

## Reduce your house and property risk

Chair: Malcolm Hackett OAM

Presenter: Dr Justin Leonard



### The Q&A process

Members of the audience submit questions during the Q&A sessions. The Moderator passes a selected question to the Chair who asks for a response from the presenter.

### Transcript of Q&A sessions

#### 1 Embers

**One of the things I'm particularly interested in, embers, because it was it was embers that got our house. And I think one of the things I wanted to ask you about is whether much is known about the way people think about embers, because I must admit I tended to think of embers as a single thing that might get in and start a fire. But in fact, the idea of embers that come like a sandstorm and they build up against things and so, in the end, you've got this red hot stuff that's actually what's going to ignite your window frame, or your mulch, or whatever it happens to be. Has there been much research on how people think about embers and what embers that are the most destructive?**

#### Justin Leonard

I guess the ember work and investigations is more like a disconnected technical deep dive into what embers can and can't do, but you do raise a very important question around the difference between human perception of embers and what's technically possible that embers can do, and how you work with them. And I think there's probably something in there to investigate people's diversity of attitudes and assumptions around ember attack.

In reality, ember attack is everything fine that's become airborne that's essentially combustible. So leaves, twigs that are either not burnt yet or are burning and flaming while they fly, or they're glowing while they fly. And they turn up and lodge in and get through gaps and build up in corners and crevices and are continually fanned by the wind, and just create prolific combustible debris build up and localized flame sources on everything external, particularly where there's a complex corner, like everywhere where leaves blow and accumulate in a normal windy day is where these embers and small flame sources build up.

And of course, what can an ember do and how small does it have to be before it's not a problem anymore, and the magic number is certainly down around 2mm. So an ember less than 2mm if it gets into something, let's say a rat's nest in your roof. A 2mm glowing ember is not quite enough to get a rat's nest going if it lands on something perfect as an ignitable source. Larger embers certainly are and the larger they are the more likely. And of course the larger the gaps the more large embers get through, and the more large embers get through the probability of ignition happening increases.

So it is a highly probability driven question. The only absolute certainty is there'll be embers there when there's a bushfire. It's just how many and how big the flame sources are and how many simultaneous things are happening all at once.

## 2 Ember entry and a tile roof

**Here's a question that feeds directly into what you were saying. This person has a terracotta roof with sarking underneath, and they see lots of light and possible ember entry points when they're up in the roof area, and they're interested in suggestions to minimize the risk of ember entry.**

**Justin Leonard**

So their intuition about recognizing that as a major ember egress problem is right, and that's seeing light streaming through into your roof space is one really clear and obvious thing. Roofs that are sarked or even quite completely sarked with conventional sarking that you can't see right through is also just as big a problem if they're under traditional terracotta tiles or traditional tiled roofs.

The problem with tiles are they're not tight fitting enough to prevent the embers from getting into your roof space. And what you'll notice with those tiled roofs is when you get up inside them, there'll be a certain amount of leaf debris or fine debris already building up over the years. And that's another indicator that the embers will come in through those same paths and ignite those things.

The debris sits on top of sarking as well, so it can be a problem that's hidden from view even if you get up into your roof space, and you only really find out how bad your problem is when you start to lift or repair your roof tiles and see how much debris is actually sitting on top of your sarking. And what you'll also notice is that the tile battens that your tiles are tied down to, or are sitting on, is actually over the top of your sarking, so you've actually got combustible timber battens on top of sarking.

The sarking isn't a flame barrier. So, it's actually a really major problem that to move from that to an ember proof scenario or a roof that isn't going to burn due to embers in a fire is a major retrofitting process involving a lot of roofing components.

## 3 Ember attack and tin roof

**I know from my experience with my neighbours that many who had corrugated iron roofs and sarking still found embers had managed to get in. Perhaps the tin distorts, the wind, or they were never particularly well sealed in the first place. But I presume tin roofs have their own challenges?**

**Justin Leonard**

Certainly do. So tin obviously doesn't have any issues within the roof sheet itself, or even with the roof sheets that overlap over multiple ribs the way they lay across. So that tends to stay quite settled and a well put together roof. That's too fine a gap and too much of a torturous path to get between the roof sheets.

But every roof sheet has an end, either at the ridge line of a house or at the gutter line of the edge of the roof, and that's where you have significant potential ember entry. And now fortunately for a steel roof, those areas can be readily addressed by putting ember screening systems either along the ridge capping and along the gutter line. That addresses that ember ingress process and it's more of a "leave your roof sheets in place but retrofit things to that roof" rather than have a really more significant dilemma of a tiled roof, where not only at the edges are a problem but between each tile is also an ember entry problem.

