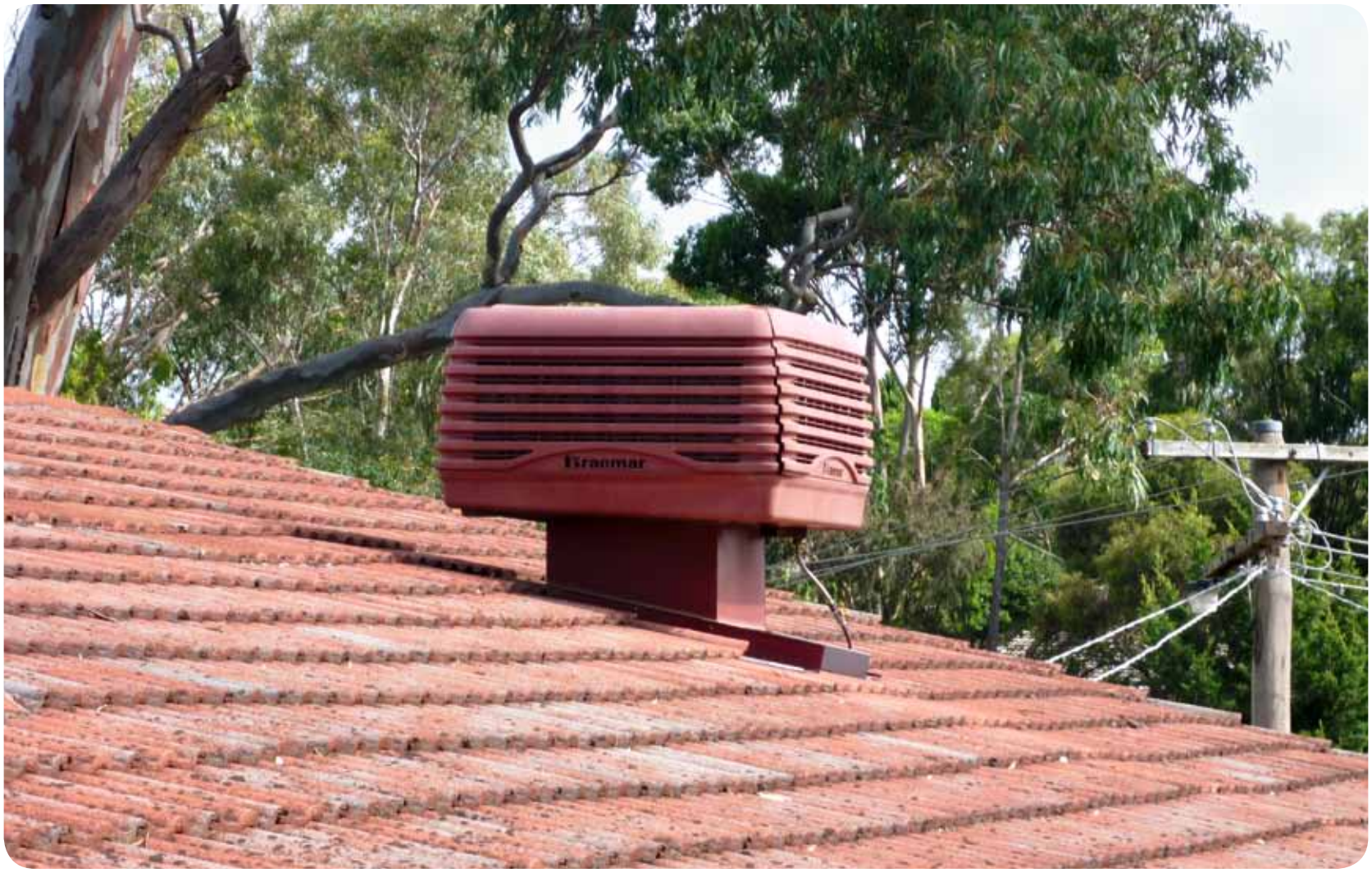
Fire and rain put focus on evaporative

Long regarded as a cheap, efficient cooling solution for residential and commercial applications, the humble evaporative cooler has come under much scrutiny in the past year. Among other things, it's the subject of a new best practice guide for its installation and commissioning, as Sean McGowan reports.



Evaporative coolers, or swampies as they are commonly known, have become common fixtures on the roofs of thousands of Australian homes since the 1960s, and for good reason.

They're cheap to run (energy-wise), have a lower capital cost than their refrigerated counterparts and provide quiet, effective cooling in many highly populated areas of Australia. For years, they've been an option for home cooling even when environmental and energy concerns weren't necessarily a factor for homeowners.

Such has been their popularity that sales of residential evaporative coolers have increased over time to reach an estimated 60,000 installed units per annum in Australia.

So why have they come under intense scrutiny over the past year or so?

