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FEATURE

Out of the frying pan

Commercial kitchen fires are an all too common occurrence in Australia. In 2014 alone, just five restaurant fires caused $30 million of damage – among them St Kilda's iconic Stokehouse. Sean McGowan reports on the release of a new AIRAH technical bulletin that highlights the fire risks inherent in commercial kitchen ventilation systems.

Given the presence of ignition sources and high fuel loads, it's not surprising to learn that kitchens have been identified as the source of 25 per cent of all structural fires, and up to 50 per cent of all structural fires in commercial buildings.

Such statistics make kitchens the No.1 source of building fires in Australia.

Unattended cooking is often to blame, and these fires typically occur directly below the kitchen exhaust hood. Thankfully, many incidents go unreported; they are quickly contained by portable fire extinguishers and fire blankets.

But it is when the fire extends into the mechanical exhaust system that human safety is compromised and considerable building damage can occur.

In light of recent updates to relevant Australian Standards, as well as changes to maintenance requirements within the National Construction Code (NCC), AIRAH has developed a fire safety technical bulletin covering kitchen exhaust ventilation. This has been done in partnership with key industry stakeholders.

Available free online, *Fire safety – Kitchen hood exhaust systems* is a valuable resource for everyone from technical service providers and facilities managers to operators of commercial kitchens, building surveyors, body corporates, local councils, property assessors and insurance companies.

One of the prominent messages in the bulletin is a call for greater compliance in system design, installation and maintenance.

"AIRAH believes kitchen exhaust ventilation systems and their impact on fire safety can be improved markedly within the community," says AIRAH's executive manager – government relations and technical services, Phil Wilkinson, F.AIRAH.

"Systems must be designed and installed in accordance with the established rules and regulations. Compliance is a huge area of strategic focus for AIRAH now and into the future, and this technical bulletin is all about compliance."

IN THE EXHAUST

Kitchen exhaust fires can spread in a number of ways.

A fire that originates within a kitchen or at the hood filters can spread rapidly into and up the ductwork system, fuelled by the oil and grease accumulated within the duct.

Once in the ductwork, high-intensity fires can be hard to locate and difficult to extinguish. Additionally they can ignite combustible materials outside of the duct via radiant heat transmission, or ignite grease that has leaked out of duct seams.