## 4 Skylights

**We've got a question here about bushfire proofing skylights. What do we know about that?**

**Justin Leonard**

Skylights come in every shape and size but, unfortunately, they create an inconsistency in the roof profile. So, any inconsistency or protrusion is a place for debris to build up on and prop against. So it's another potential place where localized flames can start to play on the adjacent sky lighting elements. And I guess skylights are made from a whole gamut of weird and wonderful things, from acrylic plastic to polycarbonate plastic to different types of glass and glass framing and whatnot. So, it's a little bit like looking at the diversity of windows and approaches with windows, that you can have many different design elements that's part of a skylight that then play out as potential issues if flames can attack it, radiation from an adjacent fire front. So we really have to put that on the table as a sensitive or vulnerable element to whatever the house is being dished up with.

## 5 Window protection

**And we've got a question here from someone who has a lot of windows facing north, not double glazed. What's the cheapest way they can do something to help reduce the risk of them breaking and letting in embers. They can spend more in the long term, but they want to know something that's quick and affordable and a way of doing something now. Perhaps window and door screening that's removable and storable, and they could bring it out on extreme days when they leave the area. What do you think about that?**

**Justin Leonard**

Yes, certainly, they're DIY homemade metal mesh screens, like flywire screens. A flywire screen, when you buy the flywire itself, it gives you a shading factor. So, a percentage shading factor might be 30%, might be 50%, well that's actually the percentage of radiant heat that will prevent reaching a window. So that already gives you some degree of protection, and in the event that the window still breaks, you've got an ember screen trying to prevent rapid ember ingress into the house itself, so it gives it that angle.

And, I guess, next level up from that is actually the DIY non-combustible robust shutter that gets clipped in place as well. Either way, it should be all metal in terms of framing the element that's held in with the framing, and the fixings that hold it to the windows. And, I guess, the question of "take them all out of the shed and put them on," that's quite a bit of work. Even better are the types that kind of fix to the house and they're kind of readily deployable, and out there invisible, but not necessarily suitable for all house designs.

## 6 Types of glass

**Staying on windows, how does double glazing and safety glass help or hinder fire protection?**

**Justin Leonard**

Really good questions. Interestingly, double glazing itself doesn't necessarily offer significant more protection than single glazing. It's actually the type of glass that has the most influence on the likely survival of that window to radiant heat. So, plain or normal float glass, the common plain glass, doesn't really stand up to more than around 12kW of radiant heat before it cracks, and can crack so prolifically it can fall out.

So if you think of a double-glazed window that's simply got two layers of plain glass, the first one will take most of the heat and crack and fall away, and if the radiant heat persists it simply then acts on the second sheet and it eventually cracks and falls away as well. So, a double-glazed unit

is a marginal improvement because it's a two-stage process. But, in reality, the most important thing is that you've got a more robust type of glass in place.

And the obvious and most common one is toughened glass, which survives to a much higher radiant heat. So we're talking about more like 40kW of radiant heat before it could crack. And it seems to do that because the edges are all ground nice and smooth and it's got a special treatment in it which is the reason why it's called toughened glass. So it breaks into small crumbs, and for some unusual reason the way they heat treat that glass gives it its special performance to the radiant heat from the fire.

There's some pretty other really cool glazing elements that do really well, and that is things like glass bricks and wired glass, are very high performing and even much higher performing than toughened glass and can be actually quite cheap depending on the application. And it's also worth, on that topic of glass, saying that laminated safety glass, the glass where it's two layers of plain glass with a plastic between it to make it a laminated safety glass isn't any significantly better than plain glass.

## **7 Window frame material**

**And how much do window frame materials matter?**

**Justin Leonard**

Obviously the frames, as you've mentioned before in your example, debris can build up on it and act on the frame and cause it to burn. The localized burning is another heat action on the glass, which can cause early failure. So it's much more important to move to a non-combustible framing material than a combustible one. And, if you're really looking for the ultimate performance, a non-combustible one with high temperature seals in that non-combustible framing gives you the ultimate protection. We've seen quite conventional aluminium windows with toughened glass in them, they can actually start to fail because the plastic beading between the aluminium and the toughened glass melts and allows the glass to drop. So there's certain window manufacturers actually offer a higher temperature seal to really make that a complete system.

## **8 Internal window blinds - up or down?**

**If caught at home on a high fire danger day, is it best to leave interior blinds up and, does that make a difference?**

**Justin Leonard**

It's very important to maintain complete awareness of what's happening outside. And that's to recognize when the fire's arrived, past its peak and moved on. Because that really helps set the context of whether, if the house starts to burn, that you've recognized that the fire front's passed and that at some point you might be able to move outside as the house becomes untenable. So that awareness is absolutely critical, so closing all the blinds and losing that awareness is definitely a negative.

