

FIRE AUSTRALIA

**Energy storage:
fire safety design
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**Etched in history:
2020 National
Memorial Service**

**The science
behind burning
the bush**

Risky behaviour

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A RENEWED COMMITMENT TO RESEARCH

DR RICHARD THORNTON

CEO, Bushfire and Natural Hazards CRC



With a little over six months to go of the Bushfire and Natural Hazards CRC's eight-year research program, right across the centre we continue to be focused on working closely with our researchers and end users to ensure that research outcomes are being used effectively in the real world. This critical work will continue, but fantastic news came in July 2020 with the announcement from the Australian Government that it will support further research into natural hazards resilience and disaster risk reduction, with the transition of the CRC into a "new, world-class disaster

research centre". This is a welcome commitment and a substantial one—\$88.1 M over the next ten years, with the CRC receiving \$2 M in the short term to undertake research on issues arising from the devastating 2019—20 fire season. There are clearly more research questions that need answering and that is where the CRC's collaborative efforts and network of knowledge holders adds huge value. A recent independent report from external consultancy firm SGS Economics & Planning shows the CRC continues to deliver substantial economic and social benefits for the Australian community. The report highlighted that \$6 is saved for every dollar invested in the CRC's natural hazards research, amounting to a net value of investment in CRC research of more than \$500 M.

A further assessment by The Risk Laboratory, Strahan Research and the International Institute for Applied Systems Research found CRC research has four distinct value areas for the country—improving the policies and practices of emergency services and, in turn, saving costs; developing the skills and capacity of people; generating knowledge through research reports and creating networks and connections; and delivering the broader economic impacts where loss and damage have been avoided thanks to research. These benefits will continue to flow for Australia in the decades to come. But it is not just in Australia that CRC research is having an impact. Other countries are looking to the CRC too, and we were pleased to have partnered in September 2020 with the French Embassy in Australia, the Group of Eight, and the Safe Cluster in France for a virtual workshop and knowledge exchange. Both countries can learn from each other and ongoing international collaboration is an important part of building capability and learning from science. You can find examples of these research benefits in this edition of *Fire Australia*. Learn about the challenges of changing risky behaviour, such as entering floodwater, on page 14; how the new Prescribed Burning Atlas tool will assist fire agencies and land managers with their prescribed burning strategies into the future on page 23; and how science is revealing which assets are most exposed to natural hazards across the country with the Australian Exposure Information Platform on page 35. While we will continue to face many natural hazard challenges into the future, we know that science and research is helping us every step of the way.

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OUR COVER

Flooding in southern Western Australia, 2017. New research finds that understanding the decision-making behind entering floodwater is key to changing risky behaviour.

PHOTO: DANA FAIRHEAD

ABOUT FIRE AUSTRALIA

Fire Australia is a joint publication of Fire Protection Association Australia, AFAC and the Bushfire and Natural Hazards CRC. We aim to bring the latest news, developments and technical information to the fire protection industry, emergency services and natural hazards research organisations. *Fire Australia* is produced quarterly and distributed throughout Australia and New Zealand. Editorial submissions are welcome and can be sent to: magazine@fpaa.com.au. For more details on submitting a contribution, please contact the editors.

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NATURAL HAZARDS SCIENCE IS A SOUND INVESTMENT FOR AUSTRALIA

The devastating 2019–20 fire season highlights the need for Australia to continue to invest in science to prevent, mitigate and respond to natural hazards.

Australia’s Chief Scientist, Dr Alan Finkel, delivered the Bushfire and Natural Hazards CRC’s 2020 Dr Laurie Hammond Oration online in August 2020, saying there had been enormous progress over many decades, informed by Royal Commissions and inquiries and a large body of research, but “we must do more”.

Noting that the federal government had recently committed \$88 M to scale up funding for critical research into bushfires and natural hazards through a new, world-class research centre, Dr Finkel said this research will need to address both adaptation and mitigation.

“We need to continue to invest heavily in climate and natural disaster research because our circumstances in Australia continue to evolve; be they community expectations, the siting of buildings and infrastructure and the construction materials used, our unique climate, or climate change,” he said.

After this year’s fires, Prime Minister Scott Morrison asked Dr Finkel, in his role as Chief Scientist, to work with the science community on practical resilience measures to protect Australia’s natural assets. The recently released CSIRO-led report on *Climate and Disaster Resilience* assesses the challenges likely to be faced over the next 20 years.

Dr Finkel said Australia was



PHOTO: OFFICE OF THE CHIEF SCIENTIST

Dr Alan Finkel AO, Chief Scientist of Australia.

internationally recognised for its bushfire-related research, ranking second in the world in terms of research output. Its strengths were in fire ecology, health impacts, prescribed burning, modelling and predicting fire behaviour, and communications for bushfire preparation.

“Cumulatively, our research translated into action is having a significant impact,” Dr Finkel said. ■

“Cumulatively, our research translated into action is having a significant impact.”

— Dr Alan Finkel AO

Q400 LARGE AIR TANKER FOR QUEENSLAND 2020–21 FIRE SEASON

Queensland has the services of a Bombardier Q400 water-bombing aircraft for the 2020–21 season through a lease arranged by the National Aerial Firefighting Centre (NAFC).

The Q400 is one of the most advanced fixed-wing Large Air Tankers (LAT) in the world and can drop 10,000 litres of water, foam or retardant. It will be based in Bundaberg and will be able to deploy to a variety of other Queensland airbases and jurisdictions as required. This represents the first time a Q400 has been operational in Australia and the first time a LAT of this size has been based in Queensland for a fire season.

The arrival of the aircraft into Australia from its home in Canada was not without challenges, due to travel and quarantine restrictions posed by COVID-19. The Australian operator of the aircraft, Victorian-based Field Air, worked



PHOTO: CONAIR

tirelessly with its Canadian partner and Australian and international government agencies to ensure its timely arrival.

The flight path included a stopover in the Solomon Islands, with their government supporting a request from the Australian Government for the aircraft and crew to rest and refuel overnight, under tightly managed infection-control protocols. The arrival of the aircraft into Brisbane for customs clearance, and finally to Bundaberg, required the cooperation of different authorities not usually involved in the processing of arriving international

firefighting aircraft. NAFC is grateful for the facilitation provided by Emergency Management Australia and Queensland Health. The crew were required to isolate before commencing service on 1 September.

Bundaberg airbase received Commonwealth funding in 2020 to contribute towards upgrades of loading infrastructure, which allow an aircraft this size to be hosted effectively and ready to load and fly. With a ferry speed of 280 knots (500 kilometres per hour) the Q400 can reach northern or western areas of the state within an hour. ■

With above-normal fire potential for Queensland’s 2020–21 season, NAFC welcomes the addition of the Q400 Large Air Tanker to the fleet.



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FIRE AUSTRALIA CONFERENCE AND TRADESHOW

The 2020 Fire Australia Conference suffered the same fate as many events this calendar year, being cancelled as a result of the coronavirus restrictions. But it will be back again in May 2021, bigger and better than ever. The three-day event brings together insightful presenters and the most up-to-date content, highlighting innovative solutions to the industry's challenges and showcasing an impressive array of new services and technology, and this year we are introducing some exciting new features. Not only will the conference program be jam-packed with high-profile speakers from Australia and overseas, but we will be running several technical, continuing professional development (CPD) seminars led by industry experts. Of course, there will also be three exclusive off-site tours you won't want to miss. Our Tradeshow Hall will have a fresh new look with some of the leading suppliers of fire safety solutions and, for

the first time, the Conference Dinner will incorporate the FPA Australia Awards in a gala event celebrating the best in the industry. It will be an evening full of entertainment, unexpected surprises and opportunities to share a drink and network with your industry colleagues. FPA Australia Chief Operating Officer Nathan Semos said the Association has

high hopes for next year's event: "2020 has undoubtedly been a challenge for everybody, but the new year holds great promise. We look forward to welcoming you to Sydney in May for Fire Australia 2021 to celebrate new opportunities." ■

For more information visit www.fireaustralia.com.au.

NEW EVIDENCE-BASED GUIDE HELPS COMMUNITIES RECOVER FROM EMERGENCIES

A new research-backed resource, the *Guide to Post-Disaster Recovery Capitals*, has been designed to support wellbeing and decision-making during emergency recovery. The guide identifies seven community capitals associated with recovery—natural, social, financial, cultural, political, built and human—and highlights the important interconnectedness between each of them. In this context, a capital is defined as the resources that are used to generate more or new resources for the purpose of sustaining and securing wellbeing.

Part of the Bushfire and Natural Hazards CRC's *Recovery Capitals* project, the new guide is the product of an Australia—Aotearoa New Zealand collaboration between the University of Melbourne, Massey University, Australian Red Cross, other researchers,

non-government organisations and emergency management agencies.

The guide is practical and can be applied to any type of emergency, large or small. It aims to enhance wellbeing after disasters by supporting evidence-based decision-making of individuals, organisations and governments.

The current edition is a pilot version specific to Australia, which also considers Aboriginal and Torres Strait Islander peoples and recognises the need for greater attention to their particular experiences of disasters and recovery. A version tailored to Aotearoa New Zealand is also being developed, which will consider Maori perspectives.

For each of the seven community capitals, there is a section of the guide

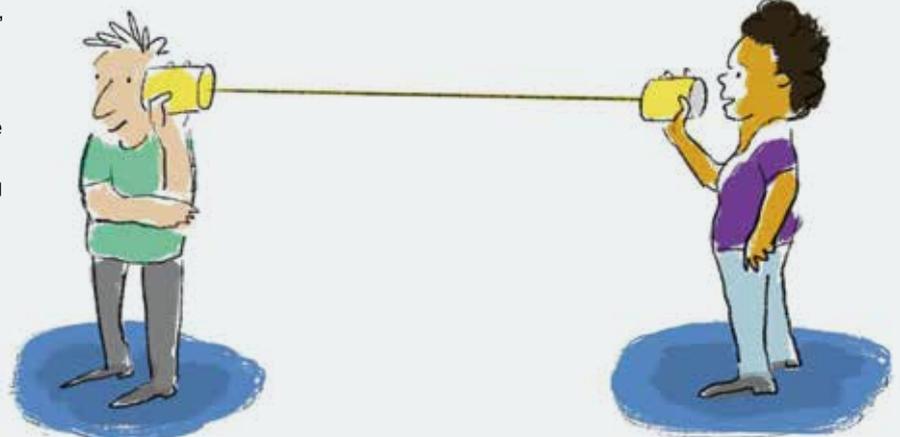
dedicated to the known role the capital plays in disaster recovery, how it can affect wellbeing, how it affects other capitals, and what to consider when assisting communities or individuals. It provides an outline of what we know about these roles of natural capital, and what considerations this raises for community recovery.

This guide is the first in a series of resources that will be developed for different audiences in different formats, depending on user needs, including online and hard copies, evidence summaries, case studies and podcasts. ■

Find out more at www.redcross.org.au/get-help/emergencies/resources-about-disasters/help-for-agencies/recap

The *Guide to Post-Disaster Recovery Capitals* is now available.

ILLUSTRATION: OSLO DAVIS





20 YEARS OF INTERNATIONAL FIREFIGHTING DEPLOYMENTS

August 2020 marked 20 years since the first operational deployment to the US by Australian and New Zealand firefighters. These arrangements were originally developed by the Forest Fire Management Group (FFMG) through personal relationships with the US Forest Service and other fire management agency networks.

This first deployment marked a

turning point in bushfire management for Australia, New Zealand, the United States and Canada. Many of the concepts and operational practices for forest firefighting that are now routine were developed and adapted from experiences gathered through these initial and ongoing international deployments.

Building on the initial work of FFMG, the AFAC National Resource

Sharing Centre is now the conduit for international deployments and this capability is continuing to improve, grow and increase in efficiency with input from AFAC member agencies and their international counterparts.

This milestone provides an opportunity to celebrate and reflect on the progress that has been made in international relationships, firefighting capability and mobilisation. ■

US firefighters assisted during the Australian 2019–20 fire season.

PHOTO: NEAL HERBERT

FIRE PROTECTION TRAINING ACADEMY GOES LIVE

After a long wait, the Sydney training facility for the Fire Protection Training Academy (FPTA) has now opened.

Situated within the Fire and Rescue NSW (FRNSW) Emergency Services Academy campus at Orchard Hills in Western Sydney—a world-class resource for training first responders—the FPTA is the first partnership between a brigade and Fire Protection Association Australia.

The water-based fire suppression room is now available for training, and trainers are already ushering the first students through to test out the equipment.

The room has been decked out with some of the latest equipment, donated by some of Australia's leading

suppliers, so students can get a good understanding of how these systems look and operate.

The co-location of FPTA on the Emergency Services Academy campus—recently opened by the NSW Premier, Gladys Berejiklian MP—means FRNSW can benefit from it too, as firefighters can now be trained on the equipment they are likely to see when called out to a fire.

The model is a good example of government–industry collaboration and has demonstrated the benefits such a partnership can bring, drawing interest from AFAC and other state and territory brigades.

Ultimately, FPA Australia aims to develop a network of these training facilities in each state and territory, which will make it easier to deliver training to practitioners locally rather than forcing them to travel large distances to get their qualifications.

The facility is not yet fully complete, and work has already commenced on the fire detection, warning and electrical training room; the passive fire and



PHOTO: FPA AUSTRALIA

smoke containment training facility; and other training spaces at the Orchard Hills site.

FPTA is open for business.

FPA Australia thanks each of the suppliers for their incredible generosity and appreciates their willingness to contribute to the development of the industry. A formal launch of the training room is planned for 2021. ■

BUSHFIRE SCIENCE IDEAS SHARED BETWEEN FRANCE AND AUSTRALIA

An online workshop has contributed to the open sharing of knowledge and expertise between Australian and French fire experts. The Bushfire and Natural Hazards CRC, in partnership with the French Embassy in Australia, the Group of Eight and Safe Cluster in France, held the three-day France and Australia Bushfire Science Workshop in mid-September 2020 to promote and extend the important collaboration of bushfire research between the two countries.

The Ambassador of France to Australia, Christophe Penot, opened the event, and highlighted the benefits of collaboration to tackle this global crisis.

"France and Australia have a lot to learn from each other and this is exactly the purpose of the workshop—to share our tools, our knowledge and our strength in order to respond in the best possible way to the forthcoming global changes that will affect us all,"



Ambassador Penot said.

Professor Margaret Gardner, Chair of the Group of Eight, praised the benefits of expert collaboration and emphasised the importance of recognising bushfires as a global crisis.

"Knowledge has no borders," she said. "It works across countries and it's best when it's given wings by international collaboration, by experts talking with experts across boundaries, sharing what they understand.

"If we have ever needed ways of preventing these sorts of conflagrations—which are embedded in climate change but which go to how we build models to work, prevent, mitigate and repair the significant damage that occurs to people

and environments—we need it now."

The virtual workshop enabled more than 40 French and Australian experts, including key researchers, policy-makers, government officials and agency representatives, to share their knowledge with an international audience of about 100 people.

With six expert panels across three days, panellists discussed bushfire science, the different emergency responses at the time of a bushfire crisis, ways that both countries draw on research for bushfire innovation, different methods of risk reduction and landscape management, health and tourism costs of fire, environmental restoration, and any new challenges they are facing. ■

REMOTELY PILOTED AIRCRAFT SYSTEMS

The National Aerial Firefighting Centre (NAFC) Strategic Committee has approved a program to build national capability and capacity for use of Remotely Piloted Aircraft Systems (RPAS).

- ◆ RPAS capabilities—current and future: Specific deliverables include the investigation of potential technologies to address gaps in operations and intelligence gathering, reporting on best practice with respect to integrating data into existing systems, and addressing ongoing developments in RPAS technologies and capabilities.
- ◆ RPAS procurement and registry: Similar to the current NAFC procurement and tracking arrangements, this part of the program will look at defining

standards for equipment and operators, and potentially integrating RPAS into the ARENA system for effective tracking of RPAS resources.

- ◆ RPAS regulatory framework: The program will work closely with industry and regulatory bodies to overcome hurdles that impact on use of RPAS by emergency services.
- ◆ RPAS doctrine: This part of the program will develop templates for standard operating procedures, training documentation and other risk mitigation activities associated with the use of RPAS.

A recent survey conducted by NAFC sought a snapshot of what is currently happening across NAFC members and AFAC agencies with respect to the current use of RPAS.

The survey responses came from all Australian jurisdictions, and New

Zealand, and across the range of agency types including land management, urban and rural fire services, and surf lifesaving. There were also some responses from non-AFAC agencies, US agencies and manufacturers.

The survey has highlighted:

- ◆ that RPAS use is actually better developed in some agencies than originally conjectured
- ◆ there is a wide variance in agencies' application of RPAS technology
- ◆ there is a wide variance in agencies' integration of RPAS into operations and systems.

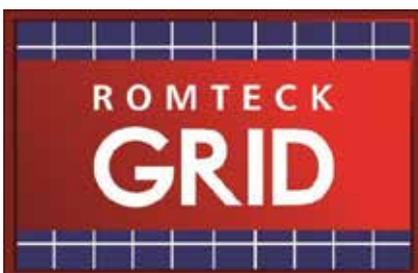
NAFC will build upon these learnings and facilitate agency collaboration regarding RPAS use by establishing a group to allow those involved to seek advice and share lessons on implementing RPAS into regular agency business. ■



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FPAS UPDATE

As reported previously, Fire Protection Association Australia (FPA Australia) was appointed as an accreditation authority by the Secretary of the NSW Department of Customer Service on 1 July 2020.

