

**Topic 11 Water Supply Tank types, trailer-mounted,
hydrants**

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Justin Leonard

Here we are in Webinar 2, and I'm looking forward to presenting on water tanks and pumps and spray systems as an augmentation to our protection systems. So, I guess the challenge with these types of systems is they're active. They're not passive systems like using the right types of materials that aren't affected by fire themselves. And in active systems, there's always the issue of, "will they operate?", "are they reliable?", "will they work under the conditions?"

So, let's move through both of those topics in this webinar. What we'll do is we'll start off with a bit of deep thought about where spray systems are appropriate, and what they aren't adequate at all for. And then in the second half of tonight's presentation, we'll move into how to actually make them reliable and design them so they'll actually hold up during the event itself.

Justin Leonard

So how do we build a reliable system? I guess there's three really key components to work with. We need water, and enough of it, we need that water to come out at sufficient pressure to be able to push it everywhere, and it needs to come out through a robust pipe network and spray heads. If we look at water, the particular amount and the way we store that water is absolutely key.

So, a large dam is obviously going to be a fantastic reliable water source.

A concrete or steel or underground tank is going to be a really reliable storage of water that can provide that water supply throughout. Noting that, I guess, once you get down to steel tanks your challenge is that the heat that would normally take out, say, a plastic water tank, is going to affect your steel tank particularly above the water line. So, if this is a drinking water tank, it'll actually have a coating on the inside of that steel that tries to maintain that high water quality for your drinking water tank. Any of that metal above the water line could damage the drinking-water plastic coating in that tank and render the tank useless for ongoing use for drinking water. But what it does do is that metal tank will hold water for the duration of your bushfire, and therefore be reliable.

Similarly, the very large metal tanks that actually have almost like a pool liner inside them, we've found that they're actually very reliable in a bushfire in holding the water for the duration of the fire, and making it useful for fire fighter defence. But the amount of that lining that sits above the water line is vulnerable to being heated under the more severe fires and can burn or melt, but it doesn't actually cause the liner to collapse inside the water tank. So, it actually does its job, but unfortunately there's possibly the price of a new liner and some upkeep for those tanks.

There's probably only one type of metal tank that's ultra-reliable and can handle quite a lot of heat, and that is a stainless-steel tank. So, it looks very similar to a normal corrugated Colorbond style tank, or a gal tank, but the stainless obviously doesn't need that plastic in a liner to maintain that water quality. So, quite expensive but an interesting option nonetheless.

And, of course, concrete tanks do really well above ground. And below ground, under really high heating conditions, you can get some spalling of those tanks, so a bit of the concrete can pop off on the outside. But, in almost all cases, that's a little bit superficial and cosmetic and the tanks are

great during the fire event and can perform really well as a drinking water and firefighter storage tank after one, two or many fires.

Chair

Are gravity feed tanks preferable over fuel type and electric generators and so on in case there's a power failure? And would gravity feed provide enough pressure for sprinklers?

Justin Leonard

That'd be pretty much the gold standard, if you had enough height to get your tank up above your sprinkler-head level. Then it's absolutely reliable, and if the tank's designed the right way, well, you've got water and attack pressure, and you don't have to rely on any means like a pump to give you the pressure. Now, how much pressure you actually need is a question about certain sprinkler-heads need certain pressures. But, you can do a little bit of maths with heights and pressures and you end up finding that a fire hydrant really needs to supply pressure at around 150kPa as an absolute minimum, and that equates to about 15m of pressure-head height. So, the tank needs to be 15 metres above your house to give you that equivalent level.

So, if you can get to that amount and be as good as a fire hydrant then you're doing really well. If you come down less than that height, like if you're down in the 10-15m range, you really have to be careful about the particular heads and how the whole system will work for that lower pressure.

And if you're lucky enough to be in an area like Marysville that actually has gravity-feed town water supply system, then you can start to think about having quite reliable water pressure. That being said, Marysville actually had a failure during the Black Saturday events from its gravity-fed water system, and that's because a car actually burned over a service manhole that was some critical valve in the system that shut the whole thing off. So, just like Malcolm's pine-tree root story for his main water supply, there's always potentially some weird and wonderful way you can take out an otherwise really reliable system.

