THE MAGAZINE FOR FIRE INDUSTRY PROFESSIONALS

fire NZ

ISSUE 3 | SEPTEMBER 2010

1880 → 2010

SUSTAINABILITY

Heritage of the Future

THE INSTITUTION OF FIRE ENGINEERS
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FPA NEW ZEALAND

THE MAGAZINE OF THE FIRE PROTECTION ASSOCIATION NEW ZEALAND AND THE INSTITUTION OF FIRE ENGINEERS (NZ BRANCH)

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Editorial

Welcome to our third edition of the Fire NZ Magazine. As you would have seen from the front cover, the focus of this magazine is the upcoming FIRE-NZ Conference and Exhibition being held in Christchurch on the 3rd and 4th November 2010. The Fire Protection Association NZ and the Institution of Fire Engineers NZ Branch have once again joined forces to provide conference attendees with a world class conference and exhibition in a world class venue - The Christchurch Convention Centre.

The FPA and IFE first held a joint conference in 1997 in Auckland and since then both organizations have gone on to produce successful conferences, the IFE partnering with various organizations such as the NZ Hazardous Substance Institute, Civil Defence and Emergency Managers and the Forest and Rural Fire Association of NZ and FPA growing each year to produce what is now known as FIRE-NZ. In 2009 the FPA and IFE once again came together to partner the FIRE-NZ 2009 conference and exhibition in Auckland and have continued this partnership with FIRE-NZ 2010 in Christchurch.

As such the FPA and the IFE are experienced in facilitating conferences and exhibitions and by partnering again for this years conference in Christchurch, "Heritage - Sustainability of the Future", we believe we have provided a great venue, exhibition and programme with an exemplary array of speakers to attract many conference delegates.

Leading the conference out on day one will be the Hon Maurice Williamson MP, Minister of Building and Construction providing the conference opening address which is significant in light of Building Act Review. We also start the morning with Steve Turek who is the Assistant Commissioner, Fire Safety Regulation with the London Fire Brigade and John Woodcock who is the International President of the Institution of Fire Engineers. The full conference programme as well as biographies for the speakers can be found in this magazine.

Mike King, well known New Zealand comedian has been booked for the Conference Dinner entertainment on Wednesday evening. Mike promises to be close to the bone with down to earth humour that is based around his personal life experiences, both sobering and laugh out loud side splitting !!

FIRE-NZ is the annual forum for Fire Protection and Fire Engineering professionals and well worth investing your time and money in attendance. FIRE-NZ isn't just about the programme. There is so much more to attending FIRE-NZ than the wealth of world class speakers to challenge our thinking. So to help you decide about attending this years here are just a few thoughts as to why you should come to FIRE-NZ 2010 in Christchurch.

1. Networking – conferences and exhibitions are a great way to network with others in the industry, to see new products and learn and gain information from not just the speakers, but from your peers. It's a chance to talk and see what's going on in our industry elsewhere in the country, make new connections and create new business opportunities.
2. Exhibition – This year we will have the largest conference exhibition of any Fire Industry conference ever held in New Zealand. We have over 30 exhibitors and conference sponsors providing you with some 50+ stands with products and services on display and personnel to answer any questions you have. They want to meet you and it's a great opportunity to visit these stands and meet face to face with companies and their representatives who you may have only dealt with via email and phone. It's also a great way to develop and build new and existing business connections.
3. The FOOD – we can't forget the food. At FIRE-NZ 2010 the one thing we strive to do is ensure that we provide good quality and tasty food. So much so, that we tend to tailormake the menu to suit. And if you do have special dietary requirements, just let us know and we will do our best to accommodate you.
4. Learning – the programme is designed and suited to provide insight and learning and to extend current thoughts on various speakers conference presentation topics. The Fire NZ 2010 conference will have available Continuing Professional Development (CPD) certificates to all delegates who attend for the full two days. A CPD certificate with hours of development recognised will enhance CPD registers for IFE members. All conference attendees are eligible for the CPD certificate as a way of attaining recognition with your employer that your attendance is internationally recognised as a form of learning and development attained from attendance at a fire protection and fire engineering industry event.

The FIRE-NZ 2010 Conference and Exhibition in Christchurch is designed to be a positive experience to influence yourself, your staff and anyone that attends. With the social interaction, the networking, the coming together of fire industry professionals in one place, you will be refreshed, empowered and invigorated as a well informed and updated conference delegate for the return to your day to day working environment.

It will be a positive experience that will enhance your professional standing and knowledge for our industry and we recommend you take advantage of this years opportunity to attend our national Fire Protection and Fire Engineering Professional Conference - FIRE-NZ 2010.

