing flames. Avoid upper floors and basements.
- Be prepared to exit quickly in case heat and smoke force you from the structure before the flame front passes.
- If forced to exit, move away from the structure and get low to the ground quickly.
- **Protecting your airways and lungs in the primary concern.**

Building Entrapments - Key Notes

- ✓ Structures can protect trapped fire personnel from a fire front.
- ✓ Remove flammable fuels near structure and 'fireproof' building.
- ✓ Be prepared to exit structure if forced to by heat and smoke.



NOTES:

[illegible]

S-185 (BC)

Fire Entrapment Avoidance

TRAINEE WORKBOOK

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