Evaporative and bushfires

It's almost inconceivable that evaporative coolers, which by their very nature require continuous "wetting" of their pads to operate, have been cited as the cause of home fires during major bushfire events. But according to Western Australia's Fire and Emergency Services Authority (FESA), it's most certainly the case.

In February, the Perth suburbs of Roleystone and Kelmscott suffered over 70 home losses as a result of severe bushfires that for days ravaged the Perth Hills and threatened homes.

Media reports at the time quoted FESA as estimating that about 50 per cent of the homes lost were as a direct result of embers igniting the dry pads of evaporative coolers during ember attack.

Whether the units were operating at the time is unknown, but it would appear unlikely.

In a statement to HVAC&R Nation, FESA said it's a problem that has been known about for some time.

"Since the late 90s FESA identified an increase in the number of homes destroyed after components within evaporative air conditioning units caught on fire," FESA says. "As a result FESA conducted broad consultation with industry and also produced an information sheet for the public which is available on the FESA website.

"Evaporative air conditioning advice forms part of FESA's annual bushfire campaign, which educates the community about how to prepare, act and survive a bushfire. It is also one of the key messages distributed to the public during a bushfire."

FESA says it has consulted with evaporative air conditioning manufacturers, retailers and suppliers of filter pad material advising of the probability of ember attack during a bushfire and provided safety recommendations.

Although such consultation has led to improvements in product design, such improvements don't address the thousands of units already installed.

The agency therefore recommends residents in bushfire-prone areas install ember protection screens to their evaporative air conditioning units. The screens should be constructed of corrosion resistant steel, bronze or aluminium and should have a mesh maximum aperture of two millimetres.

This follows testing commissioned by FESA and completed by the University of Western Australia. The testing studied the effect of a screen on the functionality of a unit and the effectiveness of a screen in preventing filter pad ignition.

The study concluded that an ember screen did not significantly affect the performance of the cooler and that the screen protected the unit from igniting.

FESA also recommends that when caught in a bushfire residents who have an evaporative cooler installed should initially run the unit to wet the pads but be sure to switch the unit off when smoke is over their home or ash starts to fall.

"If a home has an evaporative air conditioner on, the system may draw smoke and embers into the unit, or embers may land on the unit's filter pads and possibly start a fire," warns FESA.

If the unit is able to run water on the pads with the fan turned off, it is suggested residents do so. If this is not possible, or a power failure is experienced, FESA recommends residents use a garden hose to wet the pads (taking the appropriate precautions in regards to appropriate clothing and personal safety).

Those under bushfire threat should then continue to monitor the evaporative cooler and the area around the home for spot fires from embers until the danger has passed.

"If a fire starts in an evaporative air conditioner it can spread quickly and be very hard for firefighters to extinguish," FESA says. "When an evaporative air conditioner catches fire it will frequently burn into the ceiling and fall into the building. As a consequence it may ignite the building and cause significant damage if not total loss."

Bushfire Attack Levels (BAL)

As a consequence of the Black Saturday Victorian bushfires of February 2009, which saw 173 lives lost and over 2,200 homes destroyed, the Building Code of Australia was amended soon after to include the new BAL Australian Standard 3959-2009, requiring new and replacement homes to be designed, constructed and located with improved bushfire protection. BAL refers to "Bushfire Attack Level".

If you plan to build a home in a bushfire-prone area, the work now needs to take into account this standard, which includes requirements for evaporative cooling systems.

Evaporative coolers are referred to in this standard under a number of Bushfire Attack Levels, including 12.5, 19 and 29.

Here, the standard prescribes that "evaporative cooling units shall be fitted with butterfly closers at or near the ceiling level or, the unit shall be fitted with non-combustible covers with a mesh or perforated sheet with a maximum aperture of 2mm, made of corrosion-resistant steel, bronze or aluminium."