In her letter, Secretary Emma Hogan approved FPA Australia “to exercise the functions as an accreditation authority with respect to the accreditation of persons for purposes of the Act ...”

This authority recognised the accreditation of practitioners for fire systems design (except for the design of ducted smoke control systems) and for fire safety assessment under the Fire Protection Accreditation Scheme.

Under section 64 of the *Building and Development Certifiers Act 2018*, approval can only be given for one, three, or five years, but this was not declared in the original acceptance letter.

The Department of Customer Service has now written to FPA Australia to confirm it has been approved for the maximum five-year term.

This is a positive move and is a strong sign of commitment from the NSW Government to the co-regulatory model, and FPA Australia appreciates its ongoing support.

Industry is equally embracing the new requirements, with over 200 practitioners now accredited for fire systems design and over 1,000 accredited for fire safety assessment.

Work has begun on an accreditation category for the design of ducted smoke control systems, and FPA Australia is looking to create similar categories for exit and emergency lighting and for passive fire systems design.

These will be essential additions for when the *Design and Building Practitioners Act 2020* commences on 1 July 2021, as all fire systems designs will need to be accompanied by a design declaration.

Other areas requiring accredited practitioners (fire safety), but for which no accreditation currently exists, are also being examined so gaps in safety can be filled.

The industry is embracing professionalism, but there is more to do—FPA Australia’s work plan going forward will focus on bringing confidence to clients and the community that all fire safety practitioners will be competent, qualified, ethical and insured. ■

INDUSTRY IS EMBRACING THE NEW REQUIREMENTS, WITH OVER 200 PRACTITIONERS NOW ACCREDITED FOR FIRE SYSTEMS DESIGN AND OVER 1,000 ACCREDITED FOR FIRE SAFETY ASSESSMENT.

ECONOMIC RESILIENCE IN AFTERMATH OF NATURAL HAZARDS

Natural hazards are complex and the economic and social effects are not always immediately clear. How long after a bushfire, flood or cyclone are communities affected economically? Is everyone affected or does it depend on job status, industry or gender?

At a webinar in August 2020, Professor Mehmet Ulubasoglu (Deakin University) presented important insights based on Bushfire and Natural Hazards CRC research. The findings complete the *Optimising post-disaster recovery interventions in Australia* project and show that the short- and medium-term economic impacts of disasters hit different demographics and sectors harder than others.

Professor Ulubasoglu and the research team focused on four Australian disasters of differing scales, hazards and locations as case studies to explain how understanding the economic resilience of disaster-hit communities can help build more sustainable recovery models that direct funding towards the most vulnerable individuals and groups.

By evaluating the economic impacts of the 2009 Black Saturday bushfires, 2009 Toodyay bushfire in Western Australia, the 2010–11

Queensland floods and 2013’s Tropical Cyclone Oswald in Queensland, the research found that, in general, the hardest-hit incomes in a disaster belong to agriculture, food services, accommodation, part-time and female workers, low-income employees and small business owners.

“The poor become poorer following disasters,” Professor Ulubasoglu said, “and there may be lessons here governments can apply to help those suffering financially from the bushfires across Australia in late 2019 and early 2020.”

Professor Ulubasoglu believes focusing on individuals’ income streams enables policy advisers to explore how disaster-induced economic shocks can be transmitted to the labour force via income-earning channels. It also offers a greater understanding of how the indirect costs of disasters like bushfires, cyclones and floods are borne by different segments of the working population.

For more information, four short policy briefs are available at bnhrcr.com.au/research/postdisastereconomics covering each case study area, which provide a practical understanding of how the research is revealing the complexities around the economics of recovery from natural hazards. ■

“The poor become poorer following disasters.”

– Professor Mehmet Ulubasoglu



Local businesses cleaning up after the 2011 Brisbane floods.

PHOTO: ANGEUS VEITCH (CC BY-NC 2.0)



INTERNATIONAL ASSISTANCE PLANNING AMID COVID-19

On 24 August, the National Interagency Fire Center in the United States requested support from Australia in the management of wildfires occurring in California, the Great Basin and the Northwest. This was recognised to be an unusually complex request owing to the COVID-19 environment and the safety measures required to manage the risks involved.

NSW, ACT and WA agreed to participate in the deployment and

the AFAC National Resource Sharing Centre (NRSC), together with partners from the relevant jurisdictions, planned accordingly. This involved the creation of COVID-19 management plans and a health support plan for those deployed, alongside the usual planning and briefing documentation required for an international deployment.

Ultimately, having regard for the ameliorating conditions and long-range forecast, the US decided not to proceed with the deployment and it was formally

cancelled on 3 September.

Australian participants were pleased to have been able to offer in-principle support to their US colleagues after the US's support to Australia last summer. The planning process allowed AFAC NRSC and participating agencies to gain direct experience of planning a significant deployment in the COVID-19 environment. The preparation will provide direct benefits in the event that interstate deployments are required over the coming severe weather season. ■

Although the request for assistance did not proceed, important planning has taken place to facilitate COVID-19-safe international resource sharing.

VBA'S ENHANCEMENT PROGRAM TO DRIVE ESM MAINTENANCE

New initiatives to boost the compliance and performance of essential safety measures (ESMs) will be released later this year, following deficiencies found in the Victorian Statewide Cladding Audit. Through expert analysis of apartment and public buildings, responses to fire events such as the Neo200 building fire, and enforcement programs run in partnership with local councils, the Victorian Building Authority (VBA) has gained insights into the performance and compliance of ESMs across the state. Coupled with evidence pointing to widespread confusion over the roles and responsibilities related to ESM maintenance, the VBA has seen first-hand the impacts that substandard installation and maintenance can have on public safety and confidence in our built environment.

The VBA's ESM Enhancement Program has been established in collaboration with industry to address public safety, enhance practitioner competency with wet systems, and promote the importance

of effective and compliant ESMs. The objectives of the program are simple: to promote a culture of compliance, bolster the competency of those who maintain ESMs, and enhance industry assurance activities.

While much of the program remains in development, education and evidence will play a prominent part, and working groups with industry and regulatory bodies have been set up to work on key deliverables.

Organisations involved are Fire Protection Association Australia; National Fire Industry Association; Air Conditioning and Mechanical Contractors Association; and Master Plumbers and Mechanical Services Association of Australia. Joining them are the City of Melbourne; Country Fire Authority; Fire Rescue Victoria; Victorian Municipal Building Surveyors Group; Strata Community Association; the Department of Environment, Land, Water and Planning; and the Department of Justice and Community Safety.

Research will form a solid foundation for the initiatives, with the expected launch of a new program aimed at evaluating compliance with ESM requirements under the *Building Act 1993*.

At the same time, the VBA will continue its own research evaluating industry skills and capacity to conduct routine servicing and maintenance of ESMs. ■

THE VALUE OF RESEARCH FROM THE CRC

The value to Australia of the Bushfire and Natural Hazards CRC's research sums up to \$850.1 M over 15 years, according to a new report.

As it entered the final year of its current program and planned a future research agenda, the CRC sought to evaluate more systematically the impact of its research. The Risk Laboratory, the International Institute for Applied Systems Research and Strahan Research were commissioned to undertake an assessment of the value of the research delivered by the CRC over the past seven years, which would be used alongside the independent evaluation conducted by SGS

Economics & Planning earlier this year.

The report answers the question: what is the return to Australia of its investment in the Bushfire and Natural Hazards CRC? The evaluation finds that for every dollar spent on the CRC, there is a seven-dollar return and concludes this represents outstanding value for Australia.

The report outlines the four pathways used to capture the full value of research impact, which was supported by the impacts of three CRC projects—infrastructure resilience, fire surveillance, risk and warning communication during natural hazards—and a case study of the 2018–19 south-west Tasmania bushfires.

The assessment estimates the total value of four distinct pathways (project level impacts, training and capacity building, knowledge generation, and broader social and economic impacts), expanding the potential value of research, highlighting the range of strategic areas that publicly funded research enhances, and indicating the main ways the CRC has value.

Summing the value of each of the pathways, the total value of CRC research is estimated at \$850.1 M, which is based on the benefits that have begun to accrue since 2018 and will continue over 15 years to 2032. ■

The full report is available at bnhcrc.com.au.

PHOTO: JO-ANNE MCARTHUR/UNSPASH

ROYAL COMMISSION FINDINGS RELEASED

The findings from the Royal Commission into National Natural Disaster Arrangements following the 2019–20 bushfire season were released on 30 October 2020. Making 80 recommendations, the Royal Commission examined coordination, preparedness for, response to and recovery from disasters as well as improving resilience and adapting to changing climatic conditions and mitigating the impact of natural disasters. The inquiry also considered the legal framework for Commonwealth involvement in responding to national emergencies.

Download the full report at www.naturaldisaster.royalcommission.gov.au

A kangaroo and her joey who survived the forest fires in Mallacoota in Victoria.

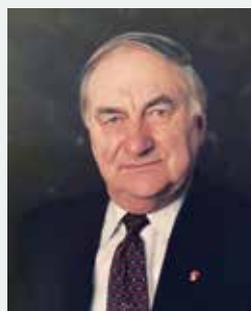


VALE: JOHN PATERSON

Fire Protection Association Australia (FPA Australia) wishes to offer our sympathies to the family, friends, and colleagues of John Paterson, who recently passed away.

John was a committed member of FPA Australia and its predecessor for 60 years, serving with distinction as both Board member and President, before being recognised as an honorary life member.

He was also a long-term former member of both the Victorian state committee and the technical advisory



committee for sprinklers and hydrant systems.

He was a widely recognised expert on automatic sprinkler protection, having worked for decades for Wormald Australia before starting up his own fire sprinkler head company, Landsdale Fire.

John was always a mine of information on automatic sprinkler matters and the history of the fire protection business in Australasia.

His strong interest in all aspects of fire protection is a matter of record and his contributions to the industry will be long remembered.



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PHOTO: ERIK KVELAND (CC BY-NC 2.0)

WOULD YOU DRIVE INTO FLOODWATER?

Milton Road, Brisbane, following the January 2011 floods in Queensland.

New research is delving into why people enter floodwater and what can be done to change this risky behaviour.

BY **RADHIYA FANHAM**

Bushfire and Natural Hazards CRC

It is widely agreed that entering floodwater, whether by foot or by vehicle, is highly risky. There is usually little to no visibility of what is underneath the surface of a flooded road, and even seemingly shallow, moderate flowing waters can sweep a person off their feet or cause a vehicle to lose control.

Globally, floods are the highest cause of fatalities from natural hazards, and the second highest in Australia, so it makes sense that plenty of flood risk communication campaigns have been instituted over the years. The question is: are they effective?

Associate Professor Melanie Taylor, Occupational Psychologist at Macquarie

University and lead researcher of the Bushfire and Natural Hazards CRC *Flood risk communication* project, said while previous research has identified the reasons behind flood fatalities, not enough research has investigated the behavioural aspect of entering floodwater.

The project commenced in July 2017 to develop an understanding of the motivations, beliefs, decision-making processes and information needs of at-risk groups for flood fatalities. State Emergency Services (SES) from around Australia have worked closely with the research team from the onset of the project, taking particular interest in the behaviours of their own personnel when it comes to risk taking and driving into floodwater, as well as their attitudes to

the public entering into floodwater.

"There has been a lot of work generally around drowning, and some work on driving into floodwater, but it's mostly been qualitative," A/Prof Taylor said.

"We wanted to do something a bit more quantitative to provide some more compelling statistics in terms of public behaviour and also SES behaviour."

Community Capability Coordinator at the NSW SES, Mr Joshua McLaren, said the changing climate requires new and improved communication strategies.

"What we've started to understand in a changing climate, and what we're seeing now going into a La Niña, is that we really need to shift gears to think about how we change the paradigm around how we operate with

communities," Mr McLaren said.

"If we have really effective communication with members of our community, we can potentially save thousands of people through one action."

Defining the message

Having a clear definition of 'floodwater' is essential when conducting research on behaviours around floodwater and potential responses to flood risk communication. In the early stages of the project, the research team worked in consultation with the NSW SES to develop a working definition of floodwater on roads to provide a clear idea of what is being referred to in driving into floodwater messaging. This was defined as an environment where:

- ◆ water is across the road surface
- ◆ there is little to no visibility of the road surface markings under the water (i.e. uncertainty of the road quality/integrity and possibly depth)
- ◆ there is water on normally dry land—either flowing or still.

"It's not rocket science," A/Prof Taylor said. "You might think you know what it's like underneath the water, but it could have been eroded away or potholes may have formed, and you don't know the integrity of the road surface. Of course, the really dangerous aspect is that you could just get swept off."

As a psychologist, A/Prof Taylor considered human nature in the reasons why one might enter floodwater despite the clear warnings and communications against it. One of the possible hypotheses, she said, was people are just not engaging with the messaging and that is why they are continuing to enter floodwater.

"We have looked at how both SES personnel and the public conceptualise floods to try to gain insights into why people might be rejecting or dismissing the messaging," A/Prof Taylor explained.

"If someone sees an advert that shows deep, flowing water that's clearly dangerous, that's the image they have of what floodwater is in the context of not to drive through it. However, when they come across water that looks quite benign, they might not see that as 'floodwater' and, therefore, feel the message doesn't apply."

Mr McLaren said communicating the risk of driving into floodwater is a particular challenge.

"Disasters aren't something that people deal with everyday," he said.

"The challenge for emergency services, and this is where Mel and the team's work is so important, is how do we effectively engage people when they



PHOTO: SOUTH AUSTRALIAN STATE EMERGENCY SERVICE

are so busy with their own lives, and how do we utilise communication and messaging to engage people who have never experienced the risk?"

Behaviour

To look at the extent to which entering floodwater is influenced by behaviour, the research team consisting of A/Prof Taylor, Dr Katharine Haynes and Dr Matalena Tofa conducted extensive survey and quantitative research to investigate the conditions in which people drive through floodwater and the decision-making around what was being thought at the time and why they chose to go through instead of turning around.

A public survey was distributed between December 2018 and January 2019 and was constructed to be proportionally representative of the adult Australian general population by state and balanced for age and gender. The survey consisted of eight main sections: driving details; demographics; experiences of entering floodwater, either on land or in flooded rivers; willingness to drive through water on roads; experience of driving into floodwater; experience of turning around in floodwater; general attitude to risks; and flood risk messages.

Over half of the 2,184 respondents who undertook the survey had driven through or been driven through floodwater, and 41% had been through floodwater on more than one occasion in the past five years.

The central question is why is it that, despite advice and warnings, people are still entering floodwater? What are they doing at the time, and why are

they disregarding risk messages? By understanding what people are doing when entering floodwater, we can find additional levers to influence their behaviour.

Of the 1,167 people who reported driving into floodwater in the survey, a fifth were returning home from work, and a further 17% were either on holiday, sightseeing or on a leisure drive (Figure 1). The vast majority of participants (90.7%) reported that they drove through floodwater without any negative consequences.

"It again speaks to behaviour that people enter floodwater fairly often," A/Prof Taylor said.

"If you do it and get away with it, there's this idea that you don't have to be cautious the second and third time, especially if it's the same location. However, it can be quite a different situation every time and there could be a lot of danger underneath in terms of obstructions. You wouldn't drive into a bushfire, so why drive into floodwater?"

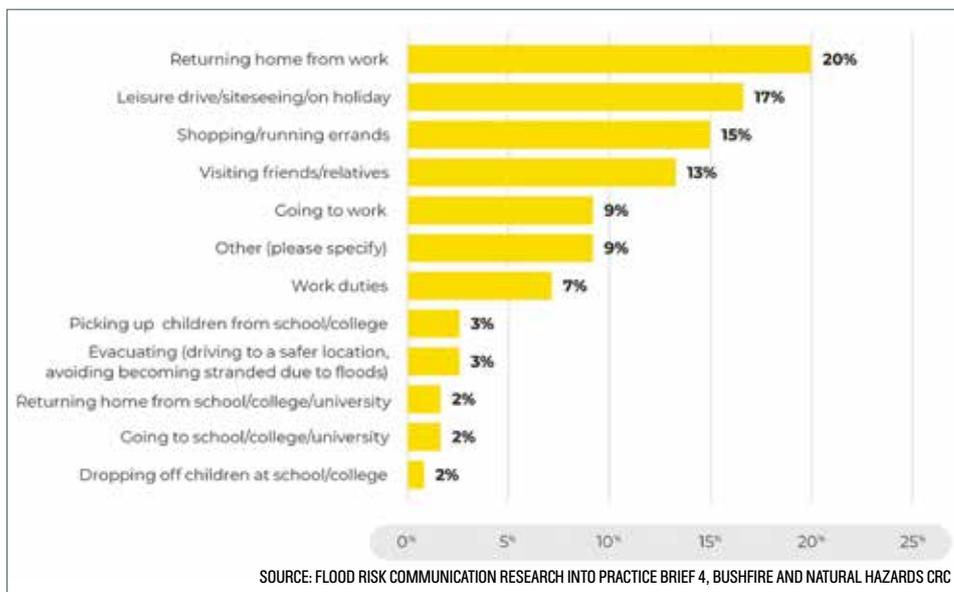
The majority of contexts in which people drove into floodwater related to common or mundane situations or activities and were therefore not about 'urgent' or high-stakes situations, and many people indicated they had carefully considered the situation. This suggests decision-making is not sudden or impulsive and means there is an opportunity to influence the decision-making process.