There's not a lot of evidence in post bushfire loss scenarios to suggest that the blinds inside the windows actually contribute to a reduction in the likelihood of things igniting inside. In fact, things don't tend to ignite inside the windows prior to the window, say, breaking. So, it really doesn't seem to offer any additional protection. External blinds and processes are potentially different.

## 9 Cement sheeting on timber decks

**Is there any merit to pre-cutting cement sheets to fit on top of a timber deck to stop embers igniting when there's an extreme risk?**

**Justin Leonard**

That sounds like a really useful idea. The way the embers fall between the gap to boards on a traditionally designed timber deck and land on the bearers is a really common way that ignition happens. And the way the wind blows through the deck then propels those small flames to track and burn along the bearers and involve the deck significantly. It doesn't completely rule out the idea that the deck will burn down because you still get surface fires attacking the stumps and burning up under the deck, if the deck's close to the ground. And the embers can still blow underneath and lodge on those bearers, although it's less likely. But I guess the sheeting does offer some extended time frames that that deck might be navigable if you have to leave your house. But, I wouldn't say it'd completely rule out the deck being lost.

## 10 Nearby buildings and houses

**What were the key learnings from the Canberra Fires some years back – would regulations have made a significant difference to house loss due to the adjacent building fires and sheer size of house to house involvement.**

**Justin Leonard**

I think that that is in itself a significant learning. The houses that were impacted within Canberra were not regulated, and probably what's even more interesting is that after the fires took out significant houses in those neighbourhoods, they didn't actually invoke regulations in those areas. And to this day, house to house is not considered part of the building regulations nationally, and it seems to be a really bizarre oversight that falls somewhere between the building regulations, which don't acknowledge it, and the planning regulations, which say you can still build close to your neighbour's house.

So, it remains an unfortunate oversight by regulation that really falls to the individual to understand and develop that sense of mutual risk obligation that you have with your neighbour if you're, say, within 6-10m of your neighbour's structure.

## 11 Mulch

**Is there any such thing as a safe garden mulch except for small rocks and scoria, which this person's concerned about? It makes plant roots hot, in summer especially. And also then, how do you manage the leaf litter in rock mulch? If you're going to have wood chip mulch, how far away from the house should it be?**

**Justin Leonard**

I guess it's a two-fold consideration and the first thing to consider there is what house elements are immediately adjacent to the mulch bed. So, if we're talking about no windows and a double brick wall up against the mulch bed, well, you could probably tolerate tanbark mulch, noting that you actually have vents that might be low and flames could play up and travel through those vents. So, you really have to think about what can a house tolerate and what kind of fuel source am I putting.

The tanbark and wood chip mulches under the middle bushfire conditions, and that dry climate that the bushfires are most problematic in, mean that virtually the entire depth of your wood chip bed is available fuel and burns for a long time and provides a lot of heat to its adjacent elements. So that's the inherent problem. So, moving to fine leaf debris build up is a problem, but it burns out relatively quickly. And you can also consider that even a gravel bed will have new leaf debris blown

onto it during a fire, and that will ignite and burn on top of that scoria. So, you don't actually completely remove the potential for flames to act on the adjacent elements, so you really have to do a significant amount with the house itself. And, I guess, what you're doing in the garden bed is then considering how to keep that down to a reasonable level, and really separation is what's needed.

I don't have any magic materials and go-to's that are better, but I really encourage people it's a relative common sense thing. If it can't burn, you're not adding fuel to the problem. But there aren't any fire retarding treated magic wood chips that I can put in the mix here. So, no magic bullet. Apologies for that.

## **12 What can be done to an established garden**

**Someone who's moved into a new house where the garden is close to the house. What should they start on to make it more safe?**

**Justin Leonard**

I guess a garden up against the house isn't just surface mulch. It's also the near surface fuels and low shrubbery and whatever it's connected to. So it's a whole potential structure of fuels. So, I think considering each of those as a component, if they're lucky enough that the tall bushes and fuels are really low-flammability plants, then it's about working with what's under those plants so that it's limited. But, I guess, identify each element at a time and start changing it out. But I'd certainly think about it more of a bottom up approach rather than a top down. Like, look at what's in there and under it and don't necessarily just rip out the big tall obvious things, unless they're iconic bad behaving plants that show up in things like the CFA Plant Key, and identified through local knowledge as being problematic in fires.

