Topic 3 Bushfire Behaviour How a house is attacked

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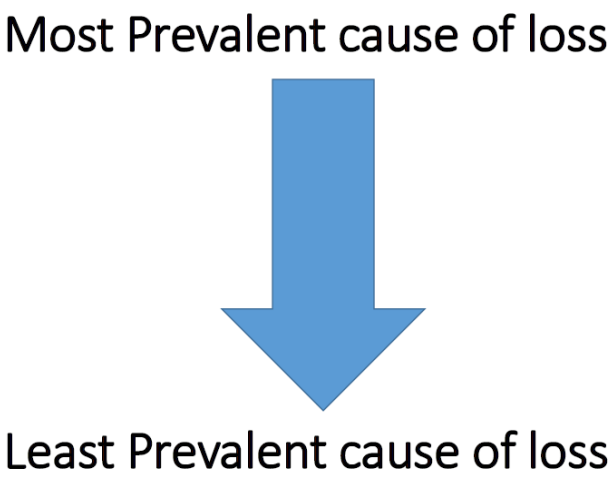
Justin Leonard

I've spent roughly 26 years delving into the nooks and crannies of: how to improve our houses in the wake of bushfires.

In terms of a bushfire itself, we do a unique thing and actually study bushfires from the perspective of the house. So, what is it like to experience a bushfire from the house's perspective? And, I guess once you put that lens on, you start to imagine what experiential processes this house will experience, and what are the mechanisms and processes of how it might respond to those things.

And, I guess, as you look into it, it's a far more complex set of actions and processes than simply a fire front turning up and spraying some embers around. There's so many extra nuances around the specific location of the house, and its proximity to other what typically are non-bushfire elements that either play roles as barriers or as additional fuel sources in those environments. I'm going to focus on all those processes, and how to harden a house and prepare its surroundings to eliminate the potential negative impacts of those other processes.

Ember Attack
Debris Accumulation
Surface Fire
Consequential fire
Radiant Heat
Flame Front contact
Wind
Tree strike



Now, if we list these processes out, this is a fairly good profile of what we're up against.

Ember attack.

Debris accumulation, which happens over the months and years building up to a bushfire.

Surface fire, which is the low-level surface fuels that are burnt out when fire fronts arrive, and it helps, and ignited and reignited by embers.

Consequential fire might be a new term you haven't heard before, but it's the term we use to describe heavy fuel elements that burn near houses and present an additional heat load might be radiant heat or flame contact or it might challenge someone's ability to leave a burning house. But a consequential fire is all what we call heavy fuels, and that might be a

vehicle or a fence, or a retaining wall, or even a wheelie bin. So, consequential fire is a very important aspect of preparing a home, or having a home adequately built to resist.

Radiant heat is what we all come to know and understand. Radiant heat from a fire front some distance away. The flame front and its ability to contact the house.

Wind action, which is a very important process that's almost ubiquitous in bushfires, where these winds can directly act on the house and weaken them.

And, of course, tree strike.

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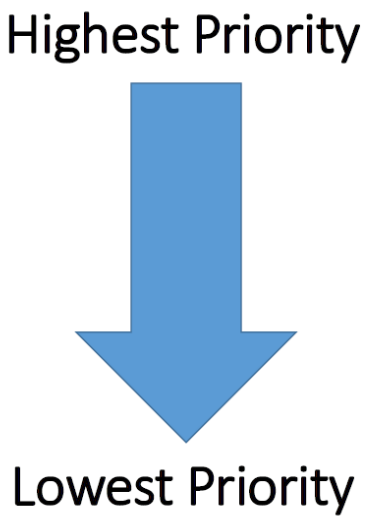

So, I've actually listed them in a deliberate order, from the ones that are most prevalent in causing structural loss through to the ones that are least prevalent. So, this gives us a bit of a guide to move through a list, from the most crucial things to begin and address first, and move further and further down the list to the lesser important ones. But, of course, for all circumstances I'd strongly encourage you to work through the entire list.

So, in terms of the process of trying to unpack, how do we solve each of these actions? It's important to recognize that they're not all created equal in terms of the best way to approach them.

Ember Attack	House	X		Landscape
Debris Accumulation	House		X	Landscape
Surface Fire	House		X	Landscape
Consequential fire	House			X Landscape
Radiant Heat	House		X	Landscape
Flame Front contact	House			X Landscape
Wind	House	X		Landscape
Tree strike	House			X Landscape

And, what I've put up here is a profile of whether a particular attack mechanism is easier to resolve through house design and upgrade, or modification, or it's more easily addressed through landscaping and removal of it as an action on the house.

