

Paper 10

BUSHFIRE SOLUTION

A professional way to eradicate the bushfire menace

Red Eagle proposes this bushfire solution as a professional way of reducing the bushfire problem to the level of an irritation.

It has a specific and rational goal – protect the house, based on the philosophy that a protected house protects the person and the house.

It has a professional process, it works within current legislation, it makes use of knowledge obtained by researchers, it accepts people's rights and independence, it specifically identifies and neutralises local bushfire threats and it manages flame size and location so that defenders can deal with it in a safe work environment within the limits of their suppression capability.

In this Paper:

- We restate the problem and the solution
- We relook at the government's tools and their capabilities
- We relook at the research
- We relook at our defence options
- We reanalyse the threat and redefine our goals
- We put it together as a packaged plan

CLARIFY THE PROBLEM AND THE SOLUTION

Most people say Black Saturday was a once a generation tragedy. We see it as a symptom of an inadequate bushfire protection system. The statistics have been going the wrong way for decades (see Paper 4). The system relies on a fire suppression model of wet fire fighting, whose design capability is medium fire danger weather. It is currently done very cheaply by volunteers, but paid fire fighters would not extend its capability. It works really well in grass fires when the weather is mild. Nowadays, houses are spread through semi bush and bush. We now have to deal with houses and forest fires in severe weather which generates tall flames and leap frog spot fires. This means we need to apply the protection principles of dry fire fighting, and put them in place on the ground, well before the fire starts. But we do not.

We say Black Saturday was not a tragedy sent by Mother Nature. It was a score card, an assessment of our ability to deal with severe bushfires. The Royal Commission saw it as a tragedy and set about fine tuning the current system. But the current system is not up to it. We can fine tune an intelligent chimpanzee as much as we like, but a chimp will never be able to handle a Mack truck. The current system is flush with money (CFA now has assets of \$1.2Billion and an annual revenue of \$½ Billion), but there are too many examples of performance failures since the Royal Commission. It now cannot prevent house loss in grass fires that get away in mild weather.

The system is failing us. The authorities have no plans to change it. The government simply gives them more money with no performance accountability. House losses are much too high. The trusting people are suffering disruptions. Unfortunately, another Black Saturday is inevitable.

Red Eagle seeks lasting and effective solutions to the bushfire problem. We seek solutions that are practical, cost effective and verifiable by science and logic. We seek solutions that result in net community benefit, which include measurable progression to bushfire safety, penalise the generators of risk not the victims of risk, and ensures there is no negative impact on local / state economy.

We define the bushfire problem as this:

Whenever a severe bushfire attacks a community, it suffers house loss and disruption, both of which increase with house loss rate. How can we protect the community from house loss, with safety and consistency?

Our solution will be realised when we can say this about all communities:

When a bushfire attacks a community, house loss will be prevented safely and consistently.

Whilst our prime goal is to save lives, we have targeted house protection because it is the mechanism to save lives and the house is the heart of people's lives. The house provides protection for are the person, but the house is a passive victim when attacked. The house cannot move, whereas the person is mobile. We acknowledge it is more difficult to protect the house. We propose the following theory as self evident.

When we protect the house, we protect the house and the person.

Meaning - when we save the house, we provide safe shelter and therefore save the person.

The rationale for the theory has been accepted knowledge for decades "remaining in one's house is preferable to trying to escape to safety" (Luke and McArthur, 1978). They said safe refuge requires the right preparation. Staying in the house is usually preferable, but they said "orderly evacuation has saved many lives. Equally it has resulted in the loss of many houses". This was reiterated in the 1980's, after one of Victoria's worst ever bushfires, Ash Wednesday. Eg, "All houses have walls that provide an excellent shield against radiation and

hence should be considered as a possible refuge during the passage of the flame front of a bushfire" (Leicester, 1985).

House loss statistics for severe bushfires showed then and now that the overwhelming cause of house loss is ember attack. This confirms that the fire front is not even close to the house in most cases, so the radiation risk from the fire front can be discounted. Embers ignite into small spot fires. They are readily extinguished while small if people are on site. The research is unequivocal. Blanche et al (2006) found that house occupation rate has the largest impact on protecting houses, eg, vacant houses have 77% probability of loss, and occupied houses have 13% chance of loss. Handmer et al (2010) quote earlier research by CSIRO that found actively defended houses are ten times more likely to survive. They also quote other pre-2009 studies that confirm a key factor in house survival is the presence of able-bodied individuals who know what to do. "Thus, protecting the house also protects the occupants so, they said, this approach was seen to protect lives".

For occupation to be safe requires the house to be protected from the running flame during a bushfire attack, so that the houses deal only with embers. This is done by the Self Defence System and defensive suppression (Paper 9). For occupation to deliver low house loss rates requires adequate defenders with correct knowledge and skill and equipment. Whittaker et al (2013) confirms this. They show a progressive decrease in house loss rate as attitude, determination, numbers and skill level:

- In households where all householders left or sheltered without defending, house loss rate was **5 in 10**.
 - Those who stayed because they were unable to leave had house loss **3 in 10**.
 - In households where at least one person stayed and defended, house loss rate **2 in 10**
 - Those who stayed because they wanted to protect their house and other assets had house loss rate of **1.6 in 10**.
 - Where extra help was available to the defenders (eg, from family, friends, neighbours, fire agencies), the house loss rate was even lower.
- Where helped by other people, house loss rate was **1 in 10**
- Where helped by fire services, house loss rate was **0.3 in 10, or 3 in 100**.

A clear inference from this data is that **defence by increasingly adequate and skilled resources yields much lower house loss rate**.

Thus, if we protect house against flames and spot fires, we protect the house as a safe shelter, which enables the person to survive. The theory can be readily extrapolated to a group of houses in a neighbourhood as follows:

When we protect the houses, we protect the houses and the people in the community.

PATHWAY TO THE SOLUTION

Current situation is this: A severe bushfire attacks an unprepared community and causes house loss.

We want a solution to prevent house loss during a severe bushfire attack

We interrogate the fire authority expert about community preparation:

Why do we allow the severe bushfire to attack unprepared communities and cause damage?

Because we cannot stop the fury of Mother Nature

Why are communities unprepared?

We send our well trained fire fighters but if the fire is too severe, it is unstoppable.

That is true, but it does not answer the question. Why are communities unprotected?

Municipal fire plans protect towns

All the towns burnt on Black Saturday had approved fire plans, but none seemed to work. Why?