And as I mentioned earlier ideally if you've got 15m of height between your tank and your house, that gets you well and truly there. If you're less than that then you're going to have to really think carefully about whether you can use the right types of low-pressure sprinkler heads and whatnot to get an adequate system. But when you're designing those systems, it's about the pressure that you get at the end of the pipe, not the pressure you've got ideally supplying the system. There's always loss in a pipe. So if you are working around those margins of having enough, just enough water head or pressure, you really need to really think about nice big pipes and having a low-loss system to work effectively.

Justin Leonard

Sheds and supports for water tanks are just as important in consideration. This is another tongue-in-cheek picture to see. 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.

Chair

Someone here wants to know how safe plastic tanks are, and how far around a plastic tank should be clear? In their case they've got short grass around their tanks.

Justin Leonard

Plastic tanks do fail quite prolifically in a fire. But the ones that do survive have nothing around them. And, I guess, short grass is about all they can handle. Dry, short grass. Anything at all beyond that, it could be a treated pine raised bed perimeter that forms the base that the plastic tank's been put on, it might be even just another plastic tank right next to it, with short dry grass under both of those, it could be one piece of wood leant against the tank. Anything at all is enough to feed off the tank and cause it to fail and let all its water out. And that can actually present quite a significant impact to an adjacent thing, like if it's a tank next to a house for example. So, yeah, the tanks can survive. But you have to be absolutely fastidious to not have anything around it at all.

Chair

Here's a question that I think a lot of people would want an understanding of: if someone has already installed plastic tanks for the house supply, is there any way that they can protect them from radiant heat?

Justin Leonard

What we've found is plastic tanks, and by plastic I assume it's polyethylene tanks, which are the dominant plastic tank type are fine if they are on their own, completely isolated out in an open paddock. So, they can handle a low-level grass fire and even a bit of debris blown up against them. They will suffer and burn a little bit but they won't lose their integrity or lose the contents of the water within them.

If you put two tanks next to each other, that's when you start to have problems, even in that open-paddock scenario. The debris that builds up between the two tanks will burn. The tanks start to burn, and then one burning tank will feed onto and off the other tank, and you'll get this chimney effect between the two tanks that will develop to a crescendo until both tanks have actually fully ruptured. And that rupturing process can be quite severe. We've seen tanks rupture, say, against a steel shed or a house and it's equivalent to driving a car into the side of the shed at about 50 K's an hour. So, it's like a really huge amount of brute force.

Tanks with any heavy fuel element around it that will start to burn even if that's treated pine boxing that you've used to form the platform to get a level surface to put the tank on is enough to take out the tank. So, to actually protect it, it's quite tricky. But whatever you do, you'd have to look at how to prevent debris building up against the base, or having any heavy fuel elements near it to burn in sympathy with the tank. Protecting it and flashing it off is usually counterproductive because the debris and leaf debris end up going between the covering and the tank itself.

Chair

I noticed someone did ask a question earlier on about you haven't mentioned fibreglass tanks. Do they have the same problem as plastic tanks?

Justin Leonard

They have the same problem. They're in fact significantly worse than plastic tanks, so I don't know if they're actually in production anymore. But, occasionally, you see a very old fibreglass tank which is like two moulded things coming together in a seam around the middle. They fail, quite absolutely with certainty, with a very mild exposure. So, even more vulnerable than the poly tanks.

Justin Leonard

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.

Chair

What's the minimum volume of water storage that's recommended to supply a sprinkler system for an average size, single-storey four-bedroom house? Assuming you've got fire pumps and sprinkler situation.

Justin Leonard

Yes it's really a "how long is a piece of string?" question, in that it's about what you need to target and protect. So, there isn't a typical system for a typical house, because a house should ideally have passive protection wherever possible, and the few things that aren't economical to passively protect by changing them to non-combustible materials, etc, you could use a spray system. And then I think you basically have to go through and look at the water requirements for all the things you need to protect.