Now, if we move through these, it becomes fairly clear ember attack, which is quite a prolific process in the landscape, and embers are spraying everywhere in a bushfire context, it's almost impossible to imagine that we could eliminate ember attack by clearing enough vegetation and enough sources of embers. It's just simply not a practical process to go for elimination from a landscape approach. However, solving it from a house design perspective is relatively straightforward. So, that's why we have an 'X' leaning well over against the house side of the process.

Conversely, if we look at something like tree strike, at the bottom of the list here, you can imagine that designing a house strong enough to withstand tree strike is near impossible. However, managing the trees and providing a sufficient buffer by managing the trees in the landscape side of the process is relatively straightforward. So, this just gives us a nice handy guide and I'll come back to this a few times throughout the presentation.

Now, let's start by also considering that these ember attack processes are obviously very important for house survival, but they are actually absolutely critical for occupant survival. So, not only is a house potentially experiencing all of these processes, but an occupant, if they're forced to leave their house during a fire event because the house may actually ignite and start to burn down will be faced with these very same actions. So, we have to think that we're doing these mitigation processes both for the house's benefit but also to make an improvement in the potential for occupant survival.

And, this graph is one of my favorite graphs to display how, as we move through the categories of fire weather severity, how the potential for life and house loss escalates. So, one of these profiles is life loss and the other one is house loss, ranging from zero to a hundred percent of all the loss that we've studied across the history of Australian fires.

So, we can see that the context of actually planning and preparing our houses for the pointy end of this process, up around the Extreme in Code Red (Catastrophic), is particularly important. Therefore, having those types of fire weather severity in mind when we're planning and upgrading our house and modifying our landscape, it really needs to be able to perform and be effective under those categories - when the winds are very severe, the landscapes are very dry and the fires are very aggressive.

The other important context to focus on is that of the people that lost their lives outside. So, not with the benefit of their house, either because the house burnt down and they were forced out to try and survive outside, or they were trying to get back to their house, or they were in the process of defending their house and weren't able to make it back inside.

The vast majority, well over 60% of the people that died outside anywhere in Australia, were no more than 100m from their own house. That's not, "any house," it's, "their own house." Which really helps us focus on this idea, that not only the house's survival but the landscape immediately around the house is critical in contributing to your prospects of surviving a fire.

Now, this isn't to negate the idea that we shouldn't be anywhere near a Bushfire Prone Area while one of these fires is active in your landscape, but in the event that those processes and plans didn't unfold the right way, you have the fallback plan of, potentially, a well-designed house and a well-prepared landscape that you could survive within if you were in the immediate surrounds of your house. This graph also highlights how approximately 80% of all fatalities outside were no further than 500m from your own home as well. So, quite startling statistics about how important the local landscape around you is in these severe fire events.

So, back to the mechanisms and we're going to address ember attack and debris accumulation first. So, these two processes are predominantly focused around “House”: what we can do with the house. So, we can do a little bit with debris accumulation by removing overhanging trees, but most of our work is trying to prepare a house to be adequate to withstand ember attack, and to be tolerant to some amount of debris accumulation.

So, photos like this show the obvious implications of adjacent and overhanging trees. And, even if they're plants that are well considered, if they are overhanging and can deposit their debris on the structure, the structure accumulates that debris load in obvious places like the gutter lines and in the subfloor areas. But, it also builds up in places that you can't see, which is under roof capping, and under tiles, and in roof cavities.

Now, to design against this kind of approach, you would think something like sarking might be might be a possible approach. However, all of our conventional sarking, even the ones specified in our building standards, actually perform similarly to this, where the debris that might accumulate on top of that sarking, and below your ridge line, will simply burn away and allow that debris to drop further into your roof cavity during a fire event. So sarking isn't really a solution, and the most appropriate way to go is actually to think about removing the capping and place a thin strip of fiberglass insulation batt, and then screw down the ridge capping seals off ember access and debris access to that ridge line.

There's also many other ways debris builds up and interacts with other features on our roofs. In this case, we're showing the interaction between a gutter and an overhang which has a polycarbonate roof covering. This scenario here is not of a particular issue, but it just shows you how a small source of fire can interact with such a glazing element. Now, if those glazing elements are actually fiberglass-reinforced skylights, they're the ones that have a matte finish and you can sort of see fiber through those coverings, they are extremely ignitable and will, in themselves, carry a fire from a gutter line all the way to a house. So, if these are present, or used in your house, they should be removed and replaced by a polycarbonate alternative, which acts in a far more benign way because it doesn't burn in situ and carry a fire across the roofline to your house.