Mother Nature's fury

That may be true, but why were the plans not effective?

Because their design capability was below the fire's ferocity level

Who sets the design capability of a fire plan?

That is not part of the plan process. The plans are required to identify assets at risk and assign treatments.

All the identified assets of Marysville were destroyed. Who approved the protection treatments?

The Shire, after comments from fire authorities and the public

Who was responsible for protecting Marysville from bushfire?

The CFA Act requires the Shire to prepare a plan in a specific format and following a specific process. The Shire then accepts the plan and the CFA is required to audit in within three years.

You have described the preparation process, but who is responsible for saying – OK, I now declare Marysville is fully protected from bushfire attack up to say FDI 75?

No one by legislation

Therefore, you are saying that fire plan is prepared by law, but its design capability is never specified or tested.

Yes, but there is nothing to stop the Shire from requiring that standard to be achieved.

Why would the fire chief not require a minimum standard?

It is not required by legislation

NOTE: We have just discovered that no one is responsible for protecting a town from bushfire attack. This explains why towns are unprotected. The fire authorities deal with bushfires by response. They literally have a "put out spot fire" approach when we need them to have a longer term planned approach to severe bushfires.

We now interrogate the expert about severe bushfire attacks:

Why does a severe bushfire attack a town?

Because it escapes control of fire fighters

Why does a severe bushfire escape control of fire fighters?

Because perimeter grows faster than control line

That is true, but is not the answer to the question

Because the fire brigade model has a design capacity of FDI 30, and severe weather is up to FDI 100 or so.

Why is design capacity so low?

Because it relies on wet fire fighting / direct attack

Why can't you stop a raging running inferno with tankers?

The flame depth is too deep for water to have an impact, accessibility and logistics are impossible, it is too dangerous to stand in its path

Why can't you stop a raging running inferno with more tankers and water bombing aircraft?

Same reasons

How can you stop a raging running inferno?

It is impossible

That is not the answer to the question. What feeds the flame?

If the fire runs into a fuel free area, it will stop. But embers will jump across

We deal with embers separately; we are now focusing on the flame. Can we stop a raging running inferno with a fuel free area upwind of a town without tankers?

Theoretically yes.

Theoretically you say. When Duffy was attacked, did the tankers physically stop the raging running inferno, or did something else stop it?

No, the running flame stopped by itself at the firebreak.

If you can stop a raging running inferno up wind of a town without tankers, would that not free up the tankers to deal with ember attack within the town?

Theoretically yes

The correct answer is no, because the embers will generate multiple simultaneous spot fires in hundreds of properties. Most will be unattended, so the houses will catch alight and there will be multiple simultaneous houses on fire. You will not have enough tankers to cope.

That exact scenario occurred in the Duffy fire.

Why was it safe for the fire fighters to attend inside Duffy residential area?

The raging running inferno stopped cold at the firebreak and there was no running flame within the residential area.

Why were the residents evacuated?

For their safety

If it was safe for fire fighters and police cars and some residents, would it have been safe for all residents to stay?

Yes, but they would have been terrified

If residents stayed and extinguished a few small spot fires on their properties, would they have prevented house loss?

Yes, theoretically

If residents had been trained and equipped and advised of what to expect, would they have been terrified, would they have been able to act confidently and cooperatively with neighbours to prevent house loss in a safe environment?

Yes, theoretically, but that is not how we do business.

Your way of doing business destroyed 200 houses at Duffy within 2 hours in a bushfire-protected environment because your few fire trucks and crews were overwhelmed by multiple simultaneous house fires that occurred because the people that could have put the spot fires out when small and manageable were evacuated.

No comment. We did the best we could.

You have said you can stop the raging running inferno without tankers upwind of a town. True?

Yes

If you stop the running flame from entering the town, the properties are under attack from embers only, which ignite the urban fuel on and near their houses and generate stationary flames? True

Yes

Stationary flames cannot run anywhere because they are confined and surrounded by fuel free areas. You have agreed it is safe for fire fighters and others to be there. True?

Yes

Is it not time for your business model to change to harness community resources to help you save their houses from a few embers in a bushfire-protected environment?

No comment

NOTE: We can now understand that a town can physically be bushfire-protected to create a safe workplace for fire fighters and residents to safely defend against ember attack.

This discourse reveals the pathway to our solution:

Our solution will be realised when we can say this about all communities:

When a bushfire attacks a community, house loss will be prevented safely and consistently.

The first steps to our solution are:

Acknowledge the problem before the solution can be achieved **Paper 4**

Acknowledge that our current model and policies cannot control the severe bushfire and we cannot prevent damage **Paper 5 plus Papers 3B ,7A, 7B, 7C, 7D and 8B**

Acknowledge that our fire brigade model / wet fire fighting model has limited design capacity on high FDI, and supplement it with strategies that work at high FDI, ie, defensive suppression **Paper 5, Paper 9**

Acknowledge that bushfires are not a natural disaster - we don't control the weather, but we control the source of the danger and the causal agents of house loss **Paper 8A**

Acknowledge we can control the source of the danger **Paper 2, Paper 3A, Paper 9**

Acknowledge we can control the causal agents and influences of house loss **Paper 2, Paper 3A, Papers 6A and 6B, Paper 9 and the Self Defence System**

Then - Just do it

See Appendix 1 of this paper for more details about bringing things together to achieve our solution

ANOTHER LOOK AT WHAT IS VULNERABLE AND WHAT ARE THE ROOT CAUSES OF HOUSE LOSS

The person is the living breathing victim of course, but the person is mobile, can escape or avoid trouble, and is readily moved out of danger.

The truly vulnerable victim is the house. It cannot move. It silently endures the heat, the embers, the ignition, the wind. It cannot defend itself. Yet it provides shelter and protects the person during a bushfire attack. It can be fortified by cladding and design. It can be protected by separation distance from flame. It can be defended from embers and spot fires in safety.

The cause of danger to the house in a severe bushfire is flame and embers that have come from some upwind or down hill property. But the source of the danger is the property on which these threats originate. Because both can be directly controlled by fuel bed management, the level of the danger is manageable.

The threat to the house is flame that occurs on or near the house. That flame either runs from the adjacent property or ignites from embers that fall onto the property. That flame can only exist where the flammable fuel lets it. Where the flame occurs and how large it grows is directly controlled by the resident's action or inaction before the bushfire attack. If a spot fire ignites, its growth is determined by the action or inaction of the resident during the bushfire attack, or if absent, of a helper. Because these threat agents can be directly controlled, the rate of house loss is manageable.