Training and rescue

"The results of this survey research are also important to guide things like training for the SES," A/Prof Taylor said.

Damaged roads in the Adelaide Hills after flooding in 2016.

FIGURE 1. Activity being undertaken at the time of driving through floodwater.



“It’s better to give SES personnel a scenario that’s actually realistic so they can begin to understand the situation in which entering floodwater happens. It’s not only about decisions being made on duty in life or death situations, it’s also those more mundane moments when maybe there is a lack of consideration to risks, or reversion to habitual driving behaviours.”

NSW SES Flood Rescue Coordinator, Mr Carl Manning agreed and explained how this research is aiding frontline SES personnel in their decision-making during flood operations.

“I’m currently involved in the flood rescue site commander project for frontline flood rescue personnel, and it’s really helpful to be able to expect outcomes based on likely behaviours of the public that this research has informed,” Mr Manning said.

“We will definitely be using this behavioural science to consider when undertaking future flood rescue operations.”

Challenging the behaviours

Despite quite a number of public risk messaging campaigns in recent years, the study found there was generally fairly poor levels of awareness of campaigns and recollection of messages.

Surprisingly, there also did not appear to be a positive link between campaign awareness and lower levels of risk taking.

“The theory tells us that to get people to take protective behaviour, in this case, not to drive through floodwaters, the first thing is that more needs to be done to make it clear that there is a risk,

especially with more benign situations,” A/Prof Taylor said.

Risk is often difficult to assess and a poor ability to perceive risk is likely to result in increased engagement in risky driving behaviours. To better understand the decision-making processes involving drivers’ decisions to enter floodwaters, the research team explored the ability to recognise floodwater hazard and adequately assess the level of associated risk, in a newly developed online tool, EXPERTise 2.0 (Expert Intensive Skills Evaluation).

“The second pillar of the equation is actually to try and give people solutions to the issue, which, in this case, is not driving into floodwater,” A/Prof Taylor said.

“Past behaviour often predicts future behaviours, so we need to modify risk communication and influence risk perception. People have got to know that it’s a risk to start with if we want them to engage with the messaging and then we need to provide them with ways to manage the risk; this is a fundamental aspect.”

As the coordinator for flood rescue operations, Mr Manning said the most common poor decision he has seen people make is underestimating the effect of floodwater.

“Floodwater is always more powerful than people expect, and the sheer force of the water alone is something people don’t anticipate when entering it,” he said.

The NSW SES is currently reviewing their messaging and flood risk management procedures to look at how they can better structure their risk messaging.

“Over the last five to ten years, we really didn’t think much into the complexities of driving into floodwater,” Mr McLaren said.

“Mel and the team’s work has been a trigger for us to understand that it is really complex and it’s probably time for us as an agency to go back to the table and look at how we can better structure our messaging to use behavioural insights and psychology.”

EXPERTise 2.0 assesses the user’s ability to interact with task-related cues and form diagnoses, and the research aims to develop and validate a measure of cue utilisation in the context of driving into floodwater.

“It doesn’t tell us what specific cues people are using but it gives us information about the extent to which they are using cues,” A/Prof Taylor explained.

“We can see whether people using cues are more risk aware and, while we are still refining the tool, we have already found that people who use cues have higher expertise in judging risk and are therefore more likely to make safer decisions.”

Mr McLaren said the team’s research and the EXPERTise 2.0 program is helping emergency services begin to understand people’s decision-making processes.

“The research shows that there’s often quite complex behavioural issues that are driving people’s actions,” he said.

“If we are going to effectively design communication and messaging, we need to understand what is driving people’s decision-making so that we can actually target that when a) we are working with people on the ground, and b) how we are messaging during an operation or when it is flooding.

“We live in a fast-paced and challenging world, and to have an asset like the Bushfire and Natural Hazards CRC to work alongside us is so important to make sure that the programs and messaging that we’re using with communities is evidence-based and grounded in research.”

In conjunction with AFAC and SES research end users, the results of this research are now informing the co-development of a set of public communication guidelines and the establishment of a set of national community safety announcements for use by the ABC in emergency broadcasting. ■

To find out more about this research visit bnhrcr.com.au/research/floodriskcomms.

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ETCHED IN HISTORY: 2020 NATIONAL MEMORIAL SERVICE

Remembering lives lost in the line of duty.

BY **ZOE KENYON**

AFAC

On 28 October, AFAC hosted its National Memorial Service to remember those who lost their lives in the line of duty over the past year.

The memorial service, traditionally taking place in early May to align with International Firefighters' Day and hosted at the National Emergency Services Memorial on the banks of Lake Burley Griffin in Canberra, was adapted this year to run online.

For AFAC CEO Stuart Ellis, it was important for the industry to come together virtually, after such a significant fire season, to reflect on the service and commitment of fire and emergency service personnel.

"Although we can't all be together in Canberra, it is important that AFAC provided a way for us to acknowledge the significant contribution and sacrifice that fire and emergency service personnel make to our communities, particularly those who have died in the past 12 months."

The service included acknowledgement of personnel from Australia and, for the first time, from the United States, with the inclusion of the aircrew who died in a Large Air Tanker crash in southern NSW in January 2020. Their names have been engraved upon the Memorial Wall, which now holds the names of over 500 people who have died in the line of duty since records began.

"This service provides national recognition and, hopefully, a level of comfort to those who have lost so much," Mr Ellis said.

"May they know that our industry, our communities and our countries acknowledge their loss and offer our support."

Mr Ellis hopes that next year COVID-19 restrictions will be eased to allow the ceremony to be run in Canberra again, where families will be able to attend in person to receive an AFAC memorial medallion. ■

PHOTOS: AFAC



AFAC President Paul Baxter and NSW Rural Fire Service State Protocol Officer John Sullivan attend the National Emergency Services Memorial in Canberra.



The 2020 virtual National Memorial Service delivered condolences and messages of support from the Governor-General, His Excellency General the Hon. David Hurley, Prime Minister the Hon. Scott Morrison, United States Ambassador to Australia Arthur B Culvahouse Jr., and others.

The full service is available to view on the AFAC YouTube channel: <https://youtu.be/ke8FITWPGRg>

PHOTO: AFAC



NAMES ADDED TO THE MEMORIAL WALL IN 2020

This year, 38 names were added to the National Emergency Services Memorial Wall in Canberra. These include both recent and historic loss of life in the line of duty, as submitted by their representing AFAC member agency.

All names on the Memorial Wall are reflected on the digital Honour Roll, where further details, including an interactive image of the memorial panel on which their name appears, can be found at <https://memorial.afac.com.au>

Name	Date of death	AFAC member agency
William Anson	14 February 1926	Department of Environment, Land, Water and Planning, Victoria
Thomas Donald	14 February 1926	Department of Environment, Land, Water and Planning, Victoria
Leslie Hay	14 February 1926	Department of Environment, Land, Water and Planning, Victoria
Allen Hume	14 February 1926	Department of Environment, Land, Water and Planning, Victoria
Herbert Johns	14 February 1926	Department of Environment, Land, Water and Planning, Victoria
Sydney Johns	14 February 1926	Department of Environment, Land, Water and Planning, Victoria
Joseph Johnstone	14 February 1926	Department of Environment, Land, Water and Planning, Victoria
Lindsay King	14 February 1926	Department of Environment, Land, Water and Planning, Victoria
Albert Lunson	14 February 1926	Department of Environment, Land, Water and Planning, Victoria
Lawrence Roberts	14 February 1926	Department of Environment, Land, Water and Planning, Victoria
Albert Sandham	14 February 1926	Department of Environment, Land, Water and Planning, Victoria
Edgar Walker	14 February 1926	Department of Environment, Land, Water and Planning, Victoria
Valentine Walsh	14 February 1926	Department of Environment, Land, Water and Planning, Victoria
John Knopp	14 February 1926	Department of Environment, Land, Water and Planning, Victoria
Edward Mille	14 February 1926	Department of Environment, Land, Water and Planning, Victoria
James Moloney	5 February 1932	Department of Environment, Land, Water and Planning, Victoria
John O'Shea	5 February 1932	Department of Environment, Land, Water and Planning, Victoria
Wilfred Richards	5 February 1932	Department of Environment, Land, Water and Planning, Victoria
August Schultz	5 February 1932	Department of Environment, Land, Water and Planning, Victoria
George Payne	10 January 1939	Department of Environment, Land, Water and Planning, Victoria
Clarence Rogers	13 January 1939	Department of Environment, Land, Water and Planning, Victoria
Gilbert Rogers	13 January 1939	Department of Environment, Land, Water and Planning, Victoria
Kenneth Welch	27 April 1962	Department of Environment, Land, Water and Planning, Victoria
Francis Robinson	23 December 1974	Department of Environment, Land, Water and Planning, Victoria
Michael Maria	18 May 2013	New South Wales Rural Fire Service
George Baldock	27 February 2019	Fire and Rescue New South Wales
Phillip Bell	15 May 2019	New South Wales Rural Fire Service
Ian Long	17 September 2019	New South Wales Rural Fire Service
Robert Panitz	18 October 2019	New South Wales Rural Fire Service
Andrew O'Dwyer	19 December 2019	New South Wales Rural Fire Service
Geoffrey Keaton	19 December 2019	New South Wales Rural Fire Service
David Moresi	30 November 2019	Department of Environment, Land, Water and Planning, Victoria
Samuel McPaul	30 December 2019	New South Wales Rural Fire Service
Mathew Kavanagh	3 January 2020	Department of Environment, Land, Water and Planning, Victoria
Bill Slade	11 January 2020	Department of Environment, Land, Water and Planning, Victoria
Ian McBeth	23 January 2020	New South Wales Rural Fire Service, Coulson Aviation (USA)
Paul Hudson	23 January 2020	New South Wales Rural Fire Service, Coulson Aviation (USA)
Rick DeMorgan Jr	23 January 2020	New South Wales Rural Fire Service, Coulson Aviation (USA)

ENERGY STORAGE SYSTEMS: LESSONS LEARNED ON FIRE SAFETY DESIGN AND RESPONSE

Lithium-ion battery storage facilities pose a risk to firefighters and need to be approached with great caution.

BY **SEAN DECRANE**

Industry Relations Manager, UL

The growing increase in lithium-ion battery energy storage system (ESS) facilities in recent years presents a new challenge for the fire protection community. Proactive measures such as appropriate fire safety provisions and regular inspections are essential to protect employees and firefighters from thermal runaway fires, including cascading thermal runaway events in larger-capacity battery systems.

According to the US Energy Storage Association, battery storage deployments in the US have grown almost 600% from 2016 to 2019. In Australia, energy storage is an emerging market, driven by demand for electric vehicles and renewable energy. Australia's Smart Energy Council (SEC) expects energy storage systems to increase from 52,500 in 2016 to 450,000 in 2020. Internationally, such growth has accelerated the need for research to inform design and operational safety.

On 19 April 2019, a cascading thermal runaway event within a 2.16 megawatt-hour, Public Utility-owned lithium-ion battery ESS in Arizona, USA, led to four firefighters suffering serious injuries. At the invitation of the local fire departments involved, the UL Firefighter

Safety Research Institute (FSRI) conducted an incident review and published a report on the findings.

UL FSRI, a research-driven organisation that is part of UL's non-profit entity, is dedicated to decreasing firefighter injuries and fatalities through increasing fire service knowledge. Its report, *Four Firefighters Injured in Lithium-Ion Battery Energy Storage System Explosion – Arizona*, is publicly available, outlining contributing factors and making recommendations for industry, regulators and the fire service that may reduce the risk of a similar occurrence.

The dedicated ESS structure was placed into service in March 2017 and built under the 2012 edition of the International Fire Code (IFC). It was approximately 15 metres x 4 m x 3.65 m, housing 27 battery racks, each containing 14 modules. This system contained 10,584 cells at a 90% state of charge. The fire protection system consisted of a VESDA smoke detection system and total flooding clean agent suppression system utilising 323 kilograms of Novec 1230. This was designed to deploy, per industry standards, at a 10% concentration 30 seconds after the VESDA system registered an alert status.

The incident

Prior to this event the battery system had been operating normally. The first indication that something was wrong was when the minimum battery cell voltage in Rack 15 began to decrease. Fourteen seconds later, the air temperatures began to rapidly increase. Within 50 seconds of the initial voltage decrease, the VESDA smoke detector registered an alarm condition with all breakers and contacts open. As designed, the suppression system discharged 30 seconds after the alarm indication.

Forty-seven minutes later, the Phoenix Metro Dispatch Center received a call from a passer-by reporting smoke in the area and a bad smell. Fire Dispatch notified the closest firefighting units, who immediately responded. Three minutes after the call, all communication with the ESS system was lost, prior to the arrival of the firefighting units.

Upon arrival, the fire officer from the responding crew initiated a 360-degree size-up around the exterior of the structure. An operations and maintenance contractor on the scene indicated that the structure served as storage for lithium-ion batteries. The fire officer recognised the potential for a hazardous materials situation and requested a hazardous materials (HAZMAT) response.





The officer of the HAZMAT crew became aware of a low-lying vapour cloud surrounding the structure. After consulting the fire officers on the scene, the HAZMAT team donned full firefighter personal protective equipment (PPE) with self-contained breathing apparatus and conducted a 360-degree size-up using several handheld gas meters and thermal imagers. They noted dangerously elevated levels of hydrogen cyanide (HCN) and carbon monoxide (CO) (above 50 parts per million (ppm) HCN and 500 ppm CO). The thermal imager indicated one small spot on the north wall with a temperature of 54.4 degrees Celsius.

Over the next 33 minutes the HAZMAT team continued to monitor the situation and consult with industry representatives and fire department command officers. They noticed the amount of vapour emitting from the structure began to diminish. They also conducted two additional 360-degree size-ups with their gas meters and thermal imagers. Within the vapour cloud, gas readings still indicated dangerously elevated readings of HCN and CO.

The HAZMAT team and fire command officers discussed potential options to end the situation. They considered life safety issues, length of time on scene and impact to local

major roadways. They also sought additional information from the industry representatives on the scene and off-site. At this time, it was also witnessed that vapours were no longer emanating from the structure.

With the agreement of all officers within the command staff, it was determined that the HAZMAT team would approach the structure and continue to conduct readings with their gas meters and thermal imager. If the hot zones were safe, they would open the door and check for live fire—and if fire were present, they would retreat and permit the fire to burn. If no fire were present, they would retreat and allow the structure to vent any remaining smoke/vapour.

As the HAZMAT team executed the response plan and opened the door to the structure, a white vapour fell out of the structure below waist level. The HAZMAT team stood in the doorway attempting to collect reliable gas meter measurements. The HAZMAT officer saw no indication of conditions changing and decided to use his thermal imager to assess conditions inside the structure. The officer saw no active fire and a reported a maximum temperature of 40 degrees Celsius.

Shortly after this series of events, the fire service personnel outside the hot zone heard a loud noise and witnessed

a jet flame extending horizontally into the desert approximately 23 m and vertically 6 m. They immediately issued a mayday and began searching for injured firefighters. This was the result of the unintended ignition of flammable gases that were released by the batteries during thermal runaway and collected inside the ESS.

All four members of the HAZMAT team lost consciousness and were found in various locations. The officer was projected under the surrounding chain-linked fence approximately 23 m into the desert. A second firefighter was propelled under the fence approximately 9 m into the desert as well. Each firefighter had pieces of their PPE blown off or removed when they passed under the fence.

Summary of findings

The report into this incident highlighted the need for ongoing education and vigilance about the fire safety hazards of ESS.

This should be informed by controlled research conducted by reputable laboratories in collaboration with fire services and industry. ■

To learn more about UL FSRI's work regarding this incident and other contemporary fire safety research, please visit www.ulfirefightersafety.org.

MOVING FORWARD: CONTRIBUTING FACTORS AND RECOMMENDATIONS

Following are the findings and recommendations from the UL FSRI report.

Education for firefighters and subject matter experts

There is a lack of research-based information and educational tools for firefighters and subject matter experts who may need to work cooperatively in response to a lithium-ion-based ESS incident.

Recommendations:

- ◆ Training should emphasise ESS safety, the potential explosion hazard from lithium-ion batteries, vapour cloud formation and dispersion, and the dynamics of deflagrations.
- ◆ Full-scale research testing should be conducted to understand the most effective and safest fire service response tactics for lithium-ion battery ESS incidents.
- ◆ Until definitive tactics can be established, fire service personnel should define a conservative blast radius of which to remain outside, while treating the gas/vapour mixture in the ESS as if it is above the lower explosive limit (LEL) until proven otherwise.
- ◆ An online education tool should be developed regarding the relevant hazards and tactical considerations.
- ◆ Education and training should be required for all industry representatives who may respond and act in a supportive role. Current and accurate information regarding battery technology and protection systems is critical.