We look forward to seeing you at FIRE-NZ 2010 in Christchurch on the 3rd and 4th of November.

Pertronic FireMap® Graphics System chosen for new correctional facility

CASE STUDY: YOUTH JUSTICE FACILITY, ROTORUA, NEW ZEALAND

A new Youth Justice facility opened recently in Rotorua, with ten Pertronic fire control panels networked together to support analogue addressable smoke detectors and pre-action systems throughout the complex. As with any correctional facility, the number of false alarms generated by the occupants can be very high. Duty staff need fast access to accurate information on the alarm location to respond quickly to these incidents and minimise their impact.

Pertronic Industries new FireMap PC-based graphics system was chosen to supply this critical information. Developed in-house by Pertronic engineers, FireMap is designed with ease of installation and ease of use as prime requirements. Most PC-based graphics systems are quite complex to develop. Unless the fire alarm company has staff with comprehensive training in graphics development, this work is usually undertaken by a third party contractor, adding cost and additional links in the communication chain to the end client.

Pertronic FireMap® simplifies the entire process. FireMap is designed so the fire alarm company can develop - and maintain - the entire graphics package themselves for their client. Once operational, navigation is via a hierarchical map viewing system, which is always visible to the left of the screen (as shown in a "home page" example, right). In the event of an alarm, the relevant map automatically displays and shows the position of the device in alarm, together with the details for that device (lower image).

At Rotorua Youth Justice, FireMap is operating in a multi-user mode across five computers, each located in different watchrooms, providing staff with immediate information on all events across ten fire panels. FireMap can connect to individual or networked Pertronic systems through either a hard-wired connection (as in Rotorua) or an ethernet (LAN) connection. This latter option provides considerable flexibility to monitor, manage and interact with multiple fire alarm systems in remote locations from one central point.

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SUSTAINABILITY - HERITAGE OF THE FUTURE

3rd & 4th November 2010

Christchurch Convention Centre, Kilmore St, Christchurch

1880 ➔ 2010

FIRE-NZ 2010

Registrations are NOW open

This is THE Fire Industry Event of the year and definitely not one to miss. So don't delay, get your registration form in today.

We have some great hotel deals with Rydges and Holiday Inn on Avon. You can find these in the conference brochure.

Go to www.ife.org.nz or www.fireprotection.org.nz and click on the links to take you to the conference registration brochure and programme, the registration form and the partner programme.

The partner programme is planned for Wednesday 3rd November - Akaroa Scenic Day Tour & Harbour Cruise.

We look forward to seeing you at FIRE-NZ 2010.

If you have any queries, please do not hesitate to call us on 09 414 4450
or email irma@fireprotection.org.nz