Because we are planning to protect houses against the one day inferno, we need to understand its destructiveness is due to combination of massive flame and ember attack. We know we cannot physically deal with the heat of a massive flame, so we have to make it small and manageable or keep it well away. Authorities can lay down passive defence infrastructure upwind of a property or a town to stop the run of a one day inferno. To create a bushfire-protected area downwind, they also make sure the fuel bed is highly discontinuous, where the only threats are ember attack and the stationary flames they generate. Because the bushfire-protected area excludes the running flame, ember attack can be directly controlled in safety by both fire fighters and residents, our solution of preventing house loss is achievable.

ANOTHER LOOK AT DEFENSIVE WEAPONS OF THE GOVERNMENT THAT IMPACT HOUSE LOSS RATE

Fire brigade model

The fire brigade model is designed for rapid response and for small scale, short term fires, eg, it copes well with slow to medium pace running fires in where truck access is good and with houses that burn one at a time. Thus, the physical capability of the fire brigade is limited by their ability to access and deliver water to kill the live edge. If control line rate is slower than the perimeter is expanding, the fire runs free. This is why running fires on windy days at medium Fire Danger Index (FDI) can escape their control, eg, Carngham and Seaton fires in Victoria and Blue Mountains fire in NSW, all in 2013, the Mickleham and Gisborne fires 2014. We estimate that for planning purposes, the peak design capability of the wet fire fighting fire brigade model is FDI 30 when winds are strong. The local brigades may well stop most fire ignitions at higher FDI's, but the escapes are of concern. One escape is enough to cause massive damage.

This is well accepted knowledge. Prominent researchers have indicated that suppression has a limited design capacity. Eg, effective suppression is limited to fires with intensities varying from 2000 to 4000kW / m depending on the type of vegetation and containment resources available (Blanchi et al, 2010), or again, direct attack is not possible above 4,000 kW / m and indirect attack (by back firing) is very unreliable above 10,000, sometimes even lower (Alexander, 2001). When these limits are compared to quoted figures for severe bushfires, eg, over 100,000 kW / sq m (eg, for the Kilmore East and Murrindindi fires, Tolhurst (2009,

Table 2), they confirm how ineffective traditional suppression model really is. Another measure of potential fire severity and suppression difficulty is FDI, which is a logarithmic scale from 1 to 100 or so. Suppression by first attack and back burning (= back firing) generally fails above FDI 25 and is impossible above FDI 50 (Lucas et al 2007, Table 1, reproduced below), which is the approximate trigger for Total Fire Ban in Victoria.

Table 1. Categories of Fire Danger Rating (FDR). Taken from Vercoe [2003].

Fire Danger Rating	FFDI range	Difficulty of suppression
Low	0-5	Fires easily suppressed with hand tools.
Moderate	5-12	Fire usually suppressed with hand tools and easily suppressed with bulldozers. Generally the upper limit for prescribed burning.
High	12-25	Fire generally controlled with bulldozers working along the flanks to pinch the head out under favourable conditions. Back burning may fail due to spotting.
Very High	25-50	Initial attack generally fails but may succeed in some circumstances. Back burning will fail due to spotting. Burning-out should be avoided.
Extreme	50+	Fire suppression virtually impossible on any part of the fire line due to the potential for extreme and sudden changes in fire behaviour. Any suppression actions such as burning out will only increase fire behaviour and the area burnt.

In a severe running bushfire, fire authorities focus on stopping perimeter expansion. House protection is not a priority. If there is nothing they can do to catch the fire, they may be deployed to asset protection, as happened in Black Saturday. But they physically cannot deal with multiple house ignitions caused by simultaneous ember attack, as was revealed in the bushfire attack on Duffy, a suburb of Canberra in 2003. In short, the community cannot count on house protection by fire brigades in severe bushfire attack, and is actually told this by fire authorities. Also see Paper 5.

What other protections do fire agencies offer for house protection?

For existing houses

Municipal fire prevention plans (MFPP) are the government's passive defence mechanism to provide protection to existing buildings. But we need to remember that all the towns destroyed in Black Saturday had an approved MFPP. These plans self-evidently provided no protection, but the Royal Commission chose not to examine their content or effectiveness. The content and quality of fire plans continues virtually unchanged, and they continue to offer minimal protection to the predominant cause of house loss, ie, ember attack.

For new houses

Since the Royal Commission, the bureaucracy has amalgamated the two criticised systems (WMO and AS3959) into the BMO, despite evidence that they had no influence on mitigating house loss. True to its pedigree, the BMO identifies nearest vegetation as a bushfire hazard. This vegetation generates a predetermined wall of flame based on the vegetation type, not on the flame height potential of the actual vegetation. This wall of flame then generates radiation load that is used to calculate the width of defendable space and the fortification required on the house. Paper 7D also describes how radiation loading from nearest vegetation is not often the true cause of house loss, which means specifications of defendable space and fire resistant materials may be misleading. Paper 7D describes how defendable space specifies low fuel

load. It even allows mown dead grass within it. Thus in the summer, when the grass tends to be dead, the specifications allow (do not disallow) a potential flame height at least 0.5 to 1m height across the entire defendable space on a severe weather day. This may compromise defence capacity.

Evacuation

Since the Royal Commission, the government has adopted a priority policy of “save lives” and now promotes evacuation heavily. Whilst this may be regarded as a symbol of the government’s shock at 173 deaths in one day, there was no evidence presented to the Royal Commission to indicate that evacuation saves lives or indeed solves any community bushfire problems. Instead, analysis of pre 2009 data and evidence presented to the Royal Commission found strong evidence that house vacancy rate is the most influential cause of house loss rate. The Royal Commission was very aware of the interconnection between Marysville’s evacuation, annihilation and community disruption and slow recovery, but nevertheless recommended evacuation policy.

In summary, we conclude that the government’s current suite of protection measures cannot deal with the causes of house loss in a severe bushfire attack. The government’s suppression model has limited design capacity. It cannot stop the running flame and cannot cope with multiple house ignitions. Municipal fire plans offer ineffective protection to existing houses. The BMO offers protection to new houses against radiation from an inflated artificial wall of flame, but the wall of flame and its radiation are a very minor cause of house loss. The evacuation policy removes potential defenders from the bushfire attack area and this is a proven cause of house loss.