Design and construction considerations—safety systems and signage

Gas monitoring of conditions is important. Knowing the gas

concentrations within the ESS could have made a difference in deciding when or if to open the door.

The ESS did not have deflagration venting panels or adequate ventilation to prevent accumulation of flammable gases. These measures may have mitigated the deflagration that resulted in the injuries to the firefighters.

It also appears that the total flooding clean agent suppression system most likely prevented flaming combustion early in the incident. However, it may have contributed to the accumulation of flammable gases and vapours, as well as stratification of the atmosphere that facilitated the deflagration.

The crew that initially responded to the ESS did not know the intended use of the structure or that a lithium-ion battery system was stored inside it. This was due to a lack of outreach between the utility and the fire department, as well as a lack of signage on the ESS.

Recommendations:

- ◆ Lithium-ion ESSs should incorporate gas monitoring that may be accessed remotely.
- ◆ Research that includes multi-scale testing should be conducted to evaluate the effectiveness and limitations of stationary gas monitoring systems for lithium-ion battery ESSs.
- ◆ Lithium-ion battery ESSs should incorporate adequate explosion protection as required by consensus standards in coordination with the emergency operations plan.
- ◆ Research that includes full-scale testing should be conducted to determine the most effective fire suppression and explosion prevention systems for lithium-ion battery ESSs.
- ◆ Signage that identifies the contents of an ESS should be required on

all ESS installations to alert fire responders to the potential hazards associated with the installation.

- ◆ It is important, when designing or approving a structure, to consider the location of the ESS and exposures involved, especially in urban settings where other structures, facilities or pedestrians represent increased risk.

Emergency response plan

A single-page emergency response plan was provided in electronic form during the incident and contained very little information. It was inadequate for providing guidance on a cascading thermal runaway incident. There was no prior collaboration between relevant stakeholders to develop an appropriate plan.

Recommendation:

Owners and operators of ESSs should develop an emergency operation plan in conjunction with local fire service personnel and the authority having jurisdiction and hold a comprehensive understanding of the hazards associated with lithium-ion battery technology.

Decommissioning

The owner of the structure required almost two months to develop the decommissioning plan and then conducted the operations on-site over several weeks. It was a long and complicated process, which would have been impractical in an urban or occupied building setting.

Recommendation:

The decommissioning process, including the role of the fire department and what potential hazards may be present, must be made clear prior to commissioning ESS installations. ■

A prescribed burn in the Blue Mountains in 2018.

HOW BEST TO BURN THE BUSH

Burn broadscale in the bush or burn small areas close to homes? One size does not fit all—the Prescribed Burning Atlas will help fire managers decide upon the best option to reduce bushfire risk.

PHOTO: NSW NATIONAL PARKS AND WILDLIFE SERVICE

BY **NATHAN MADDOCK**

Bushfire and Natural Hazards CRC

New research into the complexities of prescribed burning across varied landscapes and weather conditions is supporting the critical decisions on how and where to use fire to protect communities.

Drawing on cutting-edge science, the Prescribed Burning Atlas assists Australia's fire agencies and land management departments by presenting options for their prescribed burning strategies.

Launched in July 2020, the Atlas is a new website that provides fire and land managers with insights into the effectiveness of prescribed burning.

Developed through the Bushfire and Natural Hazards CRC in partnership with the University of Wollongong, Western Sydney University and the University of Melbourne, the Prescribed Burning Atlas is an outcome of the CRC's *From hectares to tailor-made solutions* project and was launched in a webinar by Naomi Stephens, CRC Director and Acting Executive Director Park Operations, NSW National Parks and Wildlife Service.

The Atlas incorporates thousands of fire simulations across varied landscapes and under different weather conditions, with the research behind it

headed by Professor Ross Bradstock at the University of Wollongong.

"The Prescribed Burning Atlas is about helping to identify the sweet spot of prescribed burning. It can compare the level of risk reduction achieved from different combinations of strategies, such as smaller edge burns close to homes or larger broadscale burns," Professor Bradstock said.

"There is no 'one-size-fits-all' solution to prescribed burning. Strategies must be tailored to different environments, and the cost-effectiveness of these different strategies can vary considerably between regions. For example, what is suitable for the ACT will not necessarily be best around Hobart."

One of the key drawcards of the Atlas is its ability to compare the risk reduction from different types of prescribed burning strategies. Different types of burns achieve different outcomes for reducing the likelihood of life and property loss, and for protecting environmental values.

Importantly, the Atlas also has the ability to show the likely costs, and the point at which spending more money on conducting prescribed burning does not have any measurable effect on reducing the bushfire risk.

With 13 different study areas across NSW, Victoria, ACT, Tasmania, SA and Queensland comprising the urban interface, remote bushland, arid

grassland and subtropical bush, the Atlas also has the ability to compare the effects of climate change on prescribed burning effectiveness.

Dr John Bates, CRC Research Director, believes the Prescribed Burning Atlas is a crucial tool for now and for the future.

"Australia is a land of fire and prescribed burning has many different objectives—from reducing the risk of bushfire to homes and businesses, to improving ecological outcomes. The Prescribed Burning Atlas will help our fire and land managers to tailor their prescribed burning strategies to best reduce the risk in a target area, showing what is most effective and where it has limited value," he said. ■

Explore the Prescribed Burning Atlas at prescribedburnatlas.science

The team behind the Prescribed Burning Atlas comprises Prof Ross Bradstock (University of Wollongong), A/Prof Owen Price (University of Wollongong), A/Prof Trent Penman (University of Melbourne), A/Prof Matthias Boer (Western Sydney University), Dr Hamish Clarke (University of Wollongong/Western Sydney University), Brett Cirulis (University of Melbourne) and Anthony Rawlins (University of Melbourne).

A MASSIVE PUFF OF SMOKE

Early in the afternoon of 9 February 2014, during the worst drought and heatwave south-eastern Australia had experienced in over a century, two separate bushfires raged towards the massive Hazelwood open-pit brown-coal mine, near Morwell in the Latrobe Valley. The fire at Hazelwood mine burned for 45 days ...

Tom Doig
PHOTO:
MAX MILNE



BY **TOM DOIG**

Simon Ellis sat out on the front verandah of his Morwell, Victoria, house with his younger brother Robert and his seven-year-old daughter Charity. The Ellises drank glass after glass of Coke, weathering the 40-degree heat and 50-kilometre-an-hour north-westerlies as best they could. Simon's house was near the top of a hill and faced south, with views over the pink and green

rooftops of Morwell. Across the street on the left, a pair of short, bushy trees framed the Hazelwood power station.

It was a brutally hot day and the sky was a vivid, cloudless blue. The two days before, on Friday and Saturday, Simon — a pink-cheeked, round-faced, big-bellied Brit — had been working as a chef one hour away in Clayton. His brother called him at work on Saturday morning and told him to get home: there was a fire in nearby Hernes Oak, and people in Morwell were “just up and leaving”. But by the time Simon made it back that afternoon, there was no smoke to be seen. The Country Fire Authority (CFA) had the Hernes Oak fire under control and the danger seemed to have passed.

While Simon and Robert sipped their Cokes and tried to relax, Charity went and played on the lawn with the kids from next door. Suddenly, Simon saw a puff of smoke on the horizon, a massive cloud coming out of the trees to the south of Hernes Oak, near Driffield: “It was as if someone had lit up a giant cigarette.”

Since it was a total fire ban day, he called triple zero straight away. It was 1.03 pm on Sunday 9 February 2014.

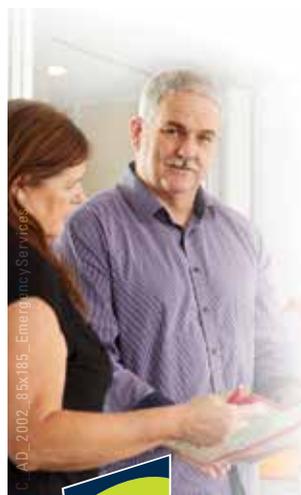
“There’s a fire just started,” Simon told the operator in his Birmingham accent. “I’ve seen it happen just now in the hills on the other side of the Strzelecki Highway.”

He was transferred to the CFA, and when the operator told him they already knew about the Hernes Oak fire, Simon replied, “This is not the same fire—this is a fire that’s just started, and I’m watching it *right now*.”

In the space of that short phone call, the column of whitish smoke had become a thick grey plume that towered into the sky.

Simon went into his bedroom. His new camera—a Canon DSLR with an infra-red mode, which he had bought himself for Christmas just six weeks beforehand—was still sitting unused in its box. He grabbed it and raced back outside to take some pictures.

An hour and a half later, the wind changed to a ripping south-westerly.



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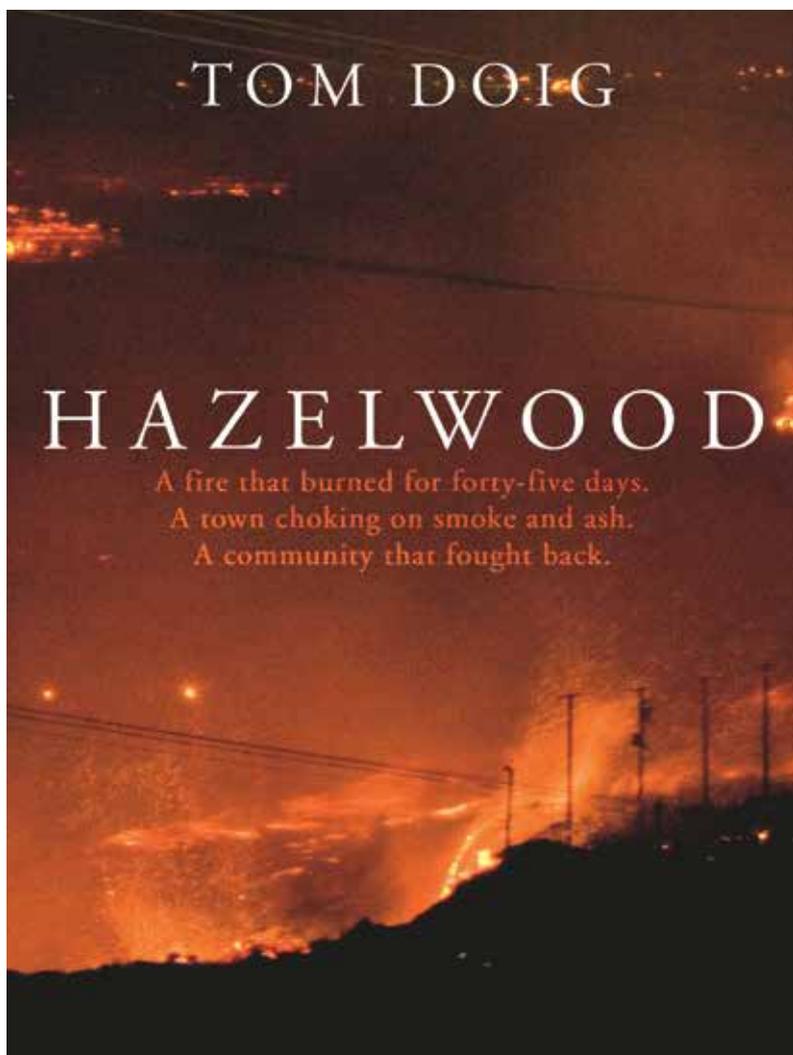
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“I can tell you that I’m looking at the mine now and the mine is burning.”

— Simon Ellis

Simon and his brother watched as the smoke moved steadily towards Hazelwood power station. Simon recalled, “It was an eerie feeling. You could see the smoke creeping towards you ... you just watched it creeping, creeping ...”

After a few minutes, the smoke thickened and darkened, and then it felt like it was coming from everywhere, swirling around and blanketing the entire town. That’s when Simon knew the fire had got into the mine.

As the afternoon wore on, Simon’s neighbours crowded onto his tiny verandah. They listened to the radio and checked the CFA website, trying to work out what was going on. ABC Gippsland radio reported that the Hernes Oak fire, which the CFA thought was contained, had flared up and spread along the Princes Freeway towards the mine, before the wind changed and pushed the flames just past the edge of Morwell

and into the timber plantations north of town. But Simon and his neighbours couldn’t see any of that—the smoke was too thick. As they sat there with their drinks, the mood was strangely festive. Simon took photograph after photograph as smoke billowed from one of Australia’s most profitable holes in the ground. The sun looked dark and cold, like an orange moon. The smoke left a strange metallic taste on their tongues.

At 8.16 pm that evening, Trevor Rowe, spokesperson for mine owners GDF Suez, was interviewed by Scott Bevan on ABC Radio.

“Earlier this afternoon the fires did spread into [the] norther batters of the Hazelwood mine,” Rowe told Bevan. “Fortunately, it’s an old, worked-out area of the mine and it’s some distance from our normal coalmining operation so [operations] haven’t been affected.”

Bevan asked: “If a fire were to get

into a mine, into coal seams, I guess, for a layman like me, what’s the threat? What’s the long-term, or indeed, the medium-term issue with that?”

“Look, our experience in years gone by, Scott, is that they are very difficult fires to manage,” Rowe replied. “But, as I said, this area is well away from our operating area, so we don’t have that concern.”

Simon thought that Trevor Rowe was trying to give listeners the impression that because Hazelwood was still supplying electricity to the grid, there was nothing to worry about. Once the interview had finished, he called the ABC newsroom.

“You’ve just finished speaking to some guy from the mine?” he said. “I’m sorry, but he’s talking a load of s_____”

The ABC asked Simon if they could put him on the air.

“Go for your life!” he said. And then, when he was live: “Some guy called Trevor Rowe has just come on the radio and said there’s no problem—but I can tell you that I’m looking at the mine now and the mine is burning.”

Bevan asked him if he was sure.

“As sure as I’m standing here. I can see both edges of the mine and I can clearly see fire coming from the middle of it.”

An hour later, the explosions started. At first everyone thought it was the old briquette factory to the east of Hazelwood power station, but Simon managed to film the second and third blasts in infra-red with his new camera, capturing the heat flaring up directly in front of the power plan—inside the mine. He called the ABC again, and they put him straight to air. He felt like a war correspondent.

“My name is Simon Ellis, I’m from Morwell in the Latrobe Valley, Gippsland. We’ve just witnessed three enormous explosions, over by Hazelwood power station ... And now we’re seeing what is probably fifty-foot-high flames, right now. All we can see is fire—I mean, it’s going so fast, it’s probably moved now, easy a couple hundred metres since I’ve been speaking to you ...”

When asked about the explosions, he said: “One minute you could see the haze of the orange of the low-lying fire, and then the entire sky just lit up.”

From Simon’s verandah, everyone peered between the trees that framed their view of Hazelwood power station, which was illuminated by the flames. Another explosion. In a blinding flash, all Simon could see was the silhouette of two little trees. ■

Extract from *Hazelwood* by Tom Doig, published by Viking 1 July 2020, RRP \$34.99.

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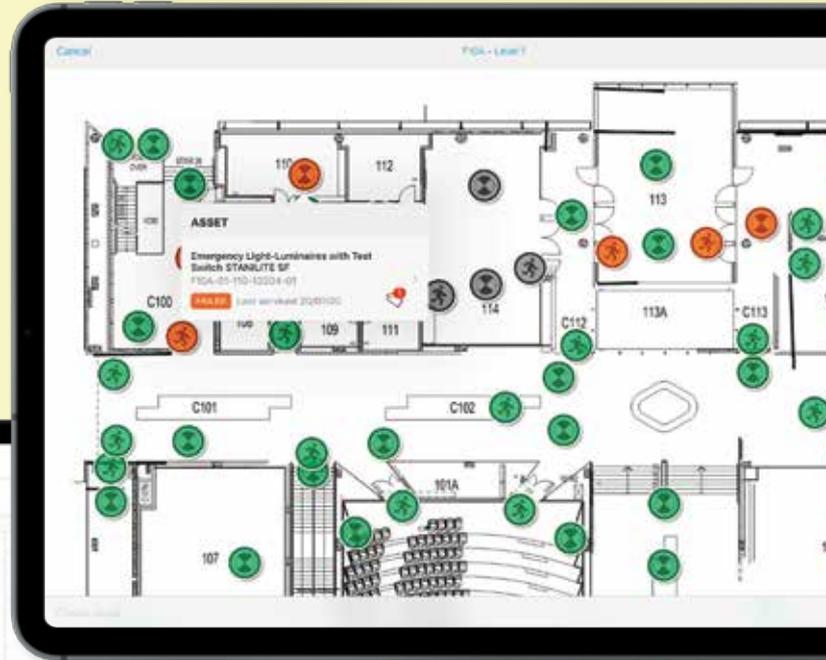
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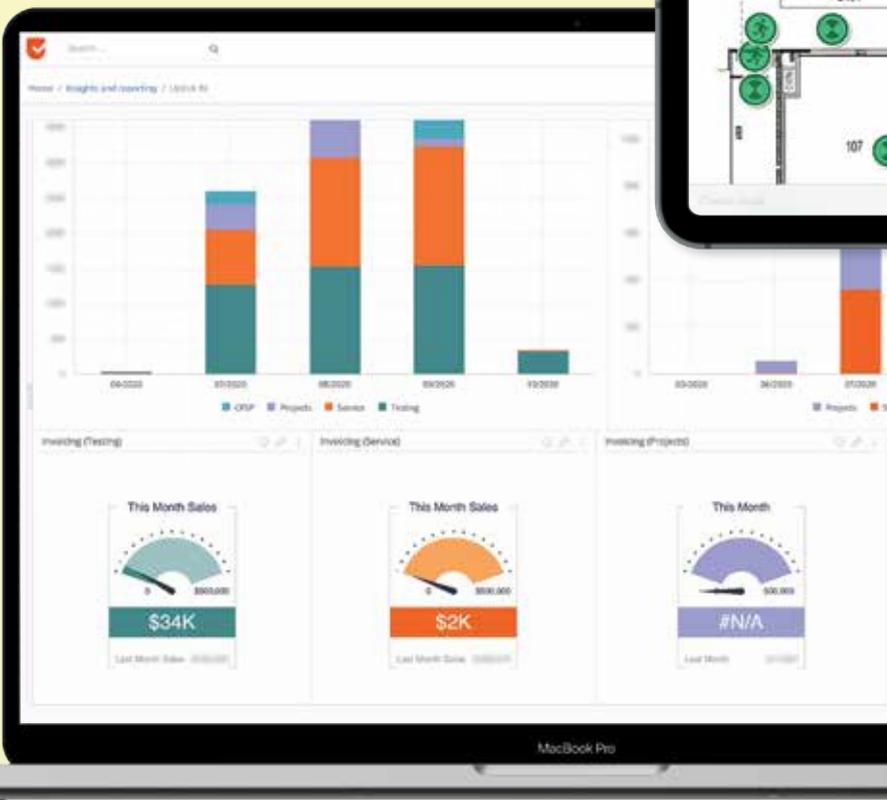


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RECOVERY: WHAT IS IT AND WHAT IS OUR ROLE AS FIRE AGENCIES?