Programme Wednesday 3 November

8.30 am	**Registration**
9.00 am	**OPENING ADDRESS - Hon Maurice Williamson, Minister of Building and Construction**
9.35 am	**When It All Goes Wrong! Learning the lessons from tragic and significant incidents to improve compliance practices and fire safety outcomes.** ***Steve Turek: Assistant Commissioner, Fire Safety Regulation, London Fire Brigade*** In an environment of lighter touch, reduced regulatory burden initiatives and less prescriptive self compliance regimes, is too much reliance being placed on businesses and other responsible bodies to ensure the same level of compliance that more prescriptive environments previously offered? In his presentation, Steve provides some high profile case studies of incidents that occurred in the UK's capital within the last year and discusses how these events have challenged whether or not this direction of travel will provide a sustainable way of managing our built environment into the future.
10.15 am	**Morning Tea**
10.45 am	**Fire Engineering to improve sustainability of communities** ***John Woodcock: Institution of Fire Engineers International President*** As the current International President of the Institution of Fire Engineers, John will take the opportunity to initially explain the Institution and how its role is being developed globally through local branches. As the core of his presidential theme for 2010, John will then address some key questions on how the practice of Fire Engineering can improve the sustainability of communities. This will include how sustainability issues affect buildings and their fire safety design, and the implications for fire prevention, mitigation and protection. He will also focus on the affect sustainability issues have on the Fire and Rescue Services roles and fire ground operations…should they be doing things differently in light of this new global focus on sustainable design?
11.30 am	**How Green is Fire?** ***David Barber, Principal – Arup Fire*** Building design globally is moving towards more ecologically sustainable development (ESD) with many buildings attempting to gain five or six star energy ratings, encouraged by both local and national Governments. Fire protection has traditionally had a poor name for environmental sustainability due to halon and other gases, which are ozone depleting. Fire safety design and the fire protection can have a positive influence on sustainability objectives. This paper will explore the issues that arise in many ESD buildings where the architectural concepts of sustainability lead to a building that cannot be compliant with the prescriptive parts of a building code. Performance based fire engineering is the only approach to resolve the design issues. Some of the innovative solutions in fire safety design and systems are explored within this paper as an introduction to the ESD concept and the fire safety engineering response. The following questions are also considered: ■ Where do fire safety engineers fit into ESD? ■ How do green star rating systems measure fire protection systems? ■ Is there recognition of fire protection systems such as sprinklers. ■ How can fire safety engineering be an enabler for sustainable design? ■ Are fire protection systems considered a benefit for a sustainable design?
12.00 pm	**What Value do YOU Add? The future belongs to those who know the answer** ***Chris Kane, Strategy, Innovation and Quality Manager, BRANZ*** BRANZ's Building the Future project has laid down a challenge to the industry: know the value of your business, and the work that it does. For the fire protection industry, this can be measured not just in dollars, but in emissions footprint, amenity delivered across the life of the building, and safety of those working in it. The future will belong to the companies that understand how the playing field can be tilted to their advantage. Chris Kane will talk about this and other insights from the project – and will challenge you to put yourself into the future to see how it feels.
12.30 pm	**Lunch**
2.00 pm	**The Impact of Automatic Sprinklers on Sustainability** ***Andre Mierzwa, Chief Engineering Technical Specialist, FM Global*** It has been known for years that automatic sprinklers provide life safety and limit property damage, however a joint study was performed to examine the relationship of residential sprinklers to environmental sustainability. Two large-scale fire tests were conducted to determine the reduction in the environmental impact between a sprinklered and unsprinklered living room fire scenario. Greenhouse gases, quantity of water used, pollutant loading in the wastewater runoff, landfill contribution and quantity of materials needed for reconstruction were quantified for the first time. This presentation will provide you all the details and the eye opening results.
2.30 pm	**Fire Safety Consenting – The Way Forward** ***Nick Saunders, Senior Advisor, Department of Building and Housing*** The Department are currently consulting on a number of facts of legislation and non mandatory documents that relate to fire safety. These consultations are expected to be closing at the end of November. This presentation will summarise the proposals for all of these facets and should be able to provide an early indication of how these proposals have been received by New Zealand.
3.00 pm	**Afternoon Tea**
3.30 pm	**Can any monkey use a computer model?** ***Charles Fleischmann, Associate Professor, University of Canterbury*** Over the last twenty-five years the application of computer models has grown exponentially. Starting with hydraulic models for sprinkler design we now have models that are able to predict complex phenomenon that we only dreamed about a decade ago. The building fire design issues that can be addressed with computer models are enormous but the potential for misuse is infinite. The misuse of computer models can range from simple incompetence of the user to deliberate manipulation of the input to achieve the desired results. This presentation focuses on the potential misuse of computer models and what we need to do to overcome this problem.
4.00 pm	**Fire Safety Documentation Guidelines - How the Industry should present fire safety designs to the Authorities for Building Consent.** ***Martin Wootton, Technical Director – Fire, Beca Carter Hollings & Ferner Ltd*** ***Michael Dixon, Director, Stephenson & Turner NZ Ltd*** Since the introduction of the 2004 Building Act in April 2005 the need for better consent documentation has become a major issue in the building industry. This is particularly relevant in the fire engineering area, but in fact affects all related disciplines. Fire Engineers provide advice to clients and other disciplines as to what fire safety features are required in a building to meet the requirements of the building code or the fire engineering brief as it applies to that building, However fire engineers do not actually carry out the detailed design of many, if any, of those features. The detailing of the various features is the responsibility of other disciplines, such as Architects, Structural Engineers, Mechanical and Electrical Engineers, Fire Protection Engineers etc. So the challenge for the fire engineering fraternity has been to address the issue of documenting the fire engineering design such that the appropriate information resides in the relevant drawings and specifications issued by other members of the design team. This presentation describes the process the SFPE / IPENZ have undertaken to achieve this outcome and presents the guidelines that are to be issued by the SFPE / IPENZ / DBH and NZFS such that all in the industry is aware of what is required and in what form the documentation should take.
4.30 pm	**Finish**
7.00 pm	**Conference Dinner** Rydges Hotel - 170 Oxford Terrace, Cnr Worcester Street, Christchurch The Conference Dinner will begin at 6.30pm with canapé's and drinks and followed by dinner at 7.00pm. **GUEST SPEAKER: MIKE KING - Sponsored by Winstone Wallboards** Known for his entertaining, candid and thought-provoking brand of comedy, Mike King is one of New Zealand's most popular and well known comedians. Mike's humour is well received by a wide range of audiences - no stone left unturned, no culture left unbruised, Mike King is hard, funny, astute, sharp and unforgiving.