While these policies remain in place, we have grave concerns that more Black Saturdays are inevitable. Therefore, to change the outcome, change policy.

ANOTHER LOOK AT WHAT THE RESEARCHERS HAVE FOUND

Researchers consistently find these are the two biggest influences on house loss rate:

- 1 The overwhelming cause of house loss in severe bushfires is ember attack, eg, up to 90%. Therefore a solution to the bushfire problem must focus on neutralising ember attack.
- 2 The biggest influence on house loss rate is the vacancy rate. This equation gives a reasonable estimate for a neat residential area.

House loss rate (%) = 64 x Vacancy rate (%) + 13

A less well prepared town can expect a higher loss rate. Marysville was approx 90% evacuated and had a house loss rate of 90%. Therefore the solution must increase occupancy rate.

Therefore, if the researchers are right, and if all we did was to make it possible and safe to neutralise ember attack and increase occupation rate, logic says that house loss rate will reduce dramatically.

How we can apply these results:

- Neutralise embers where they land

If live embers land on non-flammable surfaces, they self-extinguish. The house and surrounds can be flammable or non flammable. That is under the owner’s control. Therefore the solution needs non flammable surfaces in the right areas.

- Neutralise spot fires when small and manageable

All spot fires start as small flames, and small flames are easier to extinguish than large ones.

- Spot fire control needs people

To extinguish a fire while small requires a person to be present, and they can do it with simple household equipment. Therefore the solution needs people on hand. The more people, the sooner the spot fires are quelled. The heavier the ember attack, the more defenders needed.

- Reverse evacuation policy and create a safe work place

Evacuation removes potential defenders. Why are people evacuated? Because authorities believe it is unsafe for non-fire fighters. It may also be unsafe for fire fighters. Therefore, the solution requires a safe work place. If authorities make the neighbourhood safe, fire fighters and non fire fighters can defend in a protected workplace.

How do you make an area safe in a severe bushfire attack? Create a bushfire-protected community using defensive suppression (Paper 9)

These pointers introduce us to the framework for the solution.

ANOTHER LOOK AT THREAT MANAGEMENT

Paper 8 convinces us that a reasonable threat model views a severe bushfire attack as a threat to be neutralised or eradicated so that assets are protected.

- Assets have value that is worth protecting
- Assets have vulnerabilities
- Threats infiltrate these vulnerabilities and cause damage to the assets
- Deploy countermeasures to mitigate or eradicate the threats

WHAT BUSHFIRE THREAT SHOULD WE PLAN FOR?

We observe that most damage to houses occurs in the **One Day Inferno** fires. Our solution therefore has to neutralise damage during the One Day Inferno fire.

Our solution requires each property and each town to expect a One Day Inferno assault each year. Why? We cannot predict when and where a One Day Inferno assault will occur, but we want to be prepared.

We have identified two types of One Day Infernos. See Papers 6A and 6B. We named them after their characteristic type - the Ash Wednesday attack category and Duffy attack category. The former is a fearsome combination of flame and ember attack because there is no fuel free barrier to stop the flame's run. The latter is an ember only attack, made possible because the flame's run has been stopped upwind by defensive suppression.

The Duffy version is the lesser of two evils, but it has the huge house saving advantage of separating the fearsome flame from the ember attack. Therefore, the solution requires defensive suppression to convert an Ash Wednesday attack into a Duffy attack category. This ensures the moving flame is kept well away from the houses and the residents' houses are now within a bushfire-protected environment. People are able to defend their houses from ember attack in safety.

ANOTHER LOOK AT TOOLS AVAILABLE FOR A SOLUTION:

Active defence is the urgent physical effort during the bushfire attack of extinguishing the flame or cutting a path to stop the flame spreading. It requires people and equipment. It

includes sprinkler systems that make an area non flammable or extinguish a developing flame.

Passive defence is the infrastructure put in place prior to the bushfire attack that determines where flame is allowed or not allowed, how tall the flame is on each area, where people can access, where water delivery can reach to, and the type of fortifications used.

Defensive suppression is the application of passive defence to facilitate active defence and reduce the threat to match the capability of the defenders. It is based on the proven principles of dry fire fighting, a successful fire fighting strategy developed by foresters over many decades.

A NEW PLAN

Attacks from an aggressive and damaging enemy need strong accountable objectives.

Overall aim: In each community, protect the house from damaging threats in the One Day Inferno Fire

This will deliver the following primary objectives:

- Zero deaths
- Zero house loss

It will deliver the following sub objectives:

- Maximise community empowerment
- Maximise fire brigade safety and effectiveness
- Minimise level of disruption / trauma to people or community
- Maximise Community resilience
- Minimise Insurance payouts

Who is accountable for protecting a community?

Identify one person or body with responsibility for protecting a given town or community from bushfire damage.

The framework for the goals

To achieve the solution of community safety and protecting people and houses requires a framework within which we can invest inputs, do works and then monitor progress. We use the Logic Model (eg, Weiss, 1972) because it logically distinguishes inputs from activities and outputs and distinguishes outputs from outcomes:

INPUTS generate ACTIVITIES which lead to OUTPUTS which produce OUTCOMES, either in the short or long term.

The solutions we seek fall into the OUTCOME part of this model. They are the goals or aims. We also apply the Peter Drucker principle “what gets measured gets managed”, and its variant “what gets measured, gets done”, and carefully choose the Key Performance Indicators (KPI) to make sure they are relevant to the goal / outcome and allow us to monitor progress.

(1) KPI's

In the bushfire risk management situation, we can identify a number of measurable key performance indicators.

We see the following as Key Performance Indicators (KPI) to be reduced:

These sample KPI's allow us to monitor impact of inputs on outcomes of community safety or disruption and trauma.

Annual government costs	
Annual fire protection budgets	
Annual fire suppression costs	
Total combined government contributions to fire protection, suppression, recovery	

	Uncontrolled running fires	Other bushfires
Numbers of incidents		
Death toll		
House toll		
% houses not destroyed		
Insurance payouts		
Area burnt / Perimeter		
Cost of aircraft		
Resources deployed (person days): volunteer / paid		

We see the following as Key Performance Indicators to be increased:

These sample KPI's indicate level of self reliance and capacity to survive a bushfire attack and recover quickly. The concept of Community level protection units builds on the CFA's Community Information Guides.