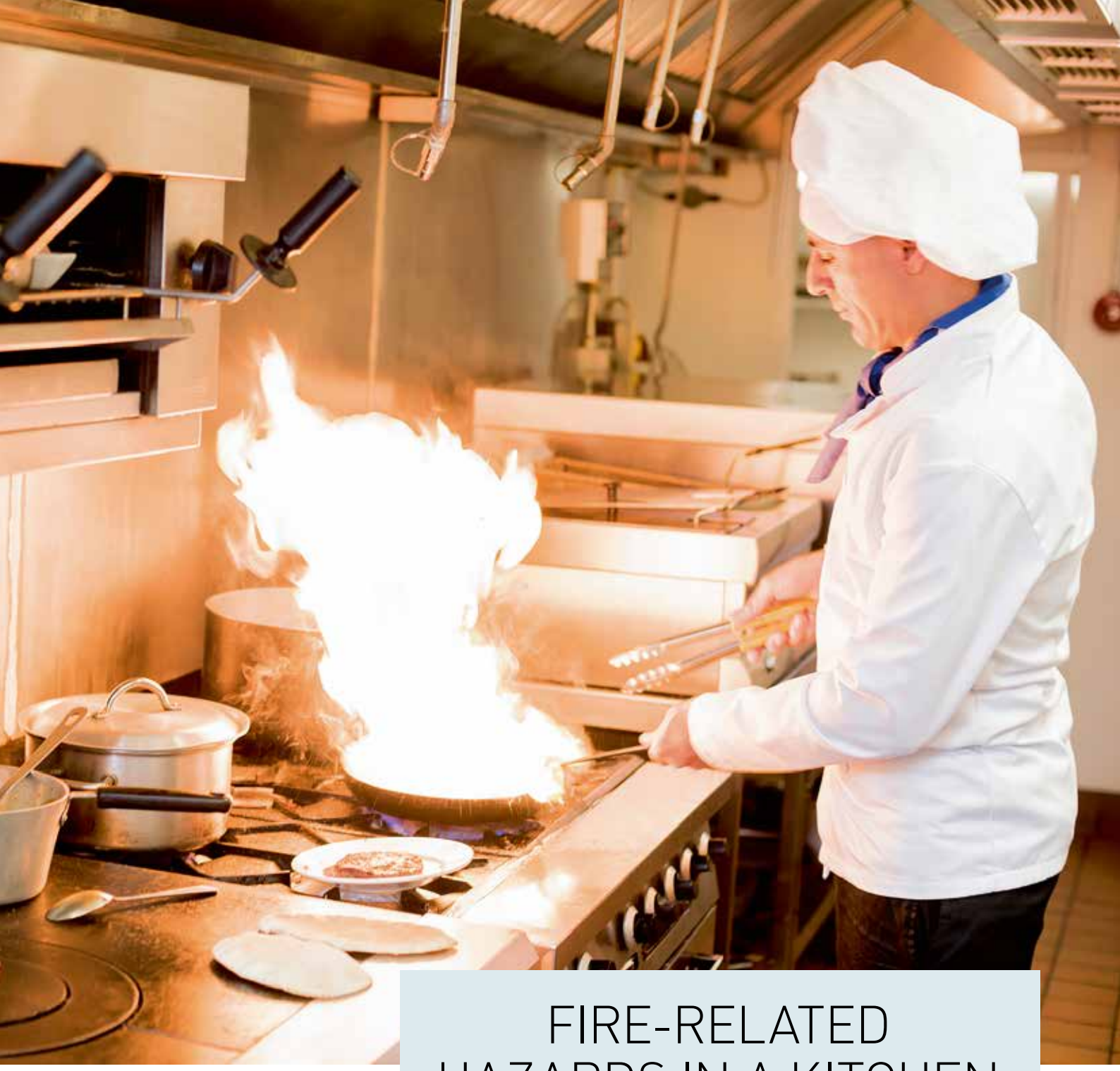
Within moments, such a fire is no longer contained within a kitchen exhaust system, and spreads throughout a building.

Kitchens are the No.1 source of building fires in Australia.

And because fire dampers are not permitted within kitchen exhaust ductwork, fire within and between ducts can compromise a building's passive fire protection such as fire-rated compartments.

Fire dampers, which are usually installed in ventilation ducts to prevent a fire from spreading, do not work in kitchen exhaust systems. Grease on the downstream side of the damper will ignite before – and irrespective of – damper closure.

The potential for false operation of the fire damper is also greater than normal. This closure – other than in the event of a fire – can have serious consequences for kitchen ventilation.



THE THREE ELEMENTS

All fire risk analysis should boil down to three key elements that are required for fire to occur: fuel, oxygen and ignition.

"Without heat the fire can't begin, without fuel the fire can't grow, and without air the fire can't spread," says the bulletin.

For fire prevention to be effective, at least one of these elements must be disrupted, and within a commercial kitchen hood exhaust system all are highly preventable.

While flare-ups are the dominant source of ignition in kitchen fires, fires can also ignite from sparks, soot from wood

FIRE-RELATED HAZARDS IN A KITCHEN

- Flames, sparks and hot gases from food preparation can ignite residues in exhaust ducts
- Food preparation equipment left without supervision during operation
- Failure to switch off equipment, especially at the end of activity
- Overheated oils that can lead to spontaneous combustion
- Food preparation equipment based on solid fuels
- Gas blowtorches used for browning some foods
- Poorly operating thermostats or lack of thermostat or fault-detecting equipment
- Faulty or overheating electrical equipment
- Metal exhaust flues that conduct heat and ignite nearby materials or debris
- Ovens without igniters/pilot lights (lit with burning pieces of paper)

or charcoal burners, and even the heat generated from some types of cooking appliances.