Programme Thursday 4 November

8.30 am **Registration**

9.00 am **PLENARY 1**

Ensuring Consistent Responses to Tunnel Emergencies from 'ALL' Stakeholders.
Jean-Marc Berthier, Managing Director, GEIE-TMB JV
Jean-Marc Berthier is a recognised international Expert in designing, setting up and managing the operation of Toll & Tunnel Road infrastructures with over 30 years of international experience. Following the 1999 blaze which killed 39 persons within the 11.6 km Mont Blanc tunnel, Jean-Marc became the Managing Director of GEIE-TMB JV, operator of the Tunnel overseeing the renovation of the tunnel at a cost of 350 million Euros. From 2005, Jean Marc has advised on the operational design, training and set up Teams for key projects around the World such as: the 9 km KPE TUNNEL at Singapore, the cars only SMARTTUNNEL at Kuala Lumpur, the NSBT tunnel at Brisbane, the Dublin PORT TUNNEL in Ireland, the THIRRA 6 km tunnel in Albania, and recently, the WELLINGTON tunnels refurbishment Alliance in New Zealand. As the safety officer for the Wellington tunnel refurbishment alliance Jean-Marc will share his knowledge and discuss the processes being adopted to ensure that our tunnels meet appropriate safety expectations, focusing on stakeholder liaison and its relevance to fire safety.

9.45 am **PLENARY 2**

Why Should Water Supplies Provide Water for Fire Protection?
Anthony Wilson
There is a universal assumption that urban water supplies will be available for fire protection. But is this in fact the case? This presentation will examine the history of why most urban water supplies do provide some fire protection capability, what design standards are applied to their design and what is likely to happen in the future. The presentation will look at the current legislative and regulatory framework in New Zealand and explain why changes in the sector are likely to make many existing fire protection systems non compliant and what needs to be done to correct this.

10.30 am **Morning Tea**

	FPANZ Stream	IFE Stream
11.00 am	**Where is our Fire Sprinkler System Water Pressure Going – A Disaster Waiting to Happen?** ***Ross Aitken – General Manager Installation and Technical Support, Chubb New Zealand Ltd*** The history of Fire Sprinkler installation in New Zealand has given us one billion good reasons why reliance on town main water supplies has proven to be a cost benefit for both our economy and the installation of effective and reliable fire sprinkler systems. With the increasing global awareness of the use of the precious recourse water, and now ageing water supply infrastructures where now does the future use of town main water supplies lie?	**Residential & Domestic Sprinklers in the UK** ***Jo Fowler, East Sussex Fire and Rescue Service*** For those who can see the benefits of residential and domestic fire sprinklers, their recognition has made slow and frustrating progress in the UK. Domestic fires still account for the majority of all building fires and casualties. However, because these occur in low numbers over a long period, they fail to have the impact that a major incident would. There is now a greater understanding and recognition of the benefits that sprinklers have to offer, not just in the reduction in fire-related deaths and injuries, but also in the cost of fire, the impact on the environment and the increased protection for firefighters. The fire service's goal for the future is to seek the necessary changes to legislation by obtaining the support of a number of political 'champions' to take our cause to Parliament.
11.30	**AGM - FPANZ**	**AGM - IFE**
12.00	**Sprinkler Contractors – Why Bother Listing Them?** ***Nigel Robinson, Verifire and Chris Mak, AON*** NZS4541:2007 has expanded the criteria for contractor listing, however the approved sprinkler contractor regime has been ineffective over a number of years. How can we revitalise this process? What are we trying to achieve? The fundamental intent of contractor listing is examined.	**Demonstrating Acceptable Risk for Tunnel Fire Safety** ***Craig Hiscock, Parsons Brinckerhoff, Australia*** Satisfying the NZBC can be achieved by either the meeting the performance requirements of the building code or satisfying the requirements of an acceptable solution. Given that fire life safety considerations for tunnels differ greatly from ordinary buildings, and that the Building Act's acceptable solutions are not applicable to tunnels, designers are left with only the performance requirements of the building code for guidance. With no minimum benchmark provided by these documents designers find themselves in the difficult position of demonstrating that each design is acceptably safe. No tunnel can be made absolutely safe in every situation and so risk-based approaches are needed. This paper outlines a risk based approach to fire safety analysis (specifically for tunnels) developed and applied to a major tunnelling project currently under construction in New Zealand.
12.30 pm	**Lunch**	
1.30 pm	**All Fire Alarm Systems Are Not Created Equal So What is the Difference? What Can We Do To Make These Types of Life Safety Systems More Reliable?** ***David Prosser, Product Manager, Tyco Safety Products*** Keith will explore the present fire alarm installation and certification process and how it is a changing environment. The ultimate outcome is to ensure we can rely on the quality of the installer and the associated system.	**Planning, Preparation and Response to Fires and Other Incidents in Large Tunnels** ***Shan Raffel, Acting Inspector, QFRS*** Australia is following international trends in road and rail traffic management by building large tunnel systems. These present unique and challenging problems for emergency service workers. Brisbane has gone from having no tunnels of significance to having the largest road tunnel in Australia with the opening of the 4.8 km Clem7. The Airport Link project is under construction and on opening it will supersede Clem7 as Australia's largest road tunnel. With even more road and rail tunnels in the planning stages, the QFRS met the challenge by dedicating a number of staff to ensuring the design, construction and operation was in line with world's best practice. With the support of the QFRS, Acting Inspector Shan Raffel was successful in gaining a Churchill Fellowship to study all aspects of planning, preparation and response. His fellowship included visits to various authorities in USA, Germany, Austria, Denmark, Sweden, Norway and Switzerland. This presentation will present key findings in relation to lessons learnt, procedures, training, and equipment in use by fire services that have experience in dealing with tunnel emergencies.