Total number of defined Communities	
Number that are bushfire-protected from external running flame	
Number of potential high hazard bushfire areas within Community boundaries	
Perimeter of potential high hazard bushfire areas within Community boundaries	
% of perimeter of these areas where threat is neutralised - low to nil flame height	
Number of Communities with self defence team or teams	
Total number people available and trained for self defence	

KPI's are linked to our objective as follows

Returning to our lead objective of delivering house protection, we see it impacts all the other KPI's in turn. It clearly delivers the top two priority KPI's - death toll and house toll. It follows that if we protect the neighbourhood, we protect the community from disruption and trauma. When we protect the community, we reduce insurance payouts. When we understand that ember attack is inevitable in severe bushfires and that multiple house protection against massive ember attack by fire brigades is impossible, we realise that house protection is only achievable by vast numbers of people, ie, the residents themselves. We realise that to defend in safety, they need a pre-prepared environment made bushfire-protected and hazard reduced beforehand, either by themselves or fire authorities. We realise that when residents are resourced and have been empowered with knowledge and skill, they can form Neighbourhood teams, they rely less on government fire suppression resources, and we should see government fire budgets and allocations reducing. Greater community self reliance also achieves the final KPI of increasing community empowerment and resilience.

In regard to area burnt by bushfires, the task of preventing bushfire spread is clearly the fire authorities. When they no longer have to divert resources to protect houses, they freely focus on stopping perimeter spread, and the area burnt should also decline.

Our sample KPI's are now allocated into the relevant components of the Logic framework.

Inputs	Activities	Outputs	Outcomes
<i>What resources are invested</i>	<i>What the inputs fund</i>	<i>What the activities produce</i>	<i>What goals / objectives the outputs achieve</i>
Government budgets	Number of bushfire incidents	Area of land burnt by runaway fires	Government recovery allocations to bushfire-protected Communities
Cost of aircraft	Resources deployed	Number of communities attacked by uncontrolled running flame	Government recovery allocations to non bushfire-protected Communities
	Number of bushfire-protected Communities created / maintained	Death toll House toll % Bushfire-protected Communities	% houses not destroyed & Insurance payouts in bushfire-protected Communities
	Perimeter of hazard areas treated	% Hazard perimeter neutralised	% houses not destroyed & Insurance payouts in non bushfire-protected Communities
	Number of people trained / refresher	Number of trained people available for self defence People trained as % of house numbers Number of teams in place % communities with team	(= direct measures of level of disruption / trauma and inverse measures of community empowerment and resilience)

We can observe that very few of these KPI's appear on fire agency publications in Australia. Instead we see generalised statements like "reduce bushfire risk" or "reduce the impact of bushfire". Refer to INSET below. Such goals are imprecise, and because they cannot be measured, they prevent monitoring and obfuscate accountability.

INSET

Case study CFA's goals and performance

CFA 2013 annual report says - "CFA's principle priority is to reduce the incidence and impact of fire and emergencies on the community" (Claire Higgins, Acting Chair CFA). When we examine the report to check progress, it shows there has been negligible reduction in incidents for many years, but there is no account about how the CFA has reduced impact of fire on the community.

CFA's mission and vision statements suggest their role is to keep Victorians safe from fire and to protect lives and property. The annual report describes many things they do, but these fit into the category of **activities**. It describes the expenditure and income, but these fit into the category of **inputs**. What are CFA outputs and outcomes? Only one performance measure is reported that has any relevance to physical on-the-ground community bushfire protection. It can be interpreted as this - attend all callouts and do so within X minutes. They aim to meet emergency response times 90% of the time. This is an **output**. Presumably, this is based on the theory that quickest arrival means least damage. If so, "least damage" is an **outcome**, albeit not quantified.

CFA also reports how many incidents they attend and some details about the larger bushfires, but that is an **activity**. There is no indication of CFA's aim for fire size. We can only assume they want to keep them small. There is no record of size of fire or analysis about perimeter or resources deployed or time

spent. This is possibly because the statistics refer to unpaid volunteers, where expenditure is obviously minimal.

They report numbers of meetings and number of attendees, but again, they are **activities**. There is no link to how they protect house and property. They indirectly report that over 200 Communities have been declared very high and extreme bushfire risk, but there is no indication of how many towns or areas they want to make safe from bushfires, or have made safe, or in fact are already safe.

Therefore, based on what the CFA reports to Parliament, we are forced to conclude that (1) accountability is very thin, yet they have assets of \$1Billion and a budget of \$1/2 Billion, (2) the CFA delivers safety and protection by relying on volunteers arriving at fires in the shortest time, and (3) we can further deduce that it literally has a “put out spot fire” approach to management of volunteers and bushfires. They let them deal with fires however they can, however they find them.

We look to the Fire Commissioner’s Office for more guidance but find that, despite the massive toll of 173 deaths and 2000 houses destroyed in one day in February 2009, the government’s bushfire objectives remain modest and qualitative - **to reduce the impact** of bushfire.

The objective of all bushfire management activities in Victoria is **to reduce the impact** of bushfire on human life, communities, essential and community infrastructure, industry, the economy and the environment. 2012 Bushfire Plan The Office of Fire Commissioner

Unfortunately, neither the CFA nor the Fire Commissioner’s Office reports about impact reduction. Yet we know that runaway fires in severe weather are well above the design capacity of the government suppression model, and the consequence is that communities remain exposed to fearsome and damaging flame and ember attack.

(2) Strategic principles

Community protection is to be done on area by area basis, with strong target of preventing house loss during attacks by the **One Day Inferno Fire**. If appropriate, subdivide Community area into Neighbourhood protection areas.

Put most effort and resources to neutralise the most significant influences on house loss. Put least effort and resources into the minor causes. Eg, major cause of house loss is embers, major influence on house loss rate is house vacancy rate, and major threat to defenders is the running flame.

Use passive defence to facilitate suppression and to provide a safe workplace. Defensive suppression does this. Apply it to neutralise the major influences. Passive defence keeps the running flame well away for the safety of defenders, defenders remain on site to provide resources for ember attack on each house and this also covers the vacancy rate issue.

Defensive suppression makes Neighbourhood and Community areas “bushfire-protected” because the only flames allowed within these areas are stationary flames in permitted areas.

Passive defence neutralises bushfire hazards within a “bushfire-protected” area by managing flame location and height to ensure successful active defence within capability of fire fighting resources, ie, fire fighters and residents.

Acknowledge residents as a spot fire defence resource that actively defends within “bushfire-protected” area when fire fighters are not available, and empower them to be self reliant and competent.