And, in fact, here's an extreme scenario where quite an aggressive fire arrived and exposed this polycarbonate covered patio area. And, in each case, the polycarbonate did not burn in situ, but melted and drooped in position, but did not add any additional fuel load to the house itself. So, while it does melt and droop, the risk that it presents is benign in a bushfire.

And, of course, there's other conventional ways to protect our gutter lines, and one of those is using gutter guards. But, in the event of using a gutter guard, it's very important to firstly select ones that are not made of polymeric materials, because they simply add to the fuel load that's in your gutter. And, when the embers arrive, they will melt and burn through along with any debris that has built up on top of them.

The mesh size for these gutter guards really needs to be 2mm or smaller in aperture size to be effective, because embers will simply pass through larger gaps and access what debris, if any, has built up under them. And, of course, the means of fixing them both to the roof and to the gutter line must be of some type of non-combustible material and flashing, so that it can perform adequately under the combined actions that bushfires bring.

Of course, a house is made up of many gaps, and we need to be really diligent in reviewing where all those gaps maybe that embers could enter, including the ones that are quite large, and in some cases are often overlooked, like the overhead gap over a roller door. But, in terms of finding gaps and understanding where they go, it's really a detective process of looking and looking and looking at your house to understand where they are and resolve them through whatever means you can. But, it's really an attitude and an approach that you just have to come to terms with and observe very carefully, and look at deliberate vents that may not have small enough apertures. The 2mm rule is absolutely relevant to every gap around your entire house.

Surface fire and surface fuels are a real challenge in a bushfire event because it's not if, but when they will burn out. And when they burn out, they can provide localized flame attack for anything near them, and depending on their thickness of debris load on the ground, they can burn for many hours and provide a really significant heat load for all things at ground level. So, the obvious ways to solve this are not having combustible materials immediately adjacent to the ground, and/or eliminating the surface fuels that come. But in a sense, the complete elimination of surface fuels doesn't completely solve the problem, because there's so much debris active in the air on these windy days, it's fairly common to observe debris build up and re-accumulation against ground elements around your house that ignite and then apply new flames to those events.

The same goes with unprotected gutters. Yes, you can clean your gutters out, but during the fire event itself the debris can build up again, to some extent, in those gutters and apply localized flame attack to the roof elements adjacent.

So, the really reliable approach is simply to eliminate ignitable building elements near the ground. And the height you actually need to think about is obviously dependent on the size of the pile of debris that's on the ground, but something like 0.5m of clearance is an effective measure to go by.

The surface fires in ember attack are quite ubiquitous in what they take out near ground level, and in my previous forum I've highlighted the issue of treated pine, which is a common timber used near and in ground contact scenarios that burns out prolifically when surface fires arrive and impact these structures.

Moving away from the ground surface itself, there's many nooks and crannies on the attached elements that surround our house. So, this decking element here actually shows how much debris has packed itself in between the decking boards and the fascia on this deck. And that has obviously provided one of the better locations for an ember to land and take hold in that fine debris, and develop into a decking fire that, if left unsuppressed, would provide such a significant heat load to a house that the house itself could be taken out.

How do you eliminate these? Well, it's simply not viable to have multiple timber elements contacting each other in a complex way, you have to eliminate timber elements by actually using non-combustible supporting elements under decks. And it's possible to use non-combustible supporting elements under decks, and possibly use high durability timber decking boards, or even better than that using deliberately-designed wood composite decking that is rated for use in Bushfire Prone Areas. But, the importance of having non-combustible substructures under the decks, and under houses themselves, is absolutely critical.

Of course, the way staircases also present re-entrant corners is ubiquitous and similar to actual decks as well. So, any little nook and cranny or re-entrant corner is a critical way that these can be lost. And, while that looks quite difficult to design a stair system that isn't susceptible to direct ember attack there are quite a few accidental designs that work particularly well. And here's one we observed in the Tathra Fires a few years back, where this staircase not only survived the onslaught of radiant heat and ember attack, it actually survived the complete burnout of the house it was attached to. And that's not because it was all non-combustible. In fact, it had high-durability timber treads, but the stair design itself highlights how a bit of isolated timber, not connected intimately with other timber elements, can perform quite effectively because the substructure supporting it has no particular combustibility. So, it can't work off each other and burn down.

Justin Leonard

Surface fire is an issue about what really is applied to and against house, and what is the detail of the house that comes down adjacent to those materials. There's so much debris that can build up and play against those actions, but really think about the detailing of, particularly, the subfloor access doorways that may be susceptible to that debris. I've seen many houses that have been very well-built, but then they do a simple job of the access doorway. In this case it's a metal one that hopefully has significant seals behind it.