	FPANZ Stream	IFE Stream
2.00 pm	**Buildings are Entitled to Birthdays too!** ***Martin Feeney, Principal, Holmes Fire & Safety*** Fire engineering design can be complicated. So can design, installation and commissioning of fire protection systems. But these are just first steps. Consideration of effective fire safety over the life of a building involves a complex tripartite web of responsibilities that is seldom appreciated because we tend to focus on our own specialised area. A quantum shift in thinking is needed across the fire protection industry to understand and strengthen the communication linkages that must function in order to maintain life safety and property protection for the lifetime of a building. This presentation discusses the linkages needed to produce collective and co-ordinated efforts from a wide range of people to avoid fire safety becoming the next example of systematic failure in the building industry.	**Effective Fire Venting and Smoke Ventilation** ***Paul Compton, Colt International Limited*** As a foreigner I am used to the terms "fire venting" and "smoke venting" being used interchangeably. I was therefore stunned when I first saw C/AS1 requiring 15% effective fire venting – this seemed incredibly high compared to a typical European smoke ventilation system, which rarely exceeds 2%. With better understanding of how the terms are used in New Zealand the separation is clear, although just how "effective" current fire venting practice is may be open to question. This paper discusses the differences between fire venting and smoke ventilation, the effectiveness of current fire venting practices and the benefits and costs of providing a smoke ventilation system that will also deal with fire venting requirements. It also discusses the issues around sprinkler systems – should smoke ventilation be used with sprinklers or even instead of sprinklers and if so what are the consequences? Understanding these issues can help decide when smoke ventilation can be an effective alternative solution under the New Zealand Building Code.
2.30pm	**Hospitals Require More for their Fire Protection Systems** ***David Houlihan, Emergency Management Advisor, ADHB and Tanya McAlister WDHB*** The industry faces unique challenges when designing hospital fire systems. Recent global events continue to show that the movement of seriously ill and highly dependent patients can result in increased mortality rates. Can a generic design for hospital buildings be "engineered" to cater for minimal movement of patients? This presentation will explore the key elements of a generic design and consider the implications of this for the fire protection industry within New Zealand.	**Heritage, Building Codes and Firefighter Intervention** ***Benjamin Hughes Brown and Christopher Jurgeit, NSW Fire Brigades*** Keeping our buildings and the history associated with them is becoming increasingly difficult especially when compliance with current legislation and occupation is concerned. Australia has the mechanism through a performance based approach to address the compliance issues but traditional comparative based alternative solutions undertaken by fire engineers doesn't always tick all the boxes. The hypothesis becomes "Can we demonstrate compliance through an alternative solution and retain function and use of buildings without breaking the bank or compromising community safety". This presentation will look at the involvement of the NSW fire brigades in historic buildings as a stakeholder with involvement from the development application stage, design, construction and ongoing occupation and maintenance stages. Smoke ventilation can be an effective alternative solution under the New Zealand Building Code.
3.00 pm	**Afternoon Tea**	
3.30 pm	**Are Our Hospitals Really Safe?** ***Debbie Scott, Fire Engineer/Director, OnFire Consulting Limited*** Fire in an operating theatre