Provide evacuation as alternative, but ensure their vacant house can be protected by a local defence team

Use valid fire behaviour science to identify threats and to verify effectiveness of threat management **strategies (see Appendix 2)**

(3) Are there any legislative hurdles to proactive house protection?

Analysis of the CFA Act shows that, apart from administration of the organisation, the CFA's role is to provide prevention and suppression services. Specifically, prevention works aim to reduce ignitions (= reduce suppression) and hazardous fuel (= improve suppression success). Fire plans specify buildings and areas at risk in municipality and treat risk (= prevent damage). Advice on improving defendability of buildings (= prevent damage). Section 97C Even allows it to enter into agreements "to provide any other property protection or loss mitigation service for the prevention of or to deal with the effects of any emergency or hazard", and to charge for its services.

Therefore, theoretically, on a given area, the fire authority is empowered to remove all fuel hazards, reduce risk on all buildings and areas, and advise people how to better defend. If it adds in the power to "prevent danger of spread of fire" from public land, the CFA could eliminate all bushfire risk from a given area. Goals could then be set for these areas. Eg, CFA could decide they will eliminate bushfire risk in ten towns per year. Activities, outcomes and outcomes in these areas could be reported.

Let us ask this question - **Why don't they?** If they don't, it is because they have decided not to, or they have priorities greater than eliminating bushfire risk from a given area.

But an obvious opportunity has now presented itself because the fire authority has now declared over 200 communities at very high to extreme risk. According to Community Information Guides, the current management strategy is to provide protection to these communities by evacuation, rather than, for example, by a staged strategy in risk reduction.

We urge the latter strategy because it is consistent with our solution of protecting houses and would actually meet the CFA objective of protect life and property. By contrast, the former results in safe people but house loss.

(4) Implementation

Appendix 1 in this Paper is an example of how this new plan could be implemented statewide. It is a significant policy shift from current situation, but there are no legislative hurdles. It outlines how the issues we are concerned about can be addressed in a systematic process. It shows how house loss rate of both new and existing houses can be minimised at the same time as community protection levels and resilience can be increased.

BENEFITS

Together, by joint community and government action, we rid Victoria of the bushfire menace

Reduce / eliminate deaths, house loss and community disruption

Community self reliance

Community empowerment and resilience

Reduce fire authorities costs, which means less drain from the community's pocket, more to spend on productive things

It changes the government approach from reactive to proactive:

FROM: ...

Send volunteers to all call outs, where the workplace is unprepared, where they will deal with the fire as they find it

TO: ...

Make communities / towns safe from one day inferno fires

Make safer workplace for volunteers

- By reducing flame size to match fire fighter capability
- By managing fuel beds to make suppression achievable for fire fighters

REFERENCES

Alexander M (2001) Fire behaviour as a factor in forest and rural fire suppression
Forest Service Research Report 21, New Zealand

Blanchi R, Leonard J and Leicester RH (2006) Bushfire risk at the rural-urban interface.
Australasian Bushfire Conference, 6-9 June, Brisbane, Queensland

Blanchi R, Lucas,C, Leonard J and Finkele K (2010) Meteorological conditions and wildfire-related house loss in Australia International Journal of Wildland Fire **2010**, 19, 914–926

Handmer J, O'Neil S and Damien Killalea D (2010) Review of fatalities in the February 7, 2009, bushfires EXP.029.003.0013 Report prepared for Royal Commission, Victorian Government, 2010 [see VBRC (2010)]

Leicester R.H. (1987) Building Technology to resist Fire, Flood and Drought. The Fireman. Operations January 21 1987.

Lucas C, Hennessy K, Mills G and Bathols J (2007) Bushfire Weather in Southeast Australia: Recent Trends and Projected Climate Change Impacts
September 2007 Bushfire CRC Witness statement TEN.056.001.0001 to Royal Commission
Victorian Government, 2010 [see VBRC (2010)]

Luke RH and McArthur AG (1978) Bushfires in Australia For and Timber Bureau,
CSIRO, Canberra Australia

Tolhurst K T (2009) Report on the Physical Nature of the Victorian Fires occurring on 7th February 2009
Report EXP.003.001.0032 to Royal Commission Victorian Government, 2010 [see VBRC (2010)]

Weiss CH (1972) Evaluation Research - Methods for Assessing Program Effectiveness.
Prentice-Hall, Inc., Englewood Cliffs, New Jersey)

Whittaker J, Haynes K, , Handmer J, McLennan J (2013) Community safety during the 2009 Australian 'Black Saturday' bushfires: an analysis of household preparedness and response
Int Journal of Wildland Fire **2013**, 22, 841–849

VBRC (2010) Victorian Bushfire Royal Commission Final Report, Government of Victoria

APPENDIX 1 HOW TO CREATE A BUSHFIRE-PROTECTED STATE

Long term goal: All houses will be protected from the bushfire menace.

How:

Create a bushfire-protected environment to enable house loss prevention during a severe bushfire attack with three steps:

Step 1 Protect the community externally from severe running flame

Step 2 Protect the community internally by neutralising threats from potential flame and ember source sites

Step 3 Empower the community with knowledge and skills to deal with spot fires and provide incentives / expectation to prevent house loss by passive and active defence measures.

Apply the principle of **hygiene factors**:

The state creates the environment to prevent house loss by providing bushfire-protected surroundings during a severe bushfire attack

Like health system, the state creates the environment to prevent disease and illness by providing accessible health services.

The owner has the right to participate or not, to defend or not in a bushfire attack

The citizen has right to become healthy or to stay unhealthy.

In the bushfire case, the state has powers to prevent the owner being a bushfire threat to the community

In the health case, the state has powers to protect the diseased person from infecting the community.

Philosophy

Protect the house because protecting the house protects the person and the house

Explanation: The state creates a bushfire-protected environment for the house to survive the worst case bushfire attack, ie, one day inferno. This provides the person with protective shelter, and provides a safe working environment to self defend on site against small spot fires that may occur. The person can chose to self defend or to organise self defence in absentia.

Aims

To make Victoria bushfire-protected

To protect the house from loss in a severe bushfire attack

State protects house from running flame on worst case day and empowers resident and community to self defend against spot fires (Defined as the one day inferno when FDI> 30)

[This will reduce impact of bushfire. This will protect people and property]

The implementation process

State divides into Integrated Bushfire Protection Units (IBPU - these could be Shires or CFA Regions) with **one body** responsible / accountable for house protection, using all fire pro components (prev, pre supp, supp, fuel management), and CFA powers.

