

Fire Safety and Fire Behaviour

By Phil Cheney

It is easy to be blasé about fire safety. There may be the attitude “Its not going to happen to me” or, “I’m experienced with fire and know what to do”. I want to discuss some common denominators about burn-over incidents. “Burn-over incident” – even that gives the impression that it is not that important, that it’s just an incident.

Being severely burnt and surviving is one of the most serious injuries you can suffer. We read of fire deaths in the news but rarely are we confronted with the ongoing suffering of the injured survivors and the consequences for the rest of their lives. The following list is a catalogue of the injuries and lifestyle consequences for a NSW volunteer firefighter trapped in a tanker, at a relatively minor forest fire of less than 500 ha and of moderate intensity.

Injuries resulting from 60% full-depth burns:

- Amputation of fingers from both hands
- Amputation of foot
- Extensive skin grafting
- Brain damage through hypoxia (lack of oxygen)
- Damage to central nervous system

Effects on physical life style:

- Continuing extreme pain when sitting or standing
- Inability to fully bend or stretch hip or knee
- Inability to stand, walk properly, run and climb stairs
- Difficulty in showering and going to the toilet
- Inability to write or other normal activities using the hands
- Difficulty in driving or entering a vehicle
- Inability to participate in sporting activities and previous hobbies
- Inability to participate in previous social activities
- Inability to continue previous occupation

Much of the restriction in activity is due to permanently exposed tendons behind the knee and the contraction of ankle, wrist and knee joints due to burn injury as well as the amputations.

Effects on mental health and resulting lifestyle changes:

- Post traumatic stress disorder
- Depression and paranoia
- Panic attacks
- Flashbacks
- Sleep difficulties
- Speech impediments
- Impaired memory and reasoning ability

- Loss of enjoyment of life
- Social and occupational impediments
- Marital breakdown

If a firefighter is burnt severely then there is a permanent and devastating impact on future lifestyle. The effects on mental health should not be understated and are probably exacerbated by hypoxia in the brain.

There is nothing in the forest threatened by fire that is worth dying for, or worth suffering this degree of injury. **DON'T GET BURNT!**

SAFETY ACTIONS YOU MUST TAKE

In Australia we don't plan for entrapment – we don't provide fire-proof astronaut suits, fire survival shelters or claim that fire trucks will provide adequate protection in intense fires. There is good evidence from the United States that provision of inadequate equipment such as fire survival shelters can lead firefighters to take additional risks. Tragically this happened in 2013 at the Yarnell fire in Arizona, where 19 members of the Granite Mountain Hotshots were killed.

The following diagram illustrates the process of safe indirect firefighting on any fire where the intensity of the head fire is too great for direct suppression.

1. Start at an **anchor point**. This is defined as a point that you can hold at all times. It is usually the most up-wind point of the fire.
2. When you are suppressing the fire you are in the **Dead-Man Zone**. This is defined as the zone where, in the event of a wind change, you will be burnt unless you can fall back to a **safe area** within 2 minutes.
3. The **safe area** inside a fire perimeter is where the radiant heat from smouldering combustion from surface fuels has reduced to a point where a firefighter in normal protective clothing can survive. In light grassy fuel this area may be present a minute after the fire has passed. In heavy forest fuels it may take **45+ minutes** after the head fire has passed before the area is safe.

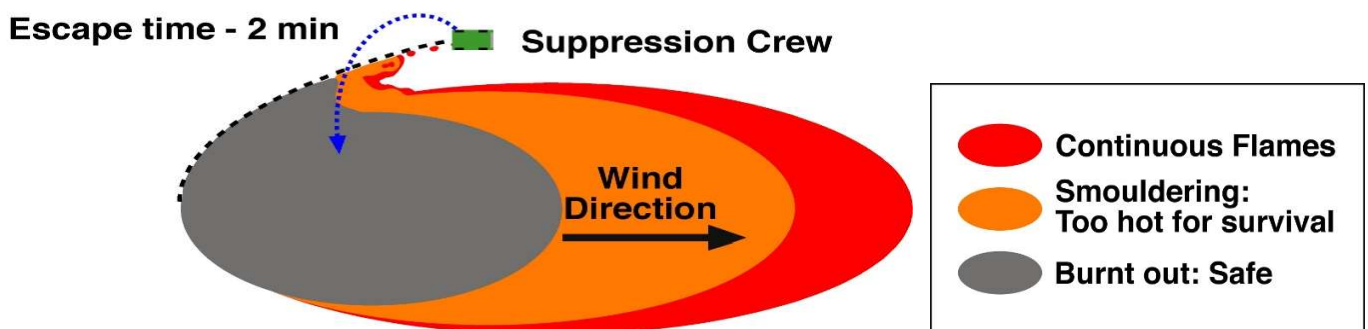


Figure 1. Escape route of a crew planning for a 90° shift in wind direction.

4. Hand crews working along the perimeter of the fire where the lateral rate of spread is low can plan their retreat back along the fireline, and can safely cross a short area of **smouldering combustion** to reach the **safe area** further inside the fire.

Firefighters sometimes assume that being in a Fire tanker will protect you, and whilst protection systems on tankers have improved significantly, they still only provide a level of protection from radiant and convected heat. They are constructed with a large amount of flammable material in the form of rubber tyres and hoses, plastic fittings and interior linings, and fuels for the tanker and accessory equipment.

The following photo illustrates a burning tanker at Lands End (ACT) that became stuck on a log before the fire arrived. The crew abandoned the tanker and retired safely to a nearby road.

Photo by Jeff Cutting



This incident was in a grassy mostly-cleared wood land. Note the amount of heavy material on the ground still burning.

Consider the conditions in the cabin if it was not facing directly into the wind!

YOU MUST ALWAYS HAVE A FALL BACK AREA THAT WON'T BURN

- Find an area without fuel – the bigger the better;
- Get protection from radiant heat, even low levels, and from hot combustion gasses;
- Make sure you will not be trapped by any wind change.