With 30 years' experience as a firefighter and senior commander, chairing and contributing to several fire risk reduction committees and international working groups, and being recognised nationally and internationally for his work in risk reduction, Peter Wilding from Fire and Emergency New Zealand unpacks the definition and relevance of recovery within fire agencies.

BY **PETER WILDING**

National Manager Fire Investigation and Arson Reduction, Fire and Emergency New Zealand

Recovery is one of the four 'R's of emergency management (reduction, readiness, response and recovery) and has become a popular phrase in emergency management discussions, conferences, and on agency websites. But dig a little deeper and it becomes clear the word 'recovery' means very different things to different people. In some quarters, there is fierce debate about whether it applies to fire agencies at all.

Conversations with staff from different fire agencies reveal the absence of a common understanding or definition of recovery. The US Federal Emergency Management Agency's (FEMA) website says the aim of the recovery phase is to restore the affected area to its previous state.

NZ Civil Defence (NZCD) says recovery is "the coordinated efforts and processes to bring about the immediate, medium-term and long-term holistic regeneration of a community following a civil defence emergency". NZCD notes that recovery is not just about what happens after an emergency, but includes pre-planning to improve recovery. Notably, it states that the recovery process begins from day one of an emergency.

While NZCD and FEMA typically respond to major emergencies impacting communities across broad geographic areas, the needs of smaller groups or individuals recovering from localised emergencies are very similar, and can adopt the recovery principles applied to larger communities.

FEMA's *National Disaster Recovery Framework* lists five core capabilities. These are key areas of focus to aid recovery and are scalable depending on the incident (see table below).

Research on the recovery of victims of smaller incidents, such as house fires, identify similar needs to those who have experienced large-scale events.

Longitudinal studies of large fire disasters have identified long-lasting psychological impacts of

fires. Schneider et al., investigating the long-term effects of a large fire on its survivors, underscored the "overwhelming impact" of non-physical or emotional trauma on long-term outcomes.

Another study examined the long-term impacts for survivors of a hotel fire that occurred 25 years ago. More than 50% of participants stated the fire had a determining effect on their lives, and 21% of respondents indicated the fire still had an impact on their daily lives 25 years on. This led to the conclusion that "a traumatising experience (such as a fire disaster) can affect psychological health in a long-term perspective".

David Wales, a former Senior Officer with Kent Fire and Rescue Service, UK, led a research project that surveyed

FEMA-identified recovery needs at large community emergency events	Recovery needs for victims of house fires and other local emergency incidents
Economic recovery	Personal, family and business finances
Health and social services	Health, injuries and trauma care
Housing	Housing
Infrastructure systems	Jobs, schooling and transport
Natural and cultural resources	Personal assets—including items that give us identity, such as heirlooms and keepsakes



PHOTO: STUFF LIMITED

...fire is an experience, not an event. It's something people journey through rather than just encounter.

hundreds of house fire victims. A key learning Mr Wales observed from his research was that for fire victims, fire is an experience, not an event. It is something people journey through rather than just encounter.

A New Zealand study of people who had suffered a house fire revealed the initial experience most frequently referred to was shock. The study was conducted by Allan + Clarke Consulting and found many fire victims described being in a state of confusion, numbness or blankness. Researchers noted that respondents talked at length about their decision-making abilities being impaired. Some described being unable to accomplish basic tasks, such as operating their mobile phones. Survivors described a sense of powerlessness. They explained this confusion had continued for weeks after the fire. Some respondents described how a fire triggered previous trauma, including childhood trauma, as a result of the fire.

Many fire agencies produce carefully crafted 'post-fire' brochures that are

diligently handed out by crews at fire scenes before they head off for the next emergency call of the day. The brochures suggest actions fire victims can take after a fire, such as contacting their insurers, banks, supportive family members or friends. Fire agencies explain they may need to replace key ID documents, credit cards and other banking instruments, and should consider explaining the impact of the fire to their children's schools and to their employers. While the provision of this information is well intended, our research tells us many of these people are actually struggling to make the simplest of decisions.

People first

This paradox was recognised by the Kent Fire and Rescue Service (KFRS) following research on hundreds of fire victims in their county. It led KFRS to rethink its response focus and become deliberate in creating a customer-focused culture. This approach put the needs of those impacted by fire

at the heart of service provision. By intentionally capturing the experiences of those affected by fire through customer journey mapping, the KFRS purposefully sought to reorient its service over time, away from meeting the needs of the fire service to identifying and meeting the needs of the customer and building its service around those needs.

An interesting discovery from the New Zealand research was that sometimes fire victims were left feeling that the firefighters who responded did not care about them. Some of those surveyed said that during the emergency no one asked if they were okay. Respondents said they needed acknowledgement, reassurance and empathy. Some said they needed support and guidance to know what to do next. Families reported being left to sleep in their cars after their homes became uninhabitable after a fire.

With years of operational fire experience behind me, I know most firefighters have a passion to serve. Why then are we leaving some fire victims with a perception that we do not care?

Fire agencies are not resourced to respond to all the needs of fire victims, but we should be well aware of other agencies and groups who collectively can. The key is understanding our part in the process. During and immediately after an incident, we are the people

The needs of smaller groups or individuals to recover well from localised emergencies are very similar and follow the recovery principles applied to larger communities.

When we tolerate the ‘it’s not our job’ mindset, we segregate emergency response from outcomes for the victims of fire and other emergencies. Our focus becomes the event, not the wellbeing of the people affected by it.

on the ground whose readiness preparations and training should enable us to provide sound and well-informed advice to fire victims struggling to turn on their mobile phone. We are the ones who have the appropriate communications and networks to link victims of fires to those who can meet many of the complex needs described by Allan + Clarke Consulting and summarised by the five core capabilities that FEMA identified. This could be instant assistance, such as searching for a treasured recoverable item from a fire scene; urgent support, such as emergency housing or emergency finance until banking access can be re-established; or guidance to longer-term support, such as trauma counselling.

Engaging effectively with people who have just encountered the traumatic experience of a fire event does require some skill. Allan + Clarke Consulting recommended that firefighters be trained in trauma-informed practice, not to make them pseudo-counsellors, but to enable them to effectively engage with fire victims who may be overwhelmed or simply unable to articulate their needs. Trauma-informed practice uses a framework that recognises the presence of trauma symptoms and emphasises physical, psychological and emotional safety for survivors to help them rebuild a sense of control and empowerment to begin recovery. In fact, research suggests that when our operating procedures do not use a trauma-informed approach, the possibility for triggering or exacerbating trauma symptoms, and re-traumatising individuals, increases.

When we tolerate the ‘it’s not our job’ mindset, we segregate emergency response from outcomes for the

victims of fire and other emergencies. Our focus becomes the event, not the wellbeing of the people affected by it. After reorienting its thinking to place the needs of fire victims first, KFRS introduced a follow-up visit from the fire service the day after a fire event, where a suitably trained officer checks on the fire victims to identify further needs and assistance they may require.

A eureka moment occurred in my career when I attended a joint fire agency meeting in Australia where I learnt of two large fire events. One was a large wildfire that occurred in the south-west of Tasmania, responded to by masses of both ground and airborne firefighters and resources to combat the fire. The other was a very large wildfire that occurred in the vast outback of the Northern Territory, an area more than five times the size of New Zealand. Fire plays an important part in regeneration of Australian native vegetation and the total response to the fire in the Northern Territory was a small plane flying occasional patrols to map the spread and condition of the fire. This was a pivotal moment that drove home a learning I have never forgotten: it is not about the fire, but rather the impact fire may have. And notwithstanding environmental issues, people usually lie at the heart of our emergency response.

Recovery

So, if our prime focus is not just about extinguishing fires but about reducing the impact of an emergency incident on the victims, recovery should be treated as an inseparable component of our emergency response, and central to our planning and operational decision-making at incidents.

This linkage between operational decision-making and recovery outcomes

is brilliantly illustrated in the 2019 report *Saving Lives Is Not Enough*. The report examined how fire and rescue agencies in the UK can significantly improve the quality of life outcomes of burn injury survivors by being more cognisant of the broader customer journey than just the agency’s response. The report identified several common fire agency operational procedures and cultural processes at incidents that, if changed, could significantly improve healing times and the likelihood of achieving a scar-free outcome. The report also noted these changes would contribute to fewer financial and social burdens, and reduced physical and emotional trauma associated with burn injuries.

Readjusting our thinking about the service we deliver will, for most agencies, require a mindset shift to envisage after-fire support as integral to the role of the fire service. Our training, our pre-incident planning, our operational procedures, even our resource allocation will all need to be filtered through this new lens. Kristina Stiles and David Wales, the authors of *Saving Lives Is Not Enough*, encourage emergency agencies to see our organisations through the eyes of our customers, as they very often will identify improvements and opportunities that those within an organisation do not notice: “Having good intentions of being well meaning is not a substitute for truly understanding the customer.”

Health services have taken a lead in placing the needs of the patient at the centre of their service delivery. It is a lead most fire agencies would do well to take note. As with patients in the health sector, many fire victims will have contact with multiple agencies and parties over varying periods of time as their lives recover from fire.

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Mapping the customer experience across these interactions provides a clearer perspective of how the service is received throughout the full span of an event. Tools such as customer journey maps provide useful, evidence-based means to capture a more holistic overview of a customer's experience.

Rather than assessing our own performance while largely ignoring the experience and outcomes for the victims of the emergency, this method provides insights into the customer experience through their whole emergency and recovery journey. It is also more likely to lead to evidence-based improvements in practices across the emergency sector. All emergency agencies have different roles to play, but when our focus becomes the wellbeing and recovery of the customer, it changes our conversations, our incident strategies and our collective actions.

The consequences of fire can negatively impact lives for months, years or even decades. We know that early assistance and a focus on the wellbeing of fire victims reduces trauma, hastens recovery of physical injuries, and promotes holistic restoration after an emergency event.

Is recovery a process for fire agencies to be involved in? If extinguishing fires is our sole mandate, then so be it. But if our legislation requires us to reduce the harm and injuries caused by fire, then perhaps a better question is: why isn't recovery a core function and focus of what we do?

If that is the case, then every fire agency leader, manager and firefighter should ask: what part should my agency and I play in reducing the impact and harm caused by fires? ■



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STRUCTURAL STEEL FIRE PROTECTION IN AUSTRALIA



PHOTO: JAN HEIKE

Passive fire protection is considered the last line of defence when a fire cannot be contained, and active fire suppression systems are depleted or do not operate as expected. Maintaining structural adequacy on load-bearing members in a fire event is critical to the fire safety of building occupants, firefighters and the surrounding built environment.

BY **SAMIA RAZZAQUE**

Permax

Structural adequacy, integrity and insulation are the three components of a fire resistance level (FRL). The National Construction Code Volume 1, otherwise known as the Building Code of Australia (BCA), outlines the fire protection requirement for different buildings. Depending on the type of construction, in some cases where the structural elements function as compartment-separating elements, integrity and insulation may also be critical. However, it is important to note that most structural steel fire protection can only achieve the structural adequacy component of an FRL (e.g. 60/—/— or 120/—/—), as structural components are designed to withstand

the building loads, rather than separate compartments.

Fundamentally, structural adequacy of a building when exposed to fire requires structural engineers to ensure the loads acting on a structure in a fire event can be resisted by the capacity of the structural members and their connections at elevated temperatures. This involves understanding the effects of thermal expansion on the structure, thereby ensuring the structure has enough capacity and robustness to allow occupants to evacuate and allowing firefighters to suppress the fire and safeguard fire spread to surrounding buildings.

Load-bearing structural elements can be made of many different building materials. Common material types include reinforced concrete, timber and—the material most

commonly requiring passive fire protection—structural steel. These materials all behave differently in a fire event, depending on their inherent thermophysical and material properties. Steel begins to lose its strength at 215 degrees Celsius. Timber chars when the surface reaches 300 degrees Celsius, resulting in a reduced effective cross-section. Concrete has a low thermal conductivity, which is critical in providing insulation to steel reinforcement and thereby limits the loss of strength in the composite member.

Without fail, structural engineers document the required concrete cover to insulate reinforcement in a fire event or oversize timber members to allow for char loss within their design process.

So, why is it not common practice in Australia for structural engineers to document the same design detail when it comes to structural steel fire resistance?

Importance of limiting steel temperature on structural steel fire protection

Limiting steel temperature (LST) is critical as it specifies the temperature that the steel must maintain for the duration of the FRL in order to continue to support the design actions on the structure. Standard assumptions of 550 degrees Celsius for columns and 620 degrees Celsius for beams are

commonly used throughout industry in the absence of documented advice from structural engineers. Unfortunately, at times this can lead to an unconservative or overconservative design, which could lead to structural failure or additional material cost.

In the Australian structural steel passive fire protection market, product manufacturers and applicators face a difficult battle to ascertain the required LSTs on structural elements for every project.

Some structural engineers are fully aware of the LST calculations and are able to provide this information easily. On the other hand, some become irritated at the request to revisit a design in the construction phase.

At times, builders will hesitate to request the additional information from structural engineers, in anticipation of a variation for their time spent. It is important to notice each passive fire protection product has its own unique characteristics. Therefore, it is essential to ensure the building design team provide the correct information so a suitable system can be selected (see table right).

Requirements of the BCA

Structural fire design is not commonly included in the training of young structural engineers, which creates a gap within the industry from the

Why is the limiting steel temperature important to me?	
Architect	LST determines the ability for a steel section to achieve the required FRL member. If the steel section is checked against the required LST by the product manufacturer, it can be ensured no last-minute upgrades to steel sizes are required.
Structural engineer	Specifying the LSTs in structural steel documentation communicates the level of fire protection required so structural adequacy can be maintained.
Fire engineer	Obtaining the LSTs from structural engineers ensures the structural adequacy component of the FRL has been considered in the design.
Certifier	The LST supplied by the structural engineer needs to be checked against the material thickness calculated by the product manufacturer to ensure the structural steel has been adequately fire rated.
Builder	Passive fire protection to structural steel can be a costly task. If the correct steel sizes and LSTs are specified, it can save cost on fire rating product and eliminate the stress of last-minute changes.
Applicator and product supplier	In order to ensure the correct thickness of passive fire protection material can be applied, it is essential that the LST is provided.

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very beginning. This results in a lack of understanding about passive fire protection and building compliance in regard to the BCA.

The Part B1 Structural Provisions of the BCA requires the following:

- ◆ in B.1.1, the resistance of a building or structure must be greater than the most critical action effect on a structure, in accordance with B.1.2, B.1.4 and general design procedures of AS 1170.0
- ◆ as per B.1.2, the magnitude of individual actions must be determined in accordance with AS 1170.1, including actions not limited to thermal effects imposed on the structure
- ◆ B.1.4 specifies the structural resistance of materials for steel construction needs to be designed in accordance with AS 4100.

AS 4100-2020 Steel structures standard

Section 12 of the structural steel standard, AS 4100-2020, focuses on steel design under fire conditions. It details the calculation process required to determine the LSTs of structural elements. Specifically, Clause 12.5 explains the relationship of limiting steel temperature T_f , to the load ratio acting on the member r_f . Equation 1 below describes the method to calculate while Equation 2 shows the relationship between T_f and r_f .