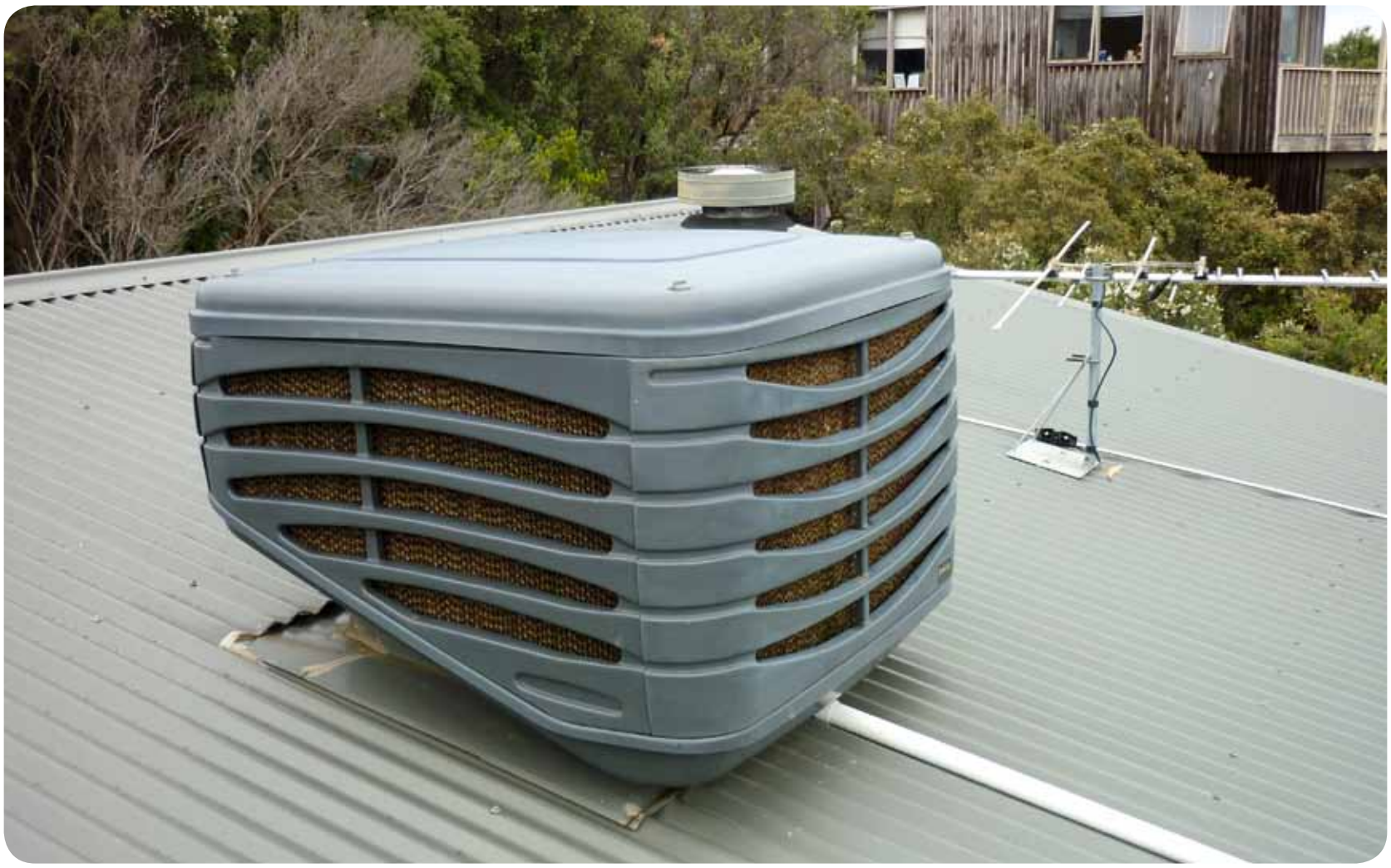
This builds on the recommendations FESA has been making and has resulted in manufacturers designing units that are BAL compliant.

Charles Benevento, national sales and marketing manager for Brivis, says his company manufactures BAL 29-compliant units that feature sturdy metal construction with full stainless steel ember protection over the unit's pads.

He says licensed installation contractors undertake the design and installation of evaporative cooling systems, and it is incumbent upon them to comply as required.

This is a message supported by AIRAH chief executive officer Phil Wilkinson, M.AIRAH, who has first-hand experience being a homeowner in a bushfire-prone area.

He says installers need to be aware of the BCA amendments regarding evaporative coolers, and urges both homeowners and installers with existing systems installed to take action to avoid unnecessary risk.



"I would urge all installers with clients in bushfire-prone areas to get in touch with owners to advise them of the risks and solutions," Wilkinson says.

"Local councils should also have a large part to play in communicating to residents, as should authorities such as the Country Fire Authority and their equivalent in other states."

To this end, Wilkinson hopes other states will follow Western Australia's lead with a high-profile PR campaign to include the involvement of local councils, fire authorities, water retailers and AIRAH to warn homeowners before the risk of bushfire returns.

Best practices to reduce water consumption

Although evaporative coolers are well known for being low energy users, many assumptions have been made in the past regarding the amount of water they consume. While estimates have suggested water use to be as little as 10 to 30 litres per hour, anecdotal evidence has suggested the figure could be significantly higher.

Following the completion of a project about water conservation in commercial cooling towers, the Victorian Department of Sustainability and Environment asked AIRAH what the Institute knew about water use in evaporative coolers.

"Our answer was simple – we knew very little," says Wilkinson.

Around the same time, Coliban Water, the water authority that supplies potable water across north-central Victoria, discovered that on hot, water-ban days, water usage was higher than expected in a regional town in Victoria.