Those surface fires can attack stairways, and this one's a very important one to look at because the stairway itself didn't actually contact the ground. If you look to the bottom left, you can actually see that there's a metal stirrup and a certain amount of clearance between the tanbark fuel bed underneath the stairway. And that typical height that those stirrups are set at are actually not far enough to prevent direct ignition and combustion of the adjacent timber elements.

The similar can be said about the typical way that poles are stirrupped with a galvanized footing stirrup, such as this. The typical height clearances are never enough, and at the same time the way these are designed is quite typical to allow debris to pack in at the base of the post but in that U-shaped stirrup. Likewise, an ember attack around decking details is also one of those really important processes to hone in on.

Now, in terms of solutions, you can't really ever completely eliminate the debris build-up under a structure or against the structure, but you can think about complete, non-combustible solutions. So, we think about brick piers or bricking-in existing timber piers, or having all-steel support posts. Now, these ones are actually a securing type. There's screw-in piers, and others that are placed in situ and three angular pegs are driven into the ground to secure their location and support.

And, of course, for decking, the steel structures underneath the decking are important, as is, in this case, a mod wood composite decking that was deliberately designed and tested for performance in bushfire, and, of course, it has performed extremely well, despite adjacent fuel loads and impacts on it. And it could actually be an effective deck to use as an egress route in a fire event.

There's plenty of ground cover options, and I would encourage you to think beyond the traditional tanbark and mulch approach, particularly in the few metres up to and immediately against the structure. It's absolutely critical, so please consider stone, various gravels and compressed aggregate finishes, concrete, and also, surprisingly, a high-quality artificial turf is actually a reasonable performer in bushfires. We've only found some very low-quality artificial grasses that have come in approximately a decade old, to be actually a poor performer. But, by and large, all the reputable brands currently on the market don't tend to perform badly in a bushfire event. And, of course think about creative garden design and plantings that simply don't provide that additional fuel load to your structure.

So, let's move on to consequential fires, radiant heat and the prospect of flame front contact. So, we can see that most of these are quite challenging things to solve from a house design perspective. And, obviously, for a consequential fire, actually removing the source of consequential fire is a lot easier than designing a house to handle the long burn out time that the fence, or a retaining wall, or a car, can present to the house.

Radiant heat is a mix between having the prospects of removing all your radiant heat sources from the landscape, versus building a house, or modifying a house, to be adequate for the radiant heat that's imposed. But in terms of looking into how to solve, and what's an appropriate thing to build against radiant heat levels, I guess, it's reasonable to say that our building standards provide a reasonable amount of guidance of appropriate materials for certain radiant heat level circumstances. And, of course, AS 3959 is currently a free standard, so I definitely encourage you to go and get a copy of that while it's free. Might not last forever.

Flame-front contact is obviously an expensive prospect to deal with direct flame-front contact on a house. However, in many cases, it can be solved in the landscape. And, I guess, the 10/30 and the 10/50 rule are good examples of where a landscape approach can, by and large, eliminate most of the flame-front contact prospect that a house may face.

So, in terms of what that clearance means, there is a few extra nuances. We spoke about 10/30 and 10/50 that I introduced in our previous webinar. There's actually a lot of detail that can be wrapped around what types of vegetation, clearance, and selection are relevant. And what the actual metrics in the 10/30 and 10/50 mean. For instance does 10m mean that you can cut down

any tree within 10m? Well certainly, if the trunk is within 10m, yes, you can take the tree out. But you can also remove overhanging foliage that reaches into the 10m zone as well.

And if you're interested in the specifics of exactly what to clear and how to clear, I'd actually encourage you to look up this particular website, called environment.vic.gov.au, and in their landing page, they have a tag that says "Native Vegetation Removal Regulations". And that actually delves very deeply into exactly what you can and can't do. And this is actually the front page of the document you can download for free, and it takes you into the really-specifics of what's behind it, and there's a lot of very good guidance advice about the tree removal and the vegetation surface removal out of the 30 or the 50m.

And, I guess, that also covers the implications and descriptions around the consideration of dead trees, which by themselves may not present a significant fuel load, provided they're a significant distance away. But the way to consider trade-offs about them being habitat trees, and what role they might play in limiting access or egress, or for vehicle access for example. And it also goes into the tree and vegetation clearances along fence lines, which is another important aspect, so, a very valuable document for people in Bushfire Prone Areas.