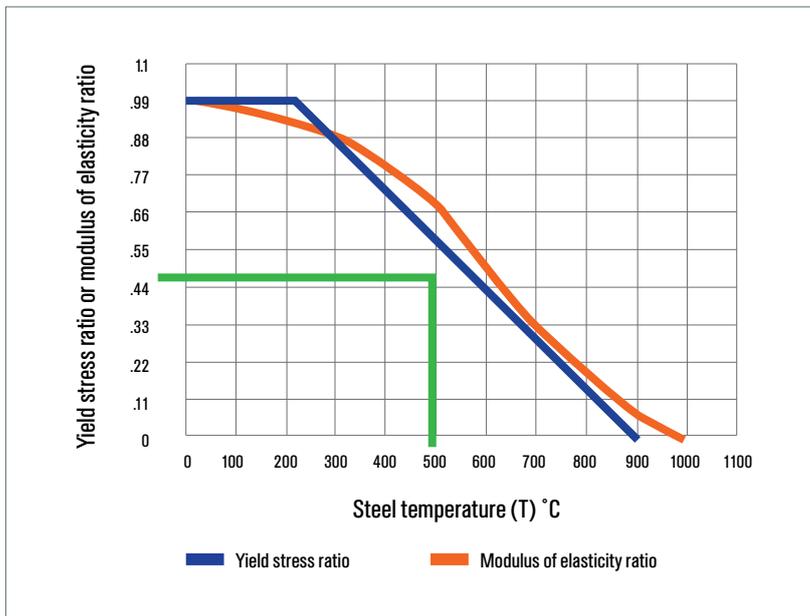
$$r_f = \frac{\text{Design load under a fire load case as per AS 1170.0}}{\text{Design member capacity at ambient conditions}} \quad [\text{Eq.1}]$$

$$T_f = 905 - 690r_f \quad [\text{Eq.2}]$$

In the design phase of a building, structural engineers ensure structural members are appropriately sized to withstand the most critical combination of design actions on a building, which includes the behaviour of the structural elements during a fire event. Documenting the design load under the fire load case against the capacity of the member can be a simpler process during the design phase of a project compared to revising at later stage.

With the correct LST specified, each product manufacturer can accurately calculate the sufficient fire protection thickness required, as per the relevant fire assessment reports.

FIGURE 1. Variation of mechanical properties of steel with temperature.



The risks of an unconservative design

If a steel column is fire protected based on an assumed LST of 550 degrees Celsius, the column is expected to retain approximately 50% of its strength capacity (Figure 1). In some cases, where the actual fire load on the structural element is greater than 50% of the member capacity, it can lead to an unconservative design eventually resulting in structural failure (see Figure 1).

The disadvantages of an overconservative design

Conversely, an overconservative design can significantly increase the cost of passive fire protection on the project and require unnecessary steel member upgrades. The thickness of a fire protection material required to fire protect a steel element to 700 degrees Celsius can be 60% lower than that required to achieve 550 degrees Celsius on the same member.

Often it can be seen that steel members require lower LSTs at the bottom of a structure as it is supporting more load compared to the upper levels. Therefore, in order to achieve the most cost-effective and safe building structure, it is critical that a multi-temperature analysis is carried out throughout a structure.

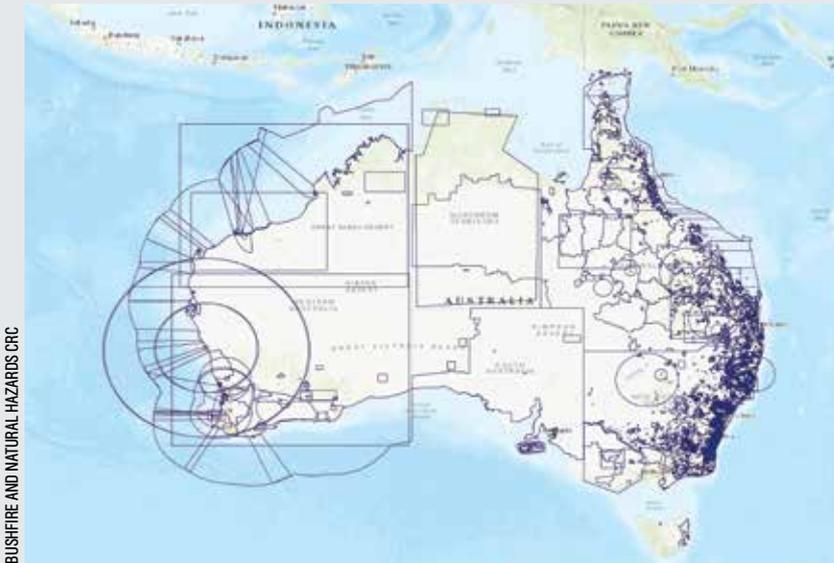
Industry passive fire protection guidance

In the absence of specific passive fire protection guidance in Australia, often the guidelines produced by the Association for Specialist Fire Protection (ASFP) in the UK are the only reference point. As an industry striving for compliance, similar guidelines and advisory notes for structural steel fire protection should really be produced locally, in particular for intumescent fire protection to structural steel.

The recently published ASFP Advisory Note 12 has been developed by intumescent manufacturers and installers to assure that intumescent coatings are specified in the correct way to ensure a structure is treated with the required level of fire protection. It highlights the responsibilities placed on the designers and specifiers to ensure the chosen fire protection system is fit for purpose.

The structural engineer needs to be involved in the passive fire protection specification process, as the ability for the fire protection system to achieve the desired FRL is directly linked to the structural behaviour. Applicators and product suppliers/manufacturers are continuously encouraging, educating and requesting structural engineers to specify required limiting steel temperatures in their steelwork specification. ■

UNCOVERING EXPOSURE TO NATURAL HAZARDS



BUSHFIRE AND NATURAL HAZARDS CRC

Understanding which environments are exposed to natural hazards is important in the response to and mitigation of such hazards.

BY **BETHANY PATCH**

Bushfire and Natural Hazards CRC

As Australian communities recover from one natural hazard and prepare for the next one, there are important questions to ask about the areas most exposed to possible loss of life, landscape and property.

We need to understand which buildings, businesses, public facilities, infrastructure, agricultural areas and natural landscapes, as well as how many people, are exposed to any natural hazard, human-induced disaster or structural failure. A clearer appreciation of this exposure is a highly valuable starting point for any sector that is required to prepare for and respond to hazards, not only in the response and warning phase, but also in mitigation.

The Australian Exposure Information Platform (AEIP) is an online platform that provides an accessible snapshot of all assets within a specified area, in the form of a customised 'exposure report'.

It was designed through a partnership between the Bushfire and Natural Hazards CRC, Geoscience Australia, the University of Melbourne, the University of Canberra and

emergency management organisations.

Chief of Division at Geoscience Australia, Alison Rose, explained the significance of the platform to the Royal Commission into National Natural Disaster Arrangements in early June 2020.

"The AEIP is an all-hazards capability, which provides exposure reports on demand at any scale," Ms Rose told commissioners.

Lead CRC researcher Mark Dunford from Geoscience Australia says these exposure reports provide a new, quick way of accessing important information that can be used for mitigation and operational decision-making for any hazard at any time within any specified area. This is essential information that helps improve safety, save lives and reduce damage to property and natural landscapes, and can be used not only by emergency management, but also researchers, town planners or anyone else who is interested.

"For the first time, everyone has direct 24/7 access to nationally consistent exposure information anywhere in Australia, through a user-driven, on-demand interface," Mr Dunford said.

"They can readily utilise exposure

information as a key piece of intel for critical pre-planning, or on-the-fly scenario event assessments."

The reports created by the AEIP draw on a wealth of data sources out of the National Exposure Information System (NEXIS) database, including local, state, federal and industry data; ABS demographics; environmental exposure data from the Department of Agriculture, Water and the Environment; and agriculture, business, building and institutional data.

The AEIP is already being widely used across Australia and has proven to be invaluable in a crisis, including during the devastating 2019–20 bushfire season, where 14,400 reports were generated. There are currently about 60 different entities that use the tool on a regular basis, half of which are emergency management agencies, with local government authorities and electricity providers also using it.

Anyone wanting to access the AEIP and its exposure reports can do so through the free online platform, aeip.ga.gov.au, or can integrate the platform into their own existing applications with an Application Programming Interface. This means users can create regular reports without having to leave their own system, which is the approach the NSW Rural Fire Service (NSW RFS) has taken.

Dr Stuart Matthews, Principal Project Officer at NSW RFS, describes the value of being able to integrate the AEIP into their internal fire simulator.

"The ability to integrate AEIP ... provides an excellent triage capability to support decision-makers in times of rapidly changing events as experienced in the unprecedented bushfire season of 2019–20," Dr Matthews said.

Throughout the 2019–20 fire season, AEIP showed how invaluable its information was in a crisis. By speeding up the delivery of vital exposure information, the AEIP's nationally consistent and easily accessible format ensures that information and decision-making can be calculated and coordinated across Australia. ■

You can find the AEIP at aeip.ga.gov.au.

End-user areas of interest (more than 14,000) for December 2019 to March 2020. This map shows that exposure reports were generated for both small and large areas, covering all states and territories. Dark blue areas show multiple AEIP queries, correlating with extreme weather events, e.g. 2019–20 bushfires.

RESILIENCE IN YOUR POCKET: FIRST RESPONDER MINDFULNESS APP



A mindfulness app tailored to the needs and experiences of Fire and Rescue NSW staff promotes self care and wellbeing among the workforce.

CREDIT: FRNSW

Firefighters operate in high-stress environments that can expose them to potentially traumatic events. A collaboratively developed mindfulness app is building personal resilience in firefighters early in their careers to support mentally healthy workplaces.

BY **ALANA BEITZ**

AFAC

A collaborative project between Fire and Rescue NSW (FRNSW), the Black Dog Institute, the University of New South Wales and Mindarma has produced a mindfulness app customised for FRNSW firefighters and supported by a body of research that evidences its impact on staff well-being.

Mindarma (formerly Resilience at Work (RAW) Mind Coach) is an app that can be used on a smartphone, tablet or computer. It comprises ten interactive sessions containing animations, quizzes and games for users to work through. These modules are supported by guided mindfulness audio exercises, a curated library of articles, podcasts, videos and book recommendations, and newsletters to support ongoing engagement and learning.

FRNSW was awarded the Stewart and Heaton Leading Practice in Mental Health Award in 2019 for the development of the Mindarma program. As a component of the award, the project was featured at this year's

Leading Practice in Mental Health masterclass event, held as an online webinar event on 15 September 2020.

Research conducted during the roll-out of the Mindarma app found firefighters who completed the training reported increased adaptive resilience, mindfulness and levels of optimism, and were more likely to seek advice and support from others. During the online masterclass event, Mindarma Co-Founder and Fellow at The Black Dog Institute, Dr Sadhbh Joyce, said this help-seeking behaviour was critical to building a mentally healthy workplace.

"There will be tough days on the job. Reaching out for help is always an act of resilience. We cope better with change when we do so with our support networks," she said.

A key function of the Mindarma app was to change the narrative on resilience within the FRNSW workforce, explained Dr Joyce.

"One of the challenges is the many varying interpretations of resilience. It is common in our culture to view it as being tough, but resilience is a dynamic process and we can adapt it over time. There are specific skills and strategies we can use to build our resilience.

"We need to view resilience as something that will naturally fluctuate, particularly after experiencing stress. This app helps users find techniques that resonate and work for them to maintain their resilience."

One of the biggest benefits of the Mindarma app for FRNSW was

that it could be scaled and delivered to their entire workforce dispersed across the state. FRNSW Occupational Psychologist Traci Carse said the app provided a level of support to their staff that was previously unattainable.

"From personal experience I know the benefits of meditation and mindfulness exercises. If I could teach mindfulness to all 7,000 plus members of our Fire and Rescue staff, I would. Mindarma is a scalable model to share the practice with our whole organisation," she said.

FRNSW Manager Health Promotion Brendan Mott said the organisation took their responsibility for staff well-being seriously, and this began with breaking down stigma, encouraging help-seeking behaviour and prioritising self-care early on in careers.

"What I've learnt in this profession is that self-care drops away really quickly. The sense of purpose for first responders and providing critical support to others eclipses taking care of their own minds and bodies. Many burn out because self-care drops off their priorities," he said.

"Self-care must be foundational and paramount. Self-care is not selfish. If we ignore it, at some point we will become unbalanced and injure ourselves physically or emotionally." ■

The Leading Practice in Mental Health webinar series is available to view via the AFAC YouTube channel: www.youtube.com/channel/UCu18IYmKgFcL27XBKF17Klw.

"Reaching out for help is always an act of resilience."

— Dr Sadhbh Joyce

Warringtonfire launches Certifire AU product certification scheme



Warringtonfire Australia has established an independent third-party certification scheme, Certifire AU, which will provide manufacturers of fire protection products and systems with the opportunity to differentiate themselves from non-certified equivalents and provide long-term confidence to specifiers and end users.



Certifire has a history of over 30 years and is widely recognised and accepted in the UK, Europe and the Middle East, proving to be a viable scheme that has improved the quality of the construction industry.

The Certifire AU scheme is progressing towards accreditation as a conformity assessment body (CAB), which will complement Warringtonfire Australia's current fire-testing laboratory (accredited by National Association of Testing Authorities, Australia), fire safety engineers and fire assessment consultants.

What is passive fire product certification?

Passive fire product certification is the process of certifying a product has passed fire performance and quality assurance tests and meets the relevant qualification criteria stipulated under the certification scheme.

The evidence accepted under the scheme will be products tested or successfully assessed in accordance with Australian standards. An important part of this certification scheme is the annual factory production control auditing, which ensures consistency of manufacture to the originally tested product.

The need for passive fire product certification in Australia

There is currently no requirement for ongoing testing of a product, and based on a single test, a product can be manufactured and sold for the lifetime of that product, regardless of when the testing was carried out.

This poses an issue as the quality of the mass-produced product compared to that submitted for the original fire-resistance test is uncertain. Even if there is no intentional change to the manufacturing process of a particular product, over time there will be changes in equipment, staff, experience, source of raw materials, etc., and each of these areas can impact the quality and composition of the product, which, in turn, could affect its stated performance. There is no way to quantify this gap in the construction industry, hence the need for product certification.

Certifire AU scheme

Warringtonfire Certification's Certifire AU scheme includes the following stages:

Evaluation—Analysis of submitted test/assessment data and evaluation of the product, resulting in a defined scope for certification. This will be used as the basis of information for the certificate/approval.

Factory Production Control (FPC) audits

Manufacturers will be required to undergo an FPC audit, in accordance with ISO 9001, at each location that produces the product where certification is sought.

Sampling—During the FPC audit, sampling of the product undergoing certification may be carried out for the purpose of performance testing at an accredited laboratory.

Production and registration of certificate—Product certificates are prepared, based on positive evaluation of supporting data/tests and FPC audit. Certificates will be uploaded to the Warringtonfire product register.

Surveillance audit—This audit will occur every 12 months to ensure that the factory production control systems continue to meet the qualification criteria.

Ongoing requirements—A review of the product will occur every five years, at which time retesting of the product is required to ensure the product being produced for the marketplace continues to meet the qualification criteria.

To find out more about how the new Warringtonfire Certifire AU scheme can help your business, please contact Chad McLean on 0400 059 930 or email chad.mclean@warringtonfire.com.

EYE ON THE SKY: THE FUTURE OF AERIAL FIREFIGHTING

Over three webinar events and an online interactive workshop, the National Aerial Firefighting Centre explored the pressing question: what does tomorrow look like for aerial firefighting?

BY **ALANA BEITZ**

AFAC

The National Aerial Firefighting Centre (NAFC) Aerial Firefighting Webinar Series replaced a fire and industry workshop scheduled for November 2019, which was postponed due to bushfire activity. The second attempt to hold the workshop, in April 2020, was also deemed untenable due to COVID-19 restrictions. While the unprecedented fire season, followed closely by pandemic, prevented these aerial firefighting meetings, both gave rise to critical new considerations for aerial operators and fire agencies alike.

The NAFC Aerial Firefighting Webinar Series was moderated by Fire Emergency Manager, Recovery Coordinator and former Chair and inaugural board member of NAFC, Euan Ferguson, who encouraged a future-focused discussion between presenters and attendees.

“What does tomorrow look like? That is a recurring question we need to keep in mind. The overall objective of these webinars is to create a direction and a vision for what tomorrow might look like for aerial firefighting,” he said. The first two webinars invited representatives from fire agencies, research and industry to share their observations of aerial firefighting in

Australia and to map the future direction. The third event hosted discussions from NAFC General Manager Richard Alder and Business Manager Josephine Stirling, as well as AFAC CEO Stuart Ellis and District Manager from NSW Rural Fire Service Viki Campbell.

Webinar one: Aviation in action

Tasmania Fire Service (TFS) Chief Officer and NAFC Chair Chris Arnol opened the virtual event series with his reflection on the use of aviation in Tasmania. He pressed that aerial firefighting was “not a silver bullet” but could assist in addressing current and emerging challenges for fire agencies, such as volunteer management and climate change.

“Aircraft are a major advance for our sector. At the turn of the 20th century, fire stations were placed in each town, you could send the first truck out, go around the corner and put the fire out. But now volunteers aren’t available all the time, they’re more available in the evenings, and many have migrated to larger towns,” Chief Officer Arnol said.