After some investigation, it was determined these water-use spikes were due to the operation of evaporative coolers.

AIRAH was therefore engaged by DSE to begin looking into the issue, and funded a stakeholder workshop where manufacturers, installers, maintainers and a water chemist met to provide recommendations to improve water use in existing residential and non-residential evaporative coolers.

"We felt it was important to investigate the issue because there has been very little guidance available to the industry," says Wilkinson. "We also know that if evaporative coolers are not installed, commissioned and maintained properly, they can be the cause of significant water waste, along with becoming a health concern due to microbial growth."

Water use revealed

In preparing its initial report, AIRAH's research indicated that approximately 550,000 residential evaporative coolers have been installed in Victoria alone, with an estimated overall water consumption associated with their use to be about 15GL annually.

Estimates also suggest water excess (waste) is in the realm of 20 per cent, or 3GL/yr.

These losses were generally attributed to controlled losses due to improperly commissioned water-management settings; poor levels of maintenance and service; and inappropriate operation by consumers, many of whom had bought mass-builder-built homes and had not been given instruction for the appropriate use of evaporative coolers.

"The main area of focus to reduce water waste is the recommissioning of the water management systems of the installed stock of evaporative coolers," says the report.

"Consideration should be given to upgrading water management controls, particularly in commercial units where water waste is considered to be high."

Based on the workshop and initial report, it was recommended that readily accessible consumer guidance needed to be developed to help homeowners select, operate and maintain their units. Improved service and maintenance of both residential and commercial units was required.

Furthermore, it was felt that to quantify the levels of water waste, a research project should be undertaken to measure water chemistry in evaporative coolers while they are operating.

After seeking further funding from DSE and the Smart Water Fund, AIRAH conducted a pilot study. This included on-site visits to 50 residential and 50 non-residential evaporative coolers across metropolitan and regional areas. The visits looked at each unit's water consumption to determine if water was being wasted.

The research concluded that evaporation rates for modern residential evaporative coolers can be up to 60 to100 litres per hour (L/hr). Non-evaporative purge (bleed and/or dump) rates vary between 5 and 30L/hr depending on salinity control, water management equipment and the factory/installer settings of the system.

The average purge consumption rate encountered was approximately 20 L/hr; amounting to approximately 25 per cent that of evaporation rates.

"In most cases, it was found that bleed or dump rates were set at levels much higher than those required to maintain maximum TDS levels of 2750ppm and that water savings of up to 2.5GL/yr could be achieved if these processes were optimised," says the report.

The report concluded that by operating evaporative units without bleed, but rather dumping the full system once per 24 hours of operation during summer months, non-evaporative savings of around 95 per cent could be made.

This saving (2.5GL/yr) would represent 17 per cent of estimated overall water consumption associated with evaporative coolers in Victoria.

"Residential units tend to be more sophisticated than non-residential ones, with extra and easy-to-adjust settings to help improve water efficiency, driven by consumers looking to save long-term on costs and water use," explains Wilkinson.

"We found that most residential systems bled or dumped on average 20 litres of water an hour, which is a significant amount and an obvious area for improvement. However, we found that a dump system – the process where excess water is discarded in one go – uses less water than a bleed system that releases small amounts over time."

The report found that most residential units, regardless of the water management equipment in place, are fitted with programmable dump valves that would allow operation without bleed, with one system volume dump every 24 hours of total operation. Yet the report found such savings would only be achievable through a program of servicing and maintenance where settings could be changed.

Furthermore, while modern systems could be set up to operate this way, old systems would likely need to be retro-commissioned or replaced altogether to achieve the savings.

In the non-residential sector, a survey of 51 systems found that many operate inefficiently and that there is potential to save 1.8GL of water annually if all non-residential evaporative coolers in Victoria were operated according to best practice.

The results of the study have been used to formulate two end-user guides – one for the residential user and another for non-residential users. A technical DA manual is also being developed for the industry, which Wilkinson suspects is a world-first.

"Unfortunately a lot of people install equipment and forget about it," says Wilkinson.

"Installers may not pass on the knowledge to the homeowner that is needed for correct operation, or in the case of brand new homes built by developers, the units are installed before the home is occupied for example.

"The main thing to consider, which has come out of this work, is that by altering factory settings, more water-efficient operation can be safely achieved."

According to Benevento, it was important as a major manufacturer to be involved in the development of the guides.

"Any accurate guide that promotes best practice in the design, supply, installation and maintenance of mechanical services such as evaporative coolers can only be of benefit to the industry as a whole," he says.

AIRAH expects to publish and begin promoting the Best Practice Guides and DA manual in the next few months, while funding from the Plumbing Industry Commission is being used to develop training for plumbers around the retro-fitting and retro-commissioning of evaporative coolers for water efficiency. ■