Now, in terms of house design, the radiant heat and the consequential fire implications are endless, really. And what I'd like to highlight here is there's just so many aspects of vulnerable places on the house, when you start to think about how consequential fires, which are materials, be it an adjacent house, be it gas bottles, be it stored materials can play out on a structure.

This picture here basically provides so many different combinations of issues that it's hard to do it justice, in that we've got gas bottles that are poorly secured against extreme fuel loads that the structure provides, and also even gas bottles that may be awaiting either removal or installation that are laid over in a worst-case scenario, where the fuel loads here are enough if that gas bottle on the ground had any liquid gas left in it, that could basically go off like a bomb in this event. Because gas bottles on their side cannot vent adequately, and can build up pressure to the point that they detonate and take out roughly a 50-80m radius; it will shatter windows.

Other consequential fire sources, like retaining walls and whatnot, are key issues. So, they more or less have to be eliminated if they're in the 0-3m range. And I guess the 3-6m range is the range where you start to consider the size and particular material of the consequential fire source, in combination with the adequacy of the house itself. So, obviously, a masonry-clad house that has no windows in it facing a consequential fire source like this isn't a particular issue. But, a similar house with a window or a door in it is vulnerable. So, you either have to seriously think about upgrading the window to be adequate - we're talking about aluminium windows with toughened glass glazing elements in them or shutters, of course, the removal of the consequential fire source.

The placement of our wheelie bins in the landscape is just one of those obvious ones that, for many, they're diligent and they will have a particular routine about where the wheelie bins get parked during the fire season, while others just simply don't register that as a significant fuel load. They do burn out quite prolifically, and they are enough in themselves, if parked under a window or against a combustible facade, to be the reason why a house is lost.

The places we store our timber is an obvious one, and I guess the question is: is it okay during the winter, when we might use it for wood heating, but how diligent are we about the complete removal of those fuel loads during the fire event itself? And, of course, in a fairly built-up environment, we've seen wood piles built against fences that are sufficient to take out a neighboring property, built at that normal setback of 900mm from a boundary. And that can be with a non-combustible fence or with a combustible fence in place.

House-to-house spread is another ubiquitous form of consequential fire, so the typical separations we see between neighbouring houses, or houses and sheds on the same property, or houses and sheds on neighbouring properties, when they're significantly less than 12m, say around the 6m range or less, then there is a higher chance that one house can burn its neighbor down.

Now the things you have to do to actually resolve a house-to-house spread are things like very tall steel fences, elimination of fuel loads between those two houses, which simply add to the problem, and quite fire-resisting construction on both houses, considering the windows, the eaves, and the fascia materials, is really the types of efforts you need. So, it's a really challenging mutual-risk problem that many face, and ideally having good separation is a virtue. However, when you don't, you're really in it together in a mutual risk scenario. And I guess, in a way, it's a very important neighborly conversation to have when you share a mutual risk like this. And I guess another way to address it is to simply be as diligent as the neighbor that you share the risk with to make both properties as bushfire resistant as you can, so that you don't face anywhere near as much prospect of one house burning its neighbor down.

The use of sprays and spray systems is another quite broad topic, and they can be used for many things, and I guess the best advice I can offer is that they're good for a few particular targeted things. However, I've never seen a spray-system design that's particularly effective at solving all aspects of bushfire risk that an otherwise vulnerable house could face. There's particular spray-system designs for drenching a house to withstand a neighboring property fire, there's another quite different sprinkler design that's adequate for filling your gutters and keeping them wet during an event, there's a different type of spray system that's dedicated to keeping glass and glazing systems wet throughout an entire event, and withstand quite a high radiant heat flame load, and then there's a different spray system again that might wet out a deck in an effective way.

What I've seen is spray systems applied to houses in a fairly generic way, with an assumption that that'll solve most of the house's problems, but in virtually all cases that's not the case. Here's a spray system fitted to the eaves. It's spraying most of its water into the air, and under a very windy day, the vast majority of that water will not impact that house or provide any particularly useful support to protect that house. It doesn't seal any gaps, it doesn't really wet the windows out adequately in this case, and if you're lucky, it might get a little bit of water in the gutter that they're mounted just below.

In a similar vein, the spray systems that are fitted to ridge lines along houses by and large put very little water into the gutter of the roof that they're fitted to, under the really windy conditions. And if they are run with enough intensity, they might get a little bit of water in the downwind gutter, but no water at all in the upwind gutter. So, I guess the vast majority of spray systems I've seen just aren't adequate for purpose or meet the claims that they are fitted on the house to achieve. But saying that, I wouldn't discourage the use of spray systems that are specific for a purpose, or a couple of purposes, and designed for that process.