Within each IBPU:

- 1 Examine all Community areas, and classify them into bushfire safe, "bushfire-protected" and "bushfire-exposed"
- 2 Define the threat agents for each (verify by testing the area with worst-case scenarios and map the type of bushfire attack and the potential house exposure numbers, eg, Red Eagle's BAR technique)

3 Apply defensive suppression to all “bushfire-exposed” communities to make them bushfire-protected.

4 Determine planned conversion rate of “bushfire-exposed” into “bushfire-protected”

5 Change legislation (if necessary) for CFA to be accountable for protection of a Community unit. Integrate planning and operational protection into a bushfire protection plan based on the “community” unit. Coordinate prevention, presuppression, suppression and fuel bed management within each community unit.

6 Assess and map bushfire potential by “bushfire-exposed” and “bushfire-protected” Use this for the BMO process instead of current mapping system - Bushfire Prone Area (which is based on Byram’s fireline intensity (which is not appropriate), it uses peak total fine fuel, rather than fuel consumed by moving flame, it does not differentiate intensities between fuel types, and does not include grassland paddocks.). Amend the BMO process and provisions to replace Table 1 with actual bushfire behaviour estimates plus a safety factor.

7 Adopt **proactive fire protection policy** as follows:

In bushfire-protected areas, use hazard notices and other CFA powers to ensure existing and new building sites are and remain protected from running flame and record on local fire plan (prev, pre supp, supp, fuel management).

8 In bushfire-exposed areas, use hazard notices and other CFA powers to ensure existing and new building sites are and remain protected from running flame and record on local fire plan (prev, pre supp, supp, fuel management).

9 For all houses / buildings (existing and new sites):

Ensure access and infrastructure facilitates efficient and safe suppression up to FDI 30 by fire brigade

Ensure access and infrastructure facilitates efficient and safe suppression above FDI 30 by fire brigade and spot fire control by residents and other defenders.

There will be difficult and borderline sites. The State’s goal is to prevent house loss. If the State cannot protect the house from the running flame, so certify, and obtain indemnities from house owner. The insurer may want extra protections. It is the owner’s choice to select fire retardant materials. The state cannot enforce.

Administration

By government region or municipality

Scientific basis

Identify / document broad scale bushfire scenarios and define the threats (type, scale, concern factor) to the each “community”

Identify local threats (type, scale, concern factor) within “community”

Identify source of threats and land ownership for both of above

Advise owner (of the threats) of duty of care obligations and specify maximum flame height and other fire behaviour expectations

Data base

To be updated each winter

Map private land as bushfire-protected or bushfire-exposed

Map relevant adjacent public land “fringe / border” according to threat potential:

- Flame escape threat – neutralised or not (ie, without reliance on active defence)

- Ember escape threat = Source of short distance embers – neutralised or not

Note – medium / long distance embers will always be a constant threat. Where ember source is identifiable, map them and take steps with landowner to reduce ember generation capacity.

Overlay with “community” boundaries

“Community” includes whole Communities and parts thereof called Neighbourhood protected areas.

KPI and Targets

Aim is to increase proportion of bushfire-protected to 80% by 2020??

Aim is to make 100% of “fringe / border” neutralised to flame and 80% to embers by 2020??

Identify and map communities / neighbourhoods as bushfire-protected (fully / partially) or bushfire-exposed

Aim is to make 80% of communities bushfire-protected by 2020 ??

Priority treatment schedule

First priority treatment areas

Treat all CFA nominated communities at highest risk

Make all bushfire-protected by 3 years, including internal threat neutralised.

Deal with community specific concerns as they arise

Next priority treatment areas

Fringes of large blocks of public land

Deal with community specific concerns as they arise

Next priority treatment areas

Fringes of medium and small blocks of public land

Deal with community specific concerns as they arise

Policy for existing and new houses in bushfire-protected area

Because existing house sites are protected from the running flame and internal threat hazards have been neutralised, it means new house sites will also be protected. Therefore, there is no need for a bushfire planning permit. Authorities will empower and encourage the new house owner to deploy passive and active defence on their house site and the options available for defence against small spot fires.

In the meantime, there will be many bushfire-exposed areas on the waiting list to become bushfire-protected:

Policy for existing houses in bushfire-exposed areas

The policy is to protect the house from loss by one day inferno attack, and owner is encouraged / empowered to apply passive and active defence against possible ember attack.

Apply proactive fire protection approach:

Is the house or shed a threat to neighbourhood houses in a bushfire attack eg, will ignite by spot fire and flames or embers will threaten neighbouring house?

If yes, MFPO to issue hazard notice to house owner or to owner of source of embers.

Add this bushfire hazard into the local fire plan for on going maintenance

If no, and house is not exposed to running flame, policy is achieved. No further action.

If no, but house is exposed to running flame, issue hazard reduction notices on appropriate properties to stop running flame at safe distance.

Add this bushfire hazard into the local fire plan for on going maintenance

Or

Owner can take charge:

Identify external threats (type, scale, concern factor) and source properties

Identify nearby bushfire hazards, assess threat (type, scale, concern factor) and property ownership

Request owner (of threats) to neutralise the threat or ask MFPO to issue notice
Add this bushfire hazard into the local fire plan for on going maintenance
Owner applies self defence on own property
Owner fortifies house and assets at own expense

Policy for new houses in bushfire-exposed areas

The policy is to protect the house from loss by one day inferno attack, and owner is encouraged / empowered to apply passive and active defence against possible ember attack. Treat new house site in same way as existing house sites.

Apply proactive fire protection approach:

Will the house or shed a threat to neighbourhood houses in a bushfire attack eg, will ignite by spot fire and flames or embers will threaten neighbouring house?

If yes, permit is required and permit conditions aim at isolating or eliminating threat.

Add this bushfire hazard into the local fire plan for on going maintenance

If house site is exposed to running flame, issue hazard reduction notices on appropriate properties to stop running flame at safe distance. Add this bushfire hazard into the local fire plan for on going maintenance

This makes it bushfire protected, therefore no need for bushfire permit. As before, authorities will empower and encourage the new house owner to deploy passive and active defence on their house site and the options available for defence against small spot fires.

Specific examples that address higher risk sites

Current house or new house site in bush (high ember potential)

Eg. NW slope of Pauls Range in bush

The policy is to protect the house from loss by one day inferno attack, and owner is encouraged / empowered to apply passive and active defence against possible ember attack.