With a source of ignition present, accumulated grease within the exhaust system provides the fuel for a kitchen fire to spread.

Derived from cooking, the grease enters the system with the ventilation of air. High air velocities will entrain and entrap cooking contaminants, and while filters will capture some of the grease, no filter captures 100 per cent of it.

Any grease that passes through or around the filters will build up on the internal hood, duct and fan surfaces. Accumulated grease may also leak out of the ductwork through poorly sealed seams and joins, or pool in some areas to create a reservoir of highly flammable fluids and vapours ripe for ignition.

The use of solid fuels in the kitchen (such as charcoal) can create volatile gases from incomplete combustion. These can condense in the exhaust duct and mix with water vapour to form a highly combustible, tar-like creosote substance that sticks to the duct.

Once these combustible fuels ignite within the duct, the air movement created by the kitchen exhaust system can easily support a large fire. In such instances, the duct often acts as a chimney, channelling smoke and air to ventilate the fire.

If this occurs in the reverse direction, large amounts of hot toxic smoke can enter the kitchen area and building via the hoods.

These inherent dangers are why the NCC requires commercial kitchens to be fitted with kitchen exhaust hoods that comply with AS/NZS 1668.1-2015 and AS 1668.2-2012. Both standards have been recently updated.

The NCC and AS 1668.2 determines where kitchen exhaust hood systems are required, the minimum ventilation rates, the construction details in terms of functionality and hygiene, and importantly, the minimum distances between the grease-removal device and the heat source.

The NCC and AS/NZS 1668.1 specify the design and installation precautions that need to be adhered to, to mitigate the results of any fire that occurs within the exhaust system.

Fire safety – Kitchen hood exhaust systems provides a detailed summary of these requirements. This includes

DUCT FIRES

Duct fires can be intense and reach temperatures of 1,000°C within minutes – a temperature hot enough to melt some metals and ignite surrounding combustibles.

the correct spacing between ducts and combustible materials, and the use of flame barriers and fire protection systems.

It also covers the requirements for grease filters under AS 1668.2, and ductwork requirements under AS/NZS 1668.1.

The latter standard also requires that all ducts must be vertical, where practicable.

According to AS/NZS 1668.1: "Ducts that are not vertical must be graded upwards – at least 1:200 – in the direction of the airflow, allowing grease and moisture to drain back towards the hood."

INSPECTION AND MAINTENANCE

As well as addressing the design and installation of new systems, the Fire safety – kitchen hood exhaust systems technical bulletin covers some of the common problems encountered in existing systems.

GREASE IS THE WORD

Where horizontal exhaust ducts are incorrectly sealed, grease can leak through the seams and soak the false ceiling, bulkhead and roofing materials – increasing the fire hazard.

A grease-soaked ceiling space contributed to the deaths of two attending fire fighters in a commercial kitchen fire in the USA in 2007. Grease in the ceiling space burned undetected for an hour prior to flashing over violently and causing a ceiling to collapse on the fire fighters below.

These include the grease-removal device being too close to the heat source, poor maintenance and/or access, split maintenance responsibilities, ducts being too close to inappropriate materials, multiple ducts from multiple compartments, wood-fired ovens and charcoal burners, and incorrect installation.

All are important elements to kitchen exhaust fire prevention and should be addressed. Yet it is the continuing inspection and maintenance of these systems that ensures they remain both clean and safe.

Most Australian states have legislation requiring building owners to maintain fire safety systems and submit a performance assessment to the relevant authorities each year. And in some states, kitchen hood exhaust systems and associated ductwork are considered to be fire safety systems.

Consequently, owners and operators have a duty to keep systems clean and safe under work health and safety (WHS) regulations, as well as under the food safety standards for commercial kitchens.

AS 1851-2012 outlines a series of minimum inspections, maintenance and record-keeping activities for the fire and smoke control features of air handling systems. These include protocols for kitchen exhaust systems.