“We still need the boots on the ground to put the fires out, but our tactical approach has shifted. Now we use aircraft to hold the fire until we get

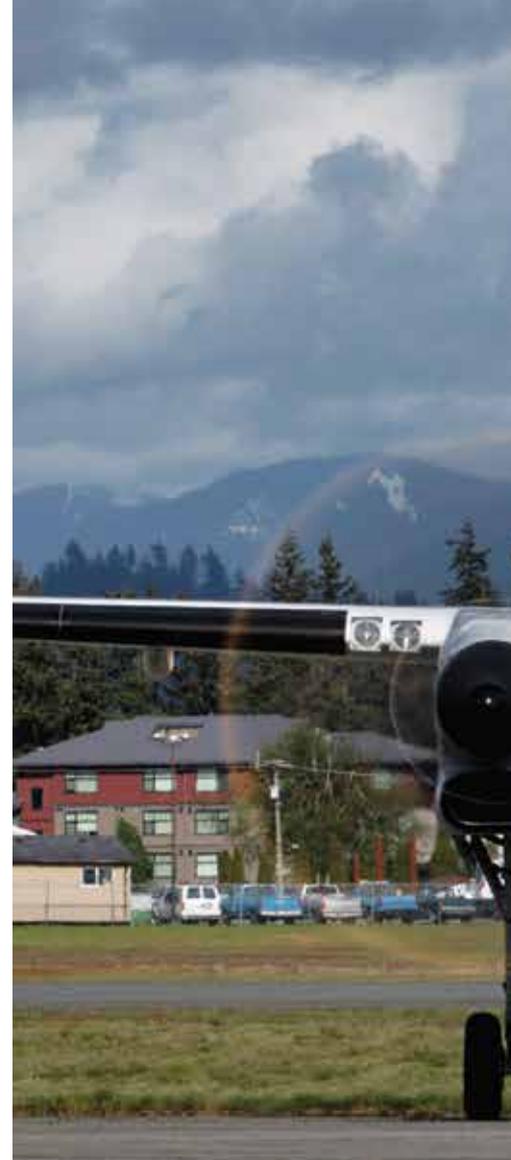


PHOTO: CONAIR

enough volunteer numbers to send a strike team for initial attack.”

He added that aircraft will play an increasing role as bushfires become more frequent and complex due to climate change.

“With changing climate, 2,402 dry lightning strikes left Tasmania with about 70 ignitions in the 2018–19 season; once it would have left us with about seven or so. How are we going to deal with lightning that leaves us with all of these multiple ignitions? I think aircraft, particularly in remote locations, are going to play a big part in this going forward.”

Chief Officer Arnol reflected on the 2018–19 Tasmania fires and the fleet of 38 aircraft in the state that season, including seven contracted by NAFC, to discuss learnings about best deploying resources for effective and economic outcomes.

“We almost had more aircraft than



“We need to ensure that when someone says something to improve whatever is at hand, it’s not taken as a fundamental criticism of the way we do our work.”

— Phil Hurst, CEO, Aerial Application Association of Australia

we knew what to do with—and the importance is knowing what to do with them. In the fog of war, we are a bit reactive and we weren’t using them as effectively as we wanted,” he said.

Backed by research

Chief Officer Arnol identified having an evidence base to inform the use of aircraft as one of the leading areas of focus for the future of aerial firefighting. He added that more research will help agencies to better employ aerial assets and provide the business case for investment in a resource that, while costly, can significantly reduce the impacts of bushfire on communities.

“Tasmania’s total firefighting cost was \$58.1 M for the 2018–19 season. And the aircraft cost a lot of money, about 50% of our costs. But I compare this to the 1967 fires of a comparable size where 62 people died in Tasmania

and 7,000 were homeless or displaced. In 2018–19 there was no loss of life, six homes were lost, and limited damage to infrastructure—and aircraft played a big part in that,” he said.

Dr Matt Plucinski of CSIRO Land and Water echoed this sentiment in his presentation, stating it was important to generate the evidence to justify investment in aerial firefighting and ensure it is used effectively when employed.

With a focus on what tomorrow’s aerial firefighting strategy will be, Dr Plucinski aptly reminded the webinar audience that some challenges facing the practice are now decades old, highlighting an example of an assessment by CSIRO of the Modular Airborne Fire Fighting System (MAFFS)/Hercules operations in Victoria in 1982 that read:

“There is certain to be considerable pressure to employ air tankers on large fires during extreme weather when they

are unlikely to be effective.”

Dr Plucinski said further research will support better use and understanding of the capability and limitations of aerial firefighting, giving a detailed overview of the recent research work that has taken place both in Australia and internationally, including Large Air Tanker deployment, retardant testing, strategic operations and night suppression activity.

Drawing upon the Bushfire CRC Suppression Project’s Strategic Level Operations Study, Dr Plucinski shared the findings of when aircraft make a difference during bushfire response.

“Aerial suppression is most effective in reducing fire containment time when wildfire suppression conditions are difficult because of fuel hazard rating, weather conditions, slope, resource response times and area burning at initial attack,” he said.

COVID-19 safety restrictions added a layer of complexity to the arrival of a Q400 Large Air Tanker to Queensland this year. Adapting to the COVID-19 environment was just one of many topics explored in the NAFC Aerial Firefighting Webinar Series.

Webinar two: COVID-19 industry impacts

The future-focus discussion continued in the second webinar which gave a platform to industry representatives.

Aerial Application Association of Australia CEO Phil Hurst opened his presentation with the immediate challenge of COVID-19 on the sector and mapped some of the considerations required by industry and agencies. He highlighted safety and communication as key to navigating the complex environment.

“COVID-19 is a very dynamic issue, and the more dynamic an issue is, the more you have to communicate. The cross-border issues are really testing us and we’ve seen changes on almost a daily basis, so we’re really following that as best we can and communicating with our members.”

“You must have a COVID-safe plan if you’re going to be doing aerial firefighting this season. COVID-19 runs a layer of complexity over everything we do this season and we need to put safety first,” he said.

Adhering to border restrictions, updating contracts, securing essential service status, complying with quarantine and isolation requirements, anticipating maintenance delays and managing crew rotations were just some COVID-19 considerations highlighted by Mr Hurst during the webinar. Despite so many competing factors, he said crew well-being should remain at the centre of COVID-safe plans.

“It’s perhaps not obvious, but the mental health management of pilots in isolation, particularly on campaign fires, is going to be an issue. Normally the crew room is a happy place to talk about what happened during the day, to think about better ways to do things, to share information and knowledge. We need to be aware that with COVID-safe environments we may lose that for pilots and crews,” he said.

Partnerships

Mr Hurst concluded by stating that the best way to secure a successful future for aerial firefighting in Australia was through government partnership with industry and fostering a culture of continuous improvement.

“We are firmly of the view that the most effective place for the tax dollar is looking at a partnership with industry so we can have a longer-term relationship and can work together to build the Australian domestic capacity to whatever we need,” he said.

“The culture of our industry is also critical. We need to ensure that when

someone says something to improve whatever is at hand, it’s not taken as a fundamental criticism of the way we do our work; we are trying to improve. That is to be encouraged, not to be shot down. When you’re talking about continuous improvement, make sure you’re talking about a just culture.”

President of the Australian Helicopter Industry Association Captain Ray Cronin agreed that many improvements and innovation could be generated through closer partnership between industry and agencies.

“It’s important that we don’t stifle innovation and we develop our own systems and solutions for the future. The industry has a wealth of experience that is often ignored and untapped, and we want the agencies to know we have a lot to offer,” he said.

“The competitive nature of operators will drive innovation, and has done, and operators are generally well ahead of the agencies, for example in the area of night initial attack. The industry is responsible, responsive and it will accept the challenge when you throw it out there.”

Change for the future

Mr Cronin highlighted the rapid change of the aerial firefighting sector as the impetus for working toward a stronger and more sustainable national aerial firefighting capability.

“We’ve been in this game over 27 years, and we’ve seen the fleet transition from nearly all foreign-owned aircraft to a significant in-country capability. When we started we had 90-day contracts, now we operate between seven to eight months. The opportunity to work with foreign operators and earn income in the other hemisphere is really dissipating, and that is part of the sustainable future we need to think about,” he said.

“One important thing we must acknowledge, if tomorrow is going to look anywhere near sustainable, solid and strong enough to handle what the environment is throwing at us, is that we have to build Australia’s capability to protect our sovereign risk.”

Webinar three: Future focus

The third webinar focused on the series’ overarching question: ‘What will tomorrow look like?’ with NAFC General Manager Richard Alder discussing the findings of a recent survey sent to participants prior to the start of the webinar series. The results found 96% of respondents agreed there is room for improving the efficiency and effectiveness of aerial firefighting. Respondents identified the greatest

potential areas for change are in improved resource sharing, better analysis of costs and the effectiveness of resources, as well as national training and education.

NAFC Business Manager Josephine Stirling spoke to the need for cultural change within the industry and how COVID-19 has changed the way we work by promoting flexible working conditions. She issued a challenge to agencies to apply a broader lens—a gender lens—to reap the benefits of better culture, better decision-making and better performance, which stem from teams that employ gender balance.

NSW Rural Fire Service Superintendent Viki Campbell discussed how the use of aerial assets has multiple applications for integration into fire incident management. She added that there is significant anecdotal evidence from last fire season that the dispatch of aerial assets for fire-bombing, together with ground crews at initial call receipt, had a greater likelihood of early containment and keeping fires as small as possible.

AFAC CEO Stuart Ellis concluded the webinar by announcing the development of a national strategy to maximise the potential benefit of aerial firefighting, and to keep communities safe and minimise loss. The NAFC Strategic Committee will consider ‘Where do we want to be by 2025? And how are we going to get there?’ The strategy will be informed by outcomes various jurisdictional inquiries and the Royal Commission, the survey results and the content from the webinars and workshop.

The NAFC webinars culminated in the 2020 virtual NAFC Strategic Workshop on 17 September 2020, attended by 36 participants from agencies around Australia and New Zealand. The workshop reinforced the need to move towards a national aerial firefighting strategy and explored three key themes:

- ◆ How do we make existing aerial firefighting systems safer and more effective?
- ◆ What does tomorrow look like?
- ◆ What do we need to do to get tomorrow to look like that?

Each state and territory provided a presentation on ‘what tomorrow looks like’ for their jurisdiction. Participants were placed into five breakout groups to discuss five different elements affecting aerial firefighting. All the actions raised by the breakout groups and subsequent plenary discussions have been captured and will provide valuable input for the development of a national aerial firefighting strategy. ■

LET'S NOT WASTE ANY MONEY ON PASSIVE FIRE PENETRATIONS

It is important to understand and comply with regulations around passive fire penetrations.

PHOTO: JP VALERY

BY **PETER BLAIN,**
PLUS PASSIVE FIRE

As inspectors and certifiers, we see so many non-complying passive fire penetrations that require reworks or, in some cases, to be pulled out and restarted. This lack of planning is costing the construction industry and owners unnecessarily, not to mention the incorrect and expensive systems being installed without considerations of new cost-effective methods.

A 2019 Deakin University study found that fire is the second biggest defect in new buildings, and 67% of these defects are passive fire-related. It is therefore no surprise that an estimated 30–40% of construction litigation surrounds passive fire issues, which may be preventable by getting it right the first time.

Further, under legislation the works may be reinspected and sooner or later a certifier, a fire brigade or building inspectors may defect the work and building owners will need to rectify at their cost.

Another key loss that will further affect the financial stability of business is the loss of reputation. There have been cases where defects have held up building handover with the obvious financial and professional ramifications.

Passive fire is an integral component of fire protection in a building, which is designed to compartmentalise fires and

slow their spread, ensuring occupiers can escape and fire services can access to fight the fire. Every penetration installed in a building, such as water pipes, air conditioning pipes, electrical sockets, cable trays and lighting units, can compromise the fire resistance of a room by creating openings in its walls, floor and ceiling.

The role of passive fire protection, should the worst happen and fire break out, is to seal the gaps these penetrations create.

Some common defects associated with passive fire protection

To avoid defects it is crucial to understand the legislation surrounding passive fire and the on-site requirements for meeting compliance standards. The following list can be used as a guide when dealing with some of the common passive fire defects that are associated with contractors:

- ◆ fire separation walls not complying or not extending full height or over eaves
- ◆ penetrations fail on fire resistance levels (FRL) insulation criteria, e.g. unwrapped metal pipes
- ◆ not thoroughly reading plans when setting collar location causing clashes
- ◆ the wrong assumption that more caulking will fix everything
- ◆ fixings not to manufacturers specification, e.g. nylon anchors melt and both layers of plasterboard not

- having correct screw centres
 - ◆ stack collars on floor wastes—showers and floor wastes have the correct collars
 - ◆ mixing and matching different manufacturers' products
 - ◆ too many services in one hole, or separation distances between services being too small
 - ◆ joint sealing missing or incorrectly applied
 - ◆ light fittings penetrating fire-rated ceilings
 - ◆ understanding that once an already-certified penetration is interfered with, the liability is on the person who made the change to have it recertified - 'if you touch it, you own it'
 - ◆ failing to create enough evidence—photos, marked-up plans and penetration registers
 - ◆ not using systems tested under AS 1530.4
 - ◆ leaving concrete in trigger points.
- If there are any doubts about the best way to ensure passive fire protection in a construction is compliant, seek the advice of a licensed certifier before works start.

The FRL of the building element must be understood to ensure the system installed is in line with the National Construction Code. This way, not only is work going to comply, there will not be costly reworks to gain the required certification, saving valuable time and money. ■

THE FLOOD

A (very inaccurate) telling
of the possible dangers of
routine service ...

BY PAUL WATERHOUSE

I could have told the story of a drover on the plains
Who guided mobs of cattle both through drought and pouring rain,
Or focused on the foibles of a far-flung country town,
Or chronicled the passing of a person of renown.

Such tried and tested topics no doubt promise to engage
(And may perhaps encourage readers not to turn the page),
But I'll leave all those tales (and many others) to the rest —
Instead, let me recount a tale about 'inspect' and 'test' ...

Jim strode towards the building with a sense of ownership,
His mobile in a holster on the tool belt on his hip,
And looked around the premises he came there to survey —
In other words, for Jim it was just any normal day.

He met the client at the door, a cheery "G'day mate!",
And glossed over the fact that he was 20 minutes late,
Then, calling the apprentice, with a purpose made his way
Down to the building's pump room, where he'd set up shop that day.

He started with his pump test, and did not suspect a thing,
When suddenly his mobile phone began to buzz and ring.
Young Jack, the new apprentice, from the basement placed the call,
Which puzzled Jim — he didn't see a need for it at all.

"Um, boss?" said Jack, a little bit of panic on the phone,
"Did we forget to do something?" he nervously intoned.
"I know you're keen on value, and these cars are rather posh,
"But did your routine service quote include a little wash?"

"What are you saying?!?" bellowed Jim, "Come on lad, spit it out!"
"This car park's filling up so fast, I think I saw a trout..."
At that Jim paled and, racing to the scene, he saw the sump
And very quickly realised that they'd overwhelmed the pump!

"Turn off the water!" Jim exclaimed — the valve could not be found!
They raced outside to see if they could find one near the ground.
To no avail — there was no sign of what they hunted for
Because someone had paved it over several weeks before!

The waters rose, and lots of cars looked like they soon might float —
But Aston Martins (not from Bond) cannot turn into boats —
And, as Jim watched, the quieter life for which he long had saved
Was slowly disappearing 'neath the ever rising waves.

Jim racked his brains, and set upon a way to save his _rse
And find himself an exit plan from this here major farce
He grabbed his phone from off his belt and (as the water poured)
He started punching in the number for the Water Board.

When they at last arrived there, they switched off a valve or two
But nothing seemed to help that much, no matter what they'd do.
They kept on switching valves until they had no valves to go
And finally, just finally, they stopped the steady flow.

While Jim was very thankful, there were others not so much
As they were interrupted in the shower, loo, and such.
The Water Board had not just halted water to Jim's lot —
They'd isolated more than half a dozen city blocks!

Jim looked out at a murky sea that swallowed up the floor,
The water'd done its damage, at a metre deep or more.
It rose up to the light switch and the lift shaft was a pond —
A wiser man would view the scene and quietly abscond.

He looked across to Jack, who on a Beamer was now perched,
With focus firmly on his phone, as if in deep research.
His finger stabbed upon its face, his own was turning pink:
"I cannot get the thing to work, I dropped it in the drink!"

Crestfallen, Jim soon calculated costs from this failed test —
The cars, the lift, electrics, cranky neighbours, and the rest —
The exercise was going to cost a bit more than a quid —
Perhaps his only chance was if he went and sold the kid ...?

He went to call his broker, who he'd known for many years
(He always quickly paid his dues, was never in arrears).
Old Charlie was an expert, he would know just what to do.
He confidently figured his insurer would come through.

The phone, it started ringing, as he clenched it in his fist,
The steam out of the lift shaft wrapped around him like a mist,
An operator answered, and her voice made all hope fall:
"Oh, welcome to Barbados, how may I direct your call?"