If you attempted to say, "Look, I've got a combustible house, combustible fascia, and I'm not prepared to change it, I'm going to try and wet the whole thing down throughout a fire event," and it could be a typical single-storey house, I would say you would need upwards of 25,000 - 30,000 litres of water to protect that house throughout its entire event, if it was, I don't know, say, something like a BAL-19/BAL-29 type scenario.

Chair

That's a lot of water. And some fire events go for a long time as we discovered on Black Saturday. You can have used all your water up before the fire even comes if you're trying to wet things down.

Justin Leonard

Yes, and that's actually why the volumes are so great. You might spend 5,000 to 9,000 litres of that to get through the peak of the fire, but there's hours and hours of persistent deluge of embers that will keep coming. And under those conditions, things dry out quite quickly, and you need to keep wetting and keep defending.

Chair

Let's have a look at how our first poll response about tanks measured up with your information. What do you reckon?

Justin Leonard

I reckon they knew a fair bit about what I was going to say. I guess the steel with plastic liners ranked fairly low, and I guess it's probably not common knowledge that the steel with plastic liner tanks actually do really well in a bushfire, where people have seemed to have given that a fairly

low score. So, it's definitely going to carry the water through the fire. You're going to have it all available. But yeah, you're up for a new liner under the worst conditions.

So, I would definitely recommend those types of tanks as an option, particularly because they also are the typical ways to get a really large volume for a reasonable price, those really large segmented tanks. And, I guess, below ground of any type, provided sufficiently below ground, is a good way to go as well.

Chair

I have seen double-skin steel tanks that have an air pocket between two lots of steel with the liner on the inside. Have you got any information about how effective they are?

Justin Leonard

No, I'm not aware of that, but anything with a double skin is going to have a huge effect on mitigating the heat to the inner skin. So, that sounds like a really good approach. I'm not sure what's the specific approach to going to a double skin design. Is that to keep you the water cooler.

Chair

I think they're specifically for bushfires, the one I've seen. I think I saw it at a field day and it looked pretty clever. Had a premium price, but it was probably still a lot, as you say, a lot cheaper than concrete because you could you could go up to those large volumes.

Chair

The 50mm outlets on most water tanks, are they actually big enough to do the job?

Justin Leonard

Once again it comes down to the design of your whole system and what you're trying to do with your system. If you're talking about some of the biggest systems where you're trying to wet down an entire house, I would say you're nowhere near the mark with a 50mm outlet. You might need multiple ones of those. Yeah, it really comes down to overall design and sizing. And that's over to the recommended calculators.

Chair

Have you got any views on these trailer-mounted fire tanks. Say, a 1,000litre with a petrol engine coupled to a fire hose – fire fighting trailers?

Justin Leonard

Yes, they were amongst the many that failed during the peak of the exposures in Black Saturday. The petrol pumps aren't typically enclosed on those trailers. A lot of those were backed up to dams and were used as "set-and-forget, hopefully we'll still get pressure out of it," type approaches. I would treat them more like the hoses. You've got to actually bring them inside and protect them, say, in your shed and bring them out and use that in the aftermath of the peak of the fire. And it would be quite a useful portable water resource in that post-fire event, but don't expect it to survive outside, especially if it's trying to be operated throughout the peak of the fire event outside.

Chair

If our water supply taps off a fire hydrant line, how reliable will our water supply be if there's fire in our area and the fire brigade is in attendance locally?

Justin Leonard

I'm fairly unreliable because the firefighters have an upper hand in that regard. They've got a pump on their truck where they can actually suck water out of the hydrant system. So, when they connect up they will want to fill their trucks as quickly as possible and they'll actually pump out of the hydrant. And unfortunately that leaves all the other hydrant outlets with little to no water.

So, you can also assume that at some point that hydrant system is connected to the mains system somewhere and that's connected to a pumping station that may or may not fail in its power supply. So, invariable we lose mains pressure, the hydrant systems aren't adequate and we certainly don't have any power. So, we really have to think about our spray systems and the reliability of water supply. It comes back to tanks, dams, gravity feed on property and reliable pumping systems.