And of course, if you're going to have a spray system, it's absolutely imperative to have a reliable source of stored water, pump, and means for that pump to operate throughout the entire fire event.

This is a tongue-in-cheek picture of a very poorly specified and located tank in that it's made of fiberglass, and for the same reason why the semi-transparent, clear fibreglass skylights burn out prolifically, these fibreglass half-shell water tanks burn out prolifically in fire events as well, and almost certainly do not provide adequate means to store water. And if they do rupture, and this one's highly likely to in a fire event, it can rupture in a way that can break open the house it's adjacent to. And you can actually see the typical combination of a treated pine edging making a platform that supports this fibreglass water tank. That's enough in itself as a fuel load to ensure that that tank fails in a fairly modest ember attack.

Sheds and supports for water tanks are just as important in consideration. This is another tongue-in-cheek picture. We have to be very careful about how we think and design our water tanks and what we put around them, and where the pump and pumping system and supply pipes actually go. It's very easy to say, "I've got an enclosure now so I'm going to store x, y, and z in with my pump." You really have to think about the implications and processes that may unfold in a bushfire, if and when it comes.

Now I'm going to talk about wind and tree strike as our final topic. Now, tree strikes are a relatively easy thing to deal with, and some of the best rules of thumb I've seen is the 45-degree rule. So, if you can sort of project a line out from the base of your house at 45 degrees, and it looks through substantial tree canopy, well, by definition that tree could impact your house in some way if it fell over. And that's a means to consider whether some pruning, and that's hopefully allowed within the 10/30 or 10/50 rule can adequately support that. I'm not saying the 10/30 and 10/50 rule is adequate if the trees are significantly taller than 10m, but that's a reasonable rule to see whether you've got significant tree-strike risk.

And of course, wind implications. Now, this previous picture shows a deliberate retention of the trees in the landscape, and those retention of tall canopy trees do a lot to help moderate the potential risk of this happening, which is direct wind loads acting on your house that is so severe that it could compromise the integrity of your house, or roof, in a fire event.

Now, the fire events that we know all too well, like Black Saturday and Ash Wednesday, both involved wind speeds and wind gusts that were sufficient for exposed houses to be damaged directly themselves. So, wind gusts that exceed 75km/hr are enough to potentially lift tin, or dislodge roof tiles, or project branches through the air that could break a window. So, that degree of weakening obviously then allows the other bushfire actions to play on the house and cause issues. And, I guess, the things that can help support or manage that risk are: retain vegetation in the landscape to reduce the loads on your house itself, but also think very carefully about how adequately your roofing is fixed. An extra pack of screws on every other ridge on a roof is an excellent consideration, as is means to protect windows by putting shutters, or fly screens, or protective things over the window glass themselves, all help to contribute to hardening those processes.

There's also good building guidance around building in cyclone areas, and I'd encourage you to look to some of those Queensland resources for ideas on how to harden up your house for those rare but particularly critical wind actions on your structure.

Chair

In 2009, when our home in Strathewen was threatened, I thought I was reasonably well prepared. I mowed the grass down to the dirt and there was a lot of bushes nearby, and I had no idea of what it would really be like in that sort of sandstorm of embers that just keeps coming and coming and coming up. I was imagining being outside and going around putting out spot fires for some reason. I guess lots of people did.

And one of the things I discovered pretty quickly was I actually needed a team of people. I watched the fire move slowly towards a shed and burn a $100,000 worth of tractors, but I couldn't leave the house because that was the thing that I wanted to protect the most. And then when my water pipe failed, of course, the house was lost. And so, I was naive, but I guess one of the things that came back to me was I had focused on putting out fires rather than what you've been talking about, which is stopping them from starting. And I suspect that there's a lot of people around like me who start to think about having lots of water and lots of hoses, and, yes, you can find yourself in trouble pretty quickly.

Justin Leonard

Yeah, we do certainly find that houses with one active adult looking after them certainly has one level of likelihood of survival. But you go and add two or three adults to that house and its prospect of survival more than doubles and triples. And it's simply because of that not-enough-hands prospect. And I guess that is a really important aspect is you're going to have simultaneous ignitions and processes unfolding and the question is: can you recognize them early enough and get to all the all of them quick enough in a safe way for that to be the case? So, elimination and passive is the golden rule, and that's the best way also to be able to confidently leave your house

in a bushfire event and feel confident that it's going to be there when you get back. An ideal house is one that just doesn't need you helping it.

Chair

You highlighted last week the risk of roof tiles allowing embers to enter the roof structure. Are there any options to modify an existing tiled roof, or do you need to replace it to give greater protection? And, I guess, it's in particular: what about a fire-resistant lining under the tiles, like Firefly or something similar to that?