Apply proactive fire protection approach:

Is the house or shed a threat to neighbourhood houses in a bushfire attack eg, will ignite by spot fire and flames or embers will threaten neighbouring house?

If yes, MFPO to issue hazard notice to house owner or to owner of source of embers.

Add this bushfire hazard into the local fire plan for on going maintenance

If no, and house is not exposed to running flame, policy is achieved. No further action.

If no, but house is exposed to running flame, issue hazard reduction notices on appropriate properties to stop running flame at safe distance.

Add this bushfire hazard into the local fire plan for on going maintenance

If new house site is protected from running flame, it is technically bushfire-protected, therefore, no bushfire permit required for new house. As before, authorities will empower and encourage the new house owner to deploy passive and active defence on their house site and the options available for defence against small spot fires.

State may issue certificates, eg, State may certify – It cannot guarantee this house is bushfire-protected. State may advise of no fire fighter attendance in severe bushfires - explain why – eg, safety / access reasons. State may certify that owner onus applies.

People will want to get insurance, they will see the certificates from government. Insurer may seek other works or else premium is huge

Housing estates in grass or heath country (low ember risk)

eg, Mickleham grass paddocks

The policy is to protect the house from loss by one day inferno attack, and owner is encouraged / empowered to apply passive and active defence against possible ember attack.

Existing houses

Apply **proactive fire protection approach:**

If house exposed to running flame, issue hazard reduction notices on appropriate properties to stop running flame at safe distance.

Add this bushfire hazard into the local fire plan for on going maintenance

New housing estates

Apply **proactive fire protection approach:**

If house exposed to running flame, issue hazard reduction notices on appropriate properties to stop running flame at safe distance.

Add this bushfire hazard into the local fire plan for on going maintenance

Alternatively, land developer may absorb the role as a service.

Because new house site is protected from running flame, it is technically bushfire-protected, therefore, no bushfire permit required for new house. As before, authorities will empower and encourage the new house owner to deploy passive and active defence on their house site and the options available for defence against small spot fires.

Summary of the differences

The current plan for prevention and suppression services:

Current aim: We reduce impact of bushfire, we protect people and property

When the fire is reported, we send the trucks. We are so proud of them. We evacuate people out of danger. Saving life is more important than saving a house. They can always rebuild a house. You can't revive a death. We have no plans to reduce the bushfire risk.

Our primary tool is the fire brigade model, which is very effective up to FDI 30.

Above FDI 30, we try their best. We bring in reinforcements and they all try their best. Our answer is to have more fire trucks.

The current concept for house protection in County Area of Victoria (CAV):

Existing houses - on severe weather days, our brigades will do their best against Mother Nature's fury. But we want people to evacuate to save their lives. Some communities are extreme risk. We also ask them to evacuate. We have no plans to reduce the bushfire risk.

New houses – because this is bushfire area, to build here they must fortify their house with fire retardant cladding and have a defensible space. We also ask them to evacuate. We have no plans to reduce the bushfire risk.

The new plan for prevention and suppression services

New aim We deliver the best level of prevention and suppression services

We reduce impact of bushfire, we protect people and property

We will protect house (existing and new sites) from worst case fire consistent with CFA Act. This is because by protecting the house, we protect the life and prevent disruption of the resident.

We want 90% Communities to be bushfire-protected by 2020

Primary tools defensive suppression, fire brigade, empowered resident defenders

State applies passive defence to facilitate suppression in safety by fire brigade and spot fire defenders.

The new concept for house protection in CAV:

Existing houses and new house sites State applies defensive suppression to ensure owner of threat is responsible for preventing threat spreading onto other property. State empowers resident and community to self defend against spot fires within a bushfire-protected area.

Defensive suppression protects the communities – makes them bushfire protected = safe workplace for fire fighters, safe for spot fire defence by residents – the heavier the ember attack, the more defenders required.

<p>Flame stretch / rollover Wind causes the flame to tilt at an angle in proportion to wind strength and when adjacent to a fuel free area it can flicker across it from horizontal to vertical. The length of the flame is determined by the same factors as flame height above. Researchers recommend rollover or flame stretch can be up to 1.5 times flame height. Because flame height is manageable, so is flame stretch.</p>	<p>Manage flame rollover Establish a fuel free break of defendable width. Manage flame height upwind of fuel free break, as above. If flame stretch (eg, 1.5 times flame height plus safety margin) is less than width of fuel free barrier, flame cannot ignite fuel down wind. Note, this stops flame crossing the fuel free barrier, but it does not stop ember throw. For ember management, see next boxes.</p>
<p>Ember generation at source A taller flame has a stronger uplift than a smaller flame because of buoyancy forces. A strong updraft tears off loose bark and twigs and carries them into the plume and wind aloft throws them hundreds of metres or kilometres downwind, and the larger ones are alight when they fall. A forest that has not been burnt recently tends to burn with a strong and tall flame, and has a large supply of potential ember material. A grass or heath fire has smaller embers than a forest. They can remain alight for only tens of metres. A smouldering tree or stump throws many sparks down wind, but they tend to be a few tens of metres</p>	<p>Manage ember source The ember volume and density that comes from a property is manageable. To reduce distance of throw downwind, manage flame height to minimise updraft force. Ensure flame height stays low (< 2m). To reduce ember volume produced from a given flame height in a source property, ensure that loose material is regularly removed, eg, by fire, or prevent flame from reaching the source, eg, isolation.</p>
<p>Ember ignition If a live ember falls onto fine flammable dry fuel, it tends to ignite quickly. It spreads laterally if the fuel bed is continuous (eg, in a gutter or a mulch bed or dead grass paddock or forest litter bed) and vertically if the flame reaches into flammable timber or flammable foliage. If a live ember ignites in a crack on a board or onto timber with a rough surface, it will be fanned in the wind and spreads with a low flame and a very hot glow. Some live embers are too small to ignite wood but as they build up numbers in a corner, they continue to glow in the wind until they ignite the timbers of the corner.</p>	<p>Manage ember ignition Identify before the bushfire attack which areas are to be spot fire free and which areas ignition will be allowed. Eliminate flammable fine fuel surfaces in areas where spot fires are not wanted (eg, prior removal, or make non flammable by wetting or coatings). Patrol these areas and sites regularly during bushfire attack to ensure that these areas remain non flammable, or to extinguish an overlooked area that has ignited Extinguish glowing timbers and remove or extinguish ember build-up sites.</p>