**Disclaimer: Written by someone who has not ever performed
a pump test or conducted routine services. All errors are Paul's
and he hereby gives an unconditional apology for each of them.**



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PERSPECTIVES ON THE SECTOR

WITH CHRIS HARDMAN

**STUART
ELLIS AM**

Chief Executive Officer,
AFAC



In this regular series, AFAC CEO Stuart Ellis interviews a senior AFAC leader for each issue of *Fire Australia*. This issue he spoke with Chris Hardman, Chief Fire Officer of Forest Fire Management Victoria.

What was your background coming into the Chief Fire Officer role?

Before becoming Chief Fire Officer (CFO) of Forest Fire Management Victoria (FFMVic), I spent 32 years working in natural resource, parks reserve protected area management.

I started on the crew, took on my first leadership role in 1997, and moved into senior management as a Chief Ranger, Dandenong Ranges Area with Parks Victoria in 1996. Things 'got real' very quickly in January 1997 when we had a series of arson attacks, which resulted in the death of three people in the Dandenong Ranges. It was that day when I knew I wanted to see if I could make a difference in bushfire management.

I first put on the Incident Controller tabard during the 2002–03 Alpine fires, then the 2006–07 Great Divide

fires, followed by the devastating 2009 Victorian bushfires, with lots in between.

At the end of 2009, I reached a crossroad and I took a step back from fire to focus on other areas of my career. After a break, I realised that I still had a lot to give the emergency management sector, so I jumped back into the fray and applied for the Chief of FFMVic. The rest, as they say, is history.

Can you provide us with a brief overview of Forest Fire Management Victoria?

FFMVic was established in 2016 within the Department of Environment, Land, Water and Planning (DELWP). It is the name we use for all public land firefighters, including staff employed by DELWP, Parks Victoria, Melbourne Water and VicForests.

The establishment of FFMVic was a great way for people to recognise and appreciate the important work we do, and the skill that comes as part of this work.

Our aim is to reduce the risk and impact of bushfires on Victoria's parks, forests and other public land, and to respond to all bushfires on public land. We are responsible for planned burning and preparedness activities, such as slashing, mowing and creating fuel breaks on public land. We also maintain water points and fire towers in our forests and parks, and manage public land and environmental recovery after a bushfire.

We work with the Country Fire Authority (CFA), other emergency services and local communities year-round to protect people, property and our iconic landscapes.

The establishment of FFMVic was a great way for people to recognise and appreciate the important work we do, and the skill that comes as part of this work. Our aim is to reduce the risk and impact of bushfires on Victoria's parks, forests and other public land, and to respond to all bushfires on public land.

Chris Hardman, Chief Officer, Forest Fire Management Victoria

Our emergency management capability continues to expand beyond fire as we adapt our skills for all emergencies, all communities.

How does it all work with Emergency Management Victoria?

We really do work as one team. We have well-defined roles and responsibilities, operational procedures and shared values that maximise our particular skills and enable the emergency management sector to work together and achieve outcomes that best serve the community.

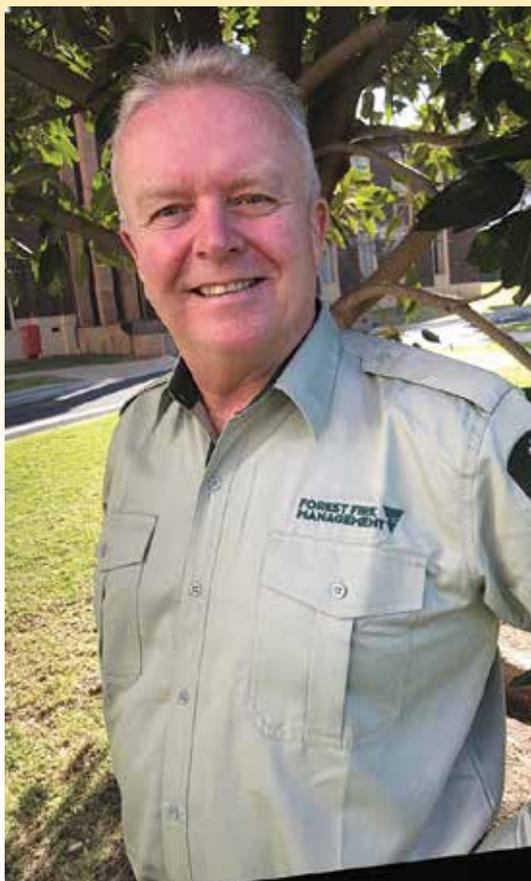
What are your major reflections from the very difficult fire season last summer?

First was the loss of life across Australia and the loss of the firefighters, but experiencing the loss of Bill, David and Mat from FFMVic was tough for everyone in our team. The fact that those firefighters will never go home again is still something I think about every day, and it motivates me to continually improve the way we operate to ensure this doesn't happen to anyone else.

From a fire management perspective, I could not be prouder of the work my team did with all of their brothers and sisters in arms. We have a long history of large, devastating fires in Victoria, but never starting so early, so in that sense they were certainly unprecedented. I flew over some of the fires just a few days after they started. We'd had nearly 15 millimetres of rain just 20 hours earlier and the fire was still crowning up slope, such was the soil dryness and the availability of heavier fuels.

I also saw more column-driven fires in our 2018 season, which was repeated again in the 2019–20 season. Our wet forests/rainforests, gully systems and eastern and southern slopes were all burning readily.

The highlight for me was when we took more than 500 forest firefighters out of the bush and stood them beside their mates in the CFA and protected townships by bringing their skills to machine and burning operations in support of communities that lost so much.



Left:
Chris
Hardman

Our emergency management capability continues to expand beyond fire as we adapt our skills for all emergencies, all communities.

Chris Hardman, Chief Officer,
Forest Fire Management
Victoria

In the wake of the Royal Commission, what national initiatives would you like to see implemented?

I have a fundamental belief in evidence-based approaches that maximise the use of innovative technology and resource availability.

A national approach to research, development of systems and processes to aid our ability to be more effective and safer in doing the work we do makes sense.

Commonwealth support is extremely valuable with logistics and planning when the state asks. I think seamlessly tapping into these resources will be a way of the future.

The recommendations from the Royal Commission and the other inquiries within Victoria present us with great opportunities to improve the way we operate and ultimately protect the community.

I believe that FFMVic has a culture of improvement and that we get the job done. So, whilst the Victorian Government is still working through the process of developing a government response, we are always looking for ways to develop, improve and collaborate, to ensure the protection of Victorians and the landscape they love.

How is COVID-19 impacting on the operations of Victorian agencies?

Fire season preparedness for the 2020–21 season is very different to any other year that I have seen, due to COVID-19 and the challenges this has thrown at us. That said, we are well advanced thanks to the collective work of our team.

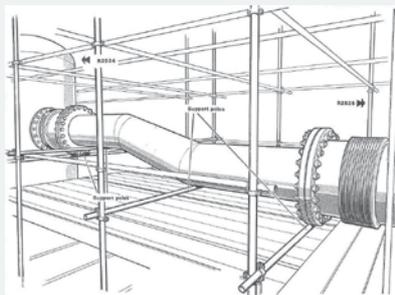
We have had the benefit of working closely with the US and Canada and learning from their experiences with the Northern Hemisphere summer. As we have heard, there is no rule book for responding to pandemics such as COVID-19, so any opportunities to learn from others we need to take with both hands. I am really buoyed by the enthusiasm of our team in working so quickly and finding innovative solutions to this unprecedented problem.

We are implementing modifications to our systems and processes, including additional personal protective equipment to protect our people, additional hygiene protocols in base camps, bringing on more resources to cater for any outbreaks, and modifying the way we deploy resources across the state. FFMVic will be ready for the season when it eventuates. The community is counting on it. ■



Right: Temporary bypass pipe.

ALL PHOTOS: THE FLIXBOROUGH DISASTER: REPORT OF THE COURT OF INQUIRY



THE FLIXBOROUGH DISASTER

BY **BARRY LEE OAM**

Just before 5.00 pm on Saturday 1 June 1974, a massive explosion wrecked the chemical plant of Nypro (UK) Ltd, Flixborough, on the banks of the River Trent in North Lincolnshire, England. Said to be the largest peacetime explosion in Britain, it killed 28 workers at the site, injured hundreds of people outside it, and damaged property within a radius of five kilometres.

The plant produced caprolactam, the raw material for Nylon 6, by the phased air oxidation of cyclohexane under pressure at 155 to 160 degrees Celsius to a mixture of cyclohexanone and cyclohexanol. The reaction took place in the liquid phase in a train of six reaction vessels, each holding about 20 tonnes. To avoid the production of unwanted byproducts, the conversion was slow and hence the inventory in the plant was large—many hundreds of tonnes.

In late March 1973, the plant was quickly shut down when a leak occurred in reactor five and a large split was found in its side. The reactor was emptied, removed and replaced by a hurriedly

made 500-millimetre stainless steel temporary bypass pipe in the shape of a dog-leg incorporating two welded mitre joints. The ends were flanged to join the ends of pipe bellows, also flanged, left attached to reactors four and six when reactor five was removed. It was inherently weak, both because the compressive forces caused by the bellows produced a strong bending movement on both mitred joints, and because each bellow was now only anchored at one end. This allowed the whole bypass assembly to squirm under pressure.

At 4.52 pm on 1 June, the bypass failed. Both bellows ruptured and the 500 mm bypass jackknifed at one of the mitred joints. Some 80 tonnes of cyclohexane at 0.96 megapascals and 155 to 160 degrees Celsius escaped at high velocity through the two opposing reactor openings, mixing rapidly with the surrounding air and resulting within 50 seconds in a classic unconfined vapour cloud explosion. It is suspected that the sources of ignition were vehicle diesel engines operating in the area at the time.

The explosion wrecked most of the fire protection equipment on the site. The fire pumps were put out of action by the collapse of the pump house and destruction of the electrical power lines. The fire main was broken in several places and hydrants were inaccessible. The dry pipe sprinkler system in the caprolactam warehouse was completely destroyed, along with the building itself. Thus, the many fire protection systems installed at Flixborough played no useful part in protection or firefighting. The River Trent bounded one side of the site, and much of the firefighting water was obtained through portable pumps mounted on pontoons and barges.

The material damage at Flixborough cost insurers about £50 M (1974 prices). Approximately 18,000 tonnes of flammable liquid, including cyclohexane, phenol, naphtha, benzene, toluene, fuel oils, etc., were destroyed, along with several hundred tonnes of acids. Well over 150 hectares of surrounding land was devastated and over 30 families lost their homes. The plant was the only one of its kind in Britain supporting the manufacture of nylon fibres. ■

CYCLOHEXANE: A colourless liquid similar in some of its properties to petrol.

Molecular formula: C₆H₁₂

Flashpoint: minus 20 °C

Explosive range in air: 1–8% by volume

Boiling point: 81 °C

Autoignition temperature: 245 °C



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BY **JESSICA TEMPLE**

Technical Administrator—Projects and Standards,
FPA Australia

AND **IAN FINDLAY**

Technical Officer—Projects and Standards, FPA Australia



TECHNICAL ADVISORY COMMITTEES

The most recent round of TAC meetings were held in July via web conference. The next round, proposed to be held in November, is also planned to be held entirely via web conference in keeping with the COVID-19 travel restrictions and social distancing requirements.

TAC/1 Maintenance of fire protection systems and equipment

The TAC continues to focus on the draft project proposal for the revision of AS 1851-2012.

TAC/2 Fire detection and alarm systems

Progress continues on the draft Good Practice Guide on speaker layout and an Information Bulletin on building occupant warning systems.

TAC/3/7 Portable and mobile equipment

The Australian Competition and Consumer Commission is still in the process of reviewing the mandatory safety standards for portable fire extinguishers. TAC/3/7 provided input to this review and is continuing to monitor its progress.

The TAC also assisted with an FPA Australia submission on PFAS foams.

TAC/4/8/9 Fire sprinkler and hydrant systems, tanks and fixed fire pumps

<http://www.fpaa.com.au/engagement/technical-committees/tacs.aspx>

The TAC discussed a number of technical issues including sprinkler protection for UPS rooms and data centres containing lithium-ion batteries.

TAC/11/22 Special hazard fire protection systems

<http://www.fpaa.com.au/engagement/technical-committees/tacs.aspx>

The TAC continues to monitor and assist FPA Australia to participate in global and

local developments in firefighting foams and associated policies (including a response to the *National PFAS Position Statement* as well as Standards Australia projects.

TAC/17 Emergency planning

The TAC made a submission to Fire and Rescue NSW on their document *Fire safety during construction work guidelines*. General discussion on the COVID-19 situation and what that means in regards to emergency evacuation procedures.

Work continues on several technical documents.

TAC/18/19 Passive fire protection

Work continues on the update of PS-05 Product compliance and evidence of suitability and development of a Good Practice Guide on intumescent dampers.

General discussion on the topic of passive training.

TAC/20 Bushfire safety

The TAC continues to monitor and provide input to future AS 3959 work, as well as progressing with a technical document on sarking.

Bushfire planning and design (BPAD) scheme discussed with goal to have this eventually recognised Australia wide.

STANDARDS

FP-002 Fire detection and alarm systems

The revisions of AS 1603.17, AS 4428.3 and AS 4428.16 were published in late June. Work on the revision of AS 1670.6 continues and projects to revise AS 1670.1, AS 1670.3 and AS 1670.4 are expected to kick off shortly.

FP-004 Automatic fire sprinkler installations

Amendment 2 to AS 2118.1-2017 was published in July. The revision of AS 2118.2 is currently at public comment closing 2 November. Work progresses on the revision of AS 2118.6.

FP-009 Fire hydrant installations

Public comment on AS 2419.4, the draft new standard for STORZ connections, closed in late July and is now being reviewed. Work continues on the revision of AS 2419.1.

FP-011 Special hazard fire protection systems

Public comment on the revisions of AS 3772-2008 and AS 4587-1999 opened in early July and closed in early September.

FP-020 Construction in bushfire prone areas

Public comment on Amendment 2 to AS 3959-2018 closed late July and is now being reviewed.

FP-022 Fire protection of mobile and transportable equipment

Work progresses on the revision of AS 5062, Fire protection for mobile and transportable equipment.

LG-007 Emergency lighting in buildings

Work continues on the amendment of AS/NZS 2293.1 and AS/NZS 2293.3.

LG-011 Photo-luminescent exit signage

Work has begun on new standards for photo-luminescent exit signage—AS 5358.1 (product specification, installation and operation) and AS 5358.2 (routine service and maintenance).

TS-001 Building commissioning

Work progresses on the new technical specification for building commissioning.

PHOTO: 123RF



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FPA AUSTRALIA TECHNICAL WEBINARS

Our webinar series has continued throughout the COVID-19 pandemic, with a diverse program of fire protection topics available. We have also recorded these, so if you missed something you can now rent it and watch it later.

A full list of upcoming events, and links to previous presentations, can be found at the FPA Australia website:
<http://www.fpaa.com.au/events.aspx>.

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FIRE

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John Clampett

John has joined Fire Protection Association Australia as National Manager, Technical, replacing Nathan Semos following his elevation to Chief Operating Officer. Mr Clampett brings 40 years' experience to the position across various building and fire protection roles, with detailed knowledge covering areas as diverse as fire engineering, building surveying, facility management, regulation and standards development, and research. He will oversee improvements to the Association's technical advice services, the development of content, and ongoing technical and advocacy activities.



Kate Fitzgerald

Kate Fitzgerald has been appointed as ongoing Chief Executive of Emergency Management Victoria (EMV). After acting in the role, her ongoing appointment was announced in September 2020. Ms Fitzgerald has an extensive public sector and emergency management career, working at an executive level in state and federal government agencies. She will continue to be responsible for the management and performance of EMV, working alongside EMV Commissioner Andrew Crisp.



Robert Cameron OAM

Robert Cameron has retired from the role of Director-General Emergency Management Australia (EMA), a division within the Australian Government Department of Home Affairs. He acted in the role since April 2018, was appointed in September 2018, and held responsibility for the coordination of Australia's response to crises, including support to those impacted by disasters. Mr Cameron's career included a number of senior emergency management roles across the Australian Government, including EMA and the Department of Health.



Jason Heffernan

Jason Heffernan has been appointed as the Chief Officer of the Country Fire Authority Victoria. Previously an Assistant Commissioner of the New South Wales Rural Fire Service and Director Area Operations, Jason has performed a number of senior roles across the RFS, including recently as Deputy Commissioner. He was a volunteer firefighter for more than two decades.

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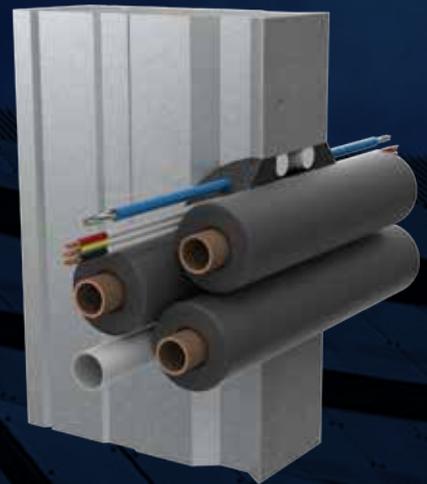
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