## **13 Sealing the roof cavity Vs ventilation**

**This person has sealed the gap above the fascia and below the roof with a custom cut flashing with a corrugated profile which seats underneath the corrugated roofing and sealed with fire-resistant caulking. But now they're worried about the roof space not having adequate ventilation. Do roof spaces need to be ventilated? And if so, how do you balance roof space ventilation requirement with the need to seal for ember-proofing?**

**Justin Leonard**

Very much a significant issue and an issue that seems to be coming up as we move to tighter and tighter and more sealed and energy efficient houses. How does the moisture play out and where does it go? So, I'd say with any a good caveat in any aspect of making a building cavity more tight or screening over vents, you are actually masking or limiting airflow to some extent. And that's where getting building advice around either adding additional vents that are also screened, or putting alternative means to make sure that those cavities are aspirated, but in an ember proof way, is an important consideration. But, unfortunately, I'm a bushfire expert and not a comprehensive building expert so I would certainly defer to builders and local building expertise to try to anticipate those moisture build up questions and issues, if they're appropriate.

## **14 Poly carbonate roof**

**Do polycarbonate roofing products like SUNTUF guard adequately against bushfire embers?**

**Justin Leonard**

Yes, really interesting question. So, what we've found is the all polycarbonate materials, where they're used externally as a pergola, shade or an extension off the side of a house unenclosed,

when there's a local flame source acting on it, it can melt and drip away like honey from that flame source. But it doesn't burn in situ or carry a fire or an additional heat load to its adjacent elements, it just simply melts and falls out of the way. And the only times we've really seen it burn and act as a flame source is when it's formed quite a significant wet molten puddle on the ground and then continued to be heated by an external source until you finally get that puddle to burn.

So, it doesn't seem to be a particularly problematic thing but, certainly, the fact that it melts away from a heat source means that if it's used as a skylight in the house itself, or as a window glazing element, it's going to potentially melt or fall away from a relatively small heat source and therefore open up the house and not act as a barrier for embers to get into things. But, certainly, a good go-to material for external material that hangs off or has some external connection to the house.

## 15 Gutter Guard

**Last year, different speakers had different opinions about gutter guard. Are there any new recommendations about the best way to stop debris getting into gutters with gutter guard and how to seal the end of the roof edge? Particularly on a metal roof.**

**Justin Leonard**

So, obviously, absolute rule number one is make sure your gutter guard's not made out of anything that can burn itself, because the last thing we want to do is put more fuel on the gutter. The real way that it has to be sealed, obviously, has to form an intimate connection to the roof sheet itself, and then to the lip of the gutter. So you actually form a complete enclosure between the gutter, the fascia and the roof sheet. And the most appropriate ways to do that is using some form of metal fixing rather than a bonded polymer based approach, because as the debris lands on and acts on it, it could actually burn the polymer and cause it to disconnect.

Things like fine metal mesh with things like stainless steel, fine mesh, or gel fine mesh, at the higher performing temperature metals, is probably a preferred approach. But, also noting a bit like closing up all your cavities, putting fine mesh over your gutters in a high rainfall, high discharge area, you're actually also potentially disturbing the rate that the water can get through the mesh and fall into your gutters as well. So there's a whole lot of challenges and trade-offs, but, yes, I guess I'd encourage you to explore all the weird and wonderful ones but still apply the 2mm threshold ember test to it and it should all be tight fitting and robust to that 2mm tolerance if it's really going to become an ember barrier.

## 16 Ember proofing Vs being able to get under house

**Here's a person who said, "We're often faced with two or more priorities to be balanced. For example, do we protect our house from ember attack, in which case the house might not be able to be inspected for termite attack. How do we rationally balance which hazard to protect against?"**

**Justin Leonard**

No straight answer, except that I guess when you look at the ways to ember proof a house, there's, say, we're talking about ember proofing a subfloor, you can fully enclose your subfloor and then obviously get into that termite access challenge. Or you can line out the entire subfloor area, assuming that debris can get in there, but if it gets in there and burns, to some extent it can only act on a shield or a barrier. But that barrier again is an inspection question around it. So, I think you really just have to look at the whole gamut of questions and make those independent trade-offs and pick your path.

## **17 Metal sheeting for under stairs**

**Where can you buy and get the metal sheeting to use under stairs and decks? Any ideas?**

**Justin Leonard**

Use your local network and chat to as many people locally as you can. It's more a question of convenience and process, I can't really recommend any particular suppliers for a given one, but I hope the broader neighbourly network can offer an answer to that question.