Manufacturers of some kitchen exhaust systems also provide their own inspection and cleaning programs. In some cases, these are even more stringent or frequent than those outlined in AS 1851. In the event of a fire, failure to comply with these may be deemed as negligent or a failure of duty.

State regulatory authorities, local councils, insurance companies, building owners, facilities managers and landlords either do, or should, impose maintenance responsibilities on the owners and operators of kitchen exhaust systems.

Regular maintenance as outlined in AS 1851 should allow inspection of all hoods, ductwork, fans, connections and discharge cowls or grilles. It is important to note that the standard does not make provisions for partial system inspection or for cleaning only those system components easily and readily accessible.

Under AS 1851, scheduled maintenance routines should be completed both monthly and annually.

Monthly routines should include checks on grease-arresting filters for excessive grease accumulation – including cleaning where required – damage and secure fitting.

Grease gutters should also be checked monthly, as well as the internal surfaces of the exhaust plenum behind the filters for excessive grease accumulation. If accumulated grease is excessive, it could be a sign that air is bypassing around the filters and this should be checked and remedied.

Grease filters are the first defence against the spread of grease, so depending on the type of cooking and usage may require more frequent cleaning – even weekly or daily in some instances.

Annual maintenance routines should include the cleaning described here. It should also include checks for excessive air leaks at the filters – with replacement where necessary – and a check and clean of the entire exhaust duct where grease has accumulated.

VERTICAL DUCTS ARE SAFER DUCTS

Ducts should be vertical and take a direct route (or as short as possible) to the outside.

Horizontal duct runs should be minimised on all systems as there is a high risk of grease build-up and grease leakage in these sections. They also have the potential to reverse the flow of smoke into the kitchen during a fire event.

Fire protection or suppression systems installed within kitchen exhaust systems may have special requirements, including additional mandatory maintenance requiring properly trained and qualified personnel.

TOWARDS BEST PRACTICE

AS 1851 outlines an agreed inspect/repair/report scheduled maintenance protocol that can be applied to commercial kitchen exhaust systems generally. However, it is best practice to tailor the maintenance procedures to better reflect both a kitchen's cooking processes and actual usage levels.

To this end, best-practice inspection and cleaning means exceeding the AS 1851 minimum requirements.

The *Fire safety – Kitchen hood exhaust systems* technical bulletin recommends three-monthly inspections for heavy use (12 to 16 hours per day), six-monthly inspections for moderate use (six to 12 hours per day) and for light use (two to six hours per day) yearly inspections may be appropriate.

To determine when the build-up of grease has reached unsafe levels, it is recommended that a depth gauge or grease comb is used.

"Readings of up to 0.05mm depth are regarded as a clean surface and readings of up to 2mm depth are acceptable," the guide says. "However, once over 2mm, surfaces should be scheduled for cleaning, and any readings over 3mm indicate that immediate cleaning is required."

Several methods can be used for cleaning, depending on the system. These include wet, dry, manual or robotic cleaning.

Manual scraping and manual washing by hand are the most common methods in Australia. Wet washing – using steam or hot water and detergent – is faster and used widely in the US, but hardly used here due to the poor sealing of ducts. Whatever the method, the system should always be shut down before cleaning commences, and the application of water and chemicals carefully controlled.

Best practice might also include adhering to international standards for cleaning commercial kitchen exhaust systems, such as the US standard ANSI/IKECA C10 and/or the UK Guide HVCA TR19 Section 7.

DO YOUR PART

The single most important thing anyone can do to keep their kitchen exhaust system safe is to comply with the relevant standards and conduct regular inspections and cleaning.

According to the technical bulletin's editor Vince Aherne, M.AIRAH, the continuing prevalence of commercial kitchen fires are evidence enough that the industry has scope for improvement.

"We believe that AIRAH's fire safety technical bulletin will go some way to improving industry performance in this area," says Aherne, "and – hopefully – reduce the frequency of serious fires in buildings." ▮

Need to know

To download the *Fire safety – Kitchen hood exhaust systems* technical bulletin, go to www.airah.org.au/technicalresources