Justin Leonard

Yeah, certainly. That's an excellent suggestion for a way forward and, I guess, it does really go straight to the point that a tiled roof needs quite a dramatic intervention to resolve the problem. And the problem is fundamentally because the tiles don't seal against each other, and the entire roof itself has almost a universal ember-access problem. The second part of that problem is that the battens that the tiles are sitting on, and secured to, are timber. And, in most cases, the trusses that those tile battens are screwed to, or nailed to, are timber also. And the sarking, if it's ever fitted, is usually fitted over the framing, the A-Framing, but under the tile battens, only because that is actually the only practical way a tile roofing contractor can navigate and walk over the roof without damaging the sarking.

So, given that that is sort of the combination of problems, using a Firefly sarking would be an excellent way forward, but it must be used in combination with metal tile battens. So, you put the Firefly sucking over the A-Frame, screw that down and secure it down with metal tile battens, and then put your tiles back on, and you can have a fairly bushfire-tolerant tile roof.

Chair

Can you describe that Firefly sarking?

Justin Leonard

It's a combination of foil coatings, and ceramic and glass fiber, but it's essentially a non-combustible fire resistant sarking type material, but the important aspect of it is that it's fire-resisting. So, if you ever want to determine whether your sarking is adequate or not, string it out, clamp it to a couple of saw horses, put a big pile of leaves in the middle of it, and burn that pile of leaves on the sarking. And if it doesn't burn through the sarking, then you've got the right stuff.

Chair

What’s the probability of embers or radiant heat affecting Dektites? - the rubber piping that surrounds a roof opening with a pipe coming through it. And is there any way to minimize the impact?

Justin Leonard

So, all Dektites aren't created equal, and you'll find that there's two types when you go into a hardware store. One is a high temperature one, which is actually designed to go around things like flues for wood heaters and gas heaters that perforate up through the roof, and they're typically a red silicon material. They're quite high-temperature performing, and can resist quite a bit of debris build up against them, and the burning out of that debris. The other types, which are a butyl-rubber-style material, which can also be red or black, so be careful. It will burn out readily when a small amount of debris builds up against it and burns in a bushfire.

Chair

And those Dektite different styles, are they marked or do you have to ask about their flammability?

Justin Leonard

The high temperature ones will be deliberately rated and marked, and will cost significantly more. So, there'll be a fair bit of enthusiastic advertising around them to try and convince you to pay the extra.

Chair

Blocking of a roof ridge capping caused by corrugated roofing. Can you confirm that you suggested a fiberglass-type batt to block the openings? This person had read, and I must admit I believed, that rockwool was recommended for those sorts of things. Because again, not all insulation is created equal.

Justin Leonard

Yeah, it's certainly true that rockwool and glass wool are two quite different batt materials, and that the rockwool, by name, means that it's actually made from a rock silica material which has a much higher melting point than glass wool. But in that application, under a roof ridgeline for ember attack, both will perform adequately because there simply isn't the heat locally to actually melt out the glass batt. So, it's easy to go with the more compliant, cheaper glass batt. If you were trying to prepare a roof for flame attack and direct-like flame-zone impingement, then the rockwool option would be a preferred upgrade.

Chair

Here's a person who'd like to confirm the desirability of replacing full-length fiberglass-reinforced skylight strips in a shed with their polycarbonate strips.

Justin Leonard

Yeah, most definitely a dramatic improvement because the fibreglass skylights can perform or burn quite aggressively from a very small gutter fire. Neither of them will offer you a complete barrier protection to those glazing units breaching when there's significant fuel load in the gutter. But, you're far better off with a polycarbonate alternative than the fiberglass.

Justin Leonard

I would say that roofs, and the weaknesses around roofs and roof access, is probably really the one to emphasize in that there is quite a high degree of loss implication around those roofs, and as a priority getting your roof sorted out is a really good approach, so good to see that one second. And, I guess, yeah, the broader issue, I guess, addressing gaps in structures is also a key approach. In a sense, the roofs are a real one I would keep coming back to in that if you happen to be in a house and trying to use it for survival, the last thing you want is it to fail via a roof failure. Because one of the main challenges is that the first thing you know about your roof actually failing is when the ceiling lining starts to fall in. And at that point, you have fractions of minutes to safely get out of that house.

Conversely, if you do have a vulnerable roof, you really need to think about ways of managing it actively during a fire, like having a really good water source near the manhole and a safe way of accessing and constantly scanning that roof cavity.