## **18 Landscaping and/or a row of trees**

**Does landscaping or a row of trees acting as a windbreak provide some level of protection against ember attack? Or is it more likely to contribute to the bushfire threat?**

**Justin Leonard**

So, the question of contribution to a bushfire threat really comes down to the species and the nature of the bark on that particular type of tree. So, once again, you know, think about the actual vegetation type and if you don't have a deep knowledge of that, things like the CFA Plant Key are quite valuable in that respect. The wind breaks question about screening embers, yes, it can screen some embers and it might halve or cut the ember attack on your house by three quarters or something like that, but it won't eliminate ember attack. So, as we mentioned at the onset, ember attack is a probabilistic process and you might, you know, improve your odds that you don't have an ember ignition, there's no magic approach to put in a windbreak that eliminates ember attack.

What wind breaks and things do though, quite significantly, is they can limit your house's direct exposure to wind actions and debris impact, if things aren't flying off the wind break itself, and the wind break isn't too close to actually collapse and fall on your house. And the benefit of limiting the severity of the wind actions on your house is probably a far more significant benefit than those wind breaks offer to your house than the notion of screening embers, and I guess the other thing that trees and wind breaks like that offer is they help to shade and keep moisture in the landscape proximal to your house as well, which means that your gardens and things are the last to dry out in the landscape or dry it at a far later stage than if those wind breaks and protections and environmental protections weren't there.

## **19 Canvas**

**Does canvas suitable to provide some protection over windows?**

**Justin Leonard**

I've actually seen the really old school traditional roll-out canvas blinds that come out at a projected angle when they unroll. Reasonably resilient to ember attack, so they can get some spot burns in them but we don't really see them igniting and burning as a fire source on the windows. So, I would agree that those traditional canvas projected awnings, particularly the ones that either are vertical or at a quite a sharp incline angle, which actually helps to prevent the embers building up or lodging on them or any significant debris getting against them end up being quite a reasonable ember and debris shield, and offer quite significant radiant heat mitigation.

But, obviously there's some ultimate limit to where the canvas gets so hot because of the radiant heats on it that it will end up flashing and igniting. And then in that circumstance the canvas could offer some additional heat load to the window. But, it's a really a subjective question about all the benefit it's offered before it's actually flashed off and burnt, might in fact be more of a heat mitigation than the fairly rapid process of it burning in that ultimate exposure scenario.

## 20 Silicon for gaps

**If you're working with an older home, is it viable to use fire resistant silicon to address those small gaps and openings?**

**Justin Leonard**

Yes, silicon is quite a useful go-to material. Go for the higher temperature ones or the fire rated ones. They're better than the typical ones, although all silicon products are reasonably good. A useful thing for you to try is actually, when you get a dag of silicon hanging off your silicon gun and it's cured, you can actually light it and it actually burns. So it's not completely innocuous to burn, but what you'll actually find is when it's beaded into a crevice, the silicon doesn't burn into the crevice. It's not that flammable. And if it's beaded into a re-entrant corner as a corked bead, it doesn't tend to burn into that corner. So while it's being cooled by the surfaces it's bonded to, it can oxidize and burn a little bit on its surface but it actually acts like a barrier even when there's significant flame and radiant heat applied to it.

## 21 Rendered Blue Board

**Can you comment on the more recent use of rendered Blue Board in the urban fringe areas. What risks does that material pose?**

**Justin Leonard**

I think the Blue Board itself can distort under the higher heat loads, but the real question is what is it rendered with? And some of the acrylic renders are technically reasonably combustible and reasonably thick in their application. But some of the cementitious and masonry renders are obviously quite benign. So, I wouldn't say the Blue Board itself is highly problematic, but the renders and the way the board's terminated to ground level, and the way it's terminated to windows, and how the joints are overlapped or butted is where the potential weaknesses in that construction style can be. And, of course, it's all a question of how much actual heat load you get on it. If we're talking about flame contact from a fire front or very high radiant heat loads, up around 29 and 40, you would start to be concerned about the way that's detailed and the actual dimensional stability of the Blue Board.

## 22 Solar panels

**Here's some people that are thinking of putting solar panels on a Colorbond roof. What are your thoughts about that?**

**Justin Leonard**

Obviously the way it's fixed and the way the cables are routed into the roof cavity are potential details where you don't want to create gaps by the addition of the solar panels. The wide range of solar panels on the market don't really represent a significant problematic fuel load added to the roof. And there's not a lot of evidence to show that that the ignition of the little amounts of combustible material that is represented by the solar panels is enough to cause a problem to the adjacent Colorbond roof, so I would say it's a relatively neutral thing to consider and add to the process. It'd be interesting to look at the specific ways the tracking and fixings are put on and whether they are relatively sympathetic to letting the debris land but blow off, so they're not put on in a way that allows significant debris to build up on the roof.