Chair

We've got a person here who's concerned that their petrol pump is the weak link in the event that they have to defend their house. Have you got any advice about using a generator instead to maintain power and enhance their water supply?

Justin Leonard

In a Black Saturday context, over 90% of the pumping systems for houses that were supplying water for active defense or spray systems failed during the peak of the event. And that was everything to do with ingestion of embers into the filter, fuel lock because the pump itself got too hot, embers and debris landing on the electrical systems and burning it out like everything possible, and/or simply the air was too hot that was ingested into the pump and the pump simply stopped functioning either temporarily and needed to be manually restarted.

So, the idea of putting your pump in a protected enclosure that not only provides ember but thermal-protection so it's a cool operating location for the pump, needs a fair bit of work. But one of the ideal solutions is you can put an electric pump out there in an enclosure and protect the electrical supply and whatnot. It can actually handle quite a lot of heat and doesn't need to breathe air through it to operate. Run your cables underground to a good safe location, like in an adequate spot where you can build an enclosure or run it in a shed or something like that, and have a generator run in that remote, more viable location rather than a location right out near your water source.

Chair

That scenario you painted there, I can add to that. What I had is a gravity-fed petrol pump from a dam. The pump functioned perfectly, but I wasn't aware that the poly pipe leading down to the pump was only 150mm under the ground, and when the tree roots caught fire, it put holes through the poly pump, and so the supply failed. And I learned a lesson there. Lost the house, learnt the lesson.

Justin Leonard

Yeah, a lot of people actually think that water-filled poly pipe will do okay because it's got water on the other side. But, in fact, it prolifically fails when it's exposed to direct flame.

And I guess the other angle to think about with pumps is a lot of them are supplied with enough fuel to operate for an hour, possibly two, and they’re often connected to a water supply that can last much much longer than that. And having that tank full in the first place is step one, but the prospects of refueling it while there's active embers in the air isn't very exciting, particularly if it's a petrol pump.

So, that's another tick for the remote generator with a fairly significant-sized tank. Or, it's in a relatively protected environment that you can safely refuel it.

Chair

What can you do to prevent ember build up, or prevent the adverse effect of ember build up, on timber window sills with single-glazed glass?

Justin Leonard

Protect them with a screen that actually fits flush with the outside of the entire frame, so the screen protects ember entry to the actual timber surface as well. The other one to consider is some novel painting products that provide some degree of combustion protection, spray systems that are dedicated to spraying on that window itself, shutters, are all reasonable options to pursue.

Chair

The screen sounds like a good idea as it does not rely on anything else other than the screen itself, which kind of appeals a bit.

Justin Leonard

And a few side benefits like the debris impact protection and a bit of radiant-heat protection from your plain glass windows, and a few other things.

Chair

Here's another question really about windows. How can we do our best in a do-it-yourself window protection at a more affordable price than roller shutters? If we don't consider heat flux the main vector of threat, will steel mesh be the best for protecting against branches and debris?

Justin Leonard

So, a steel-mesh system offers you quite good radiant-heat protection, and a good rule-of-thumb is that if you look at the mesh you're possibly going to use, it'll have a shade rating, which is the amount of light filtering it offers. So, let's say it's a 50% shade rating, that actually means that it halves the radiant heat or filters out 50% of the radiant heat that's trying to get through it to your window glass. So, it does provide a significant amount of protection. You can get higher-rated and lower-rated shade ratings than that. The critical thing though with installing mesh screens is that obviously the pore size has to be smaller than 2mm to offer some ember protection, but the framing that it's secured to needs to be metal as well, and the means that it's joined to that frame needs to be metal.

So, some of the really common cheap framing systems that have a push-in polymer bead to secure them just simply don't hold up in a bushfire, because that polymer bead melts out when any degree of radiant-heat’s applied to them. So, you need to move on to some type of crimping or some better secured screen system. And they're definitely around if you look hard enough, and you can get some sort of DIY frames and mesh systems.

Chair

Can the upslope be protected by landscaping and planting trees and shrubs that provide a potential slowing effect on the fire?

Justin Leonard

Yeah, most definitely. And not just a slowing effect, but actually a significant radiant-heat barrier between you and the active fire that's coming up the slope. Following the 10/30 and the 10/50 rule if you remove all the surface fire and have either a green lawn under tree canopy or low flammability plantings, the trees and the tree trunks will offer you radiant heat protection from that fire that's further back. And that's actually, in virtually all cases, much better than having complete clearance between you and that unmanaged bush that's at the 30m or the 50m mark. So strategic planning of low-flammability plants and hand established canopy trees are a really good asset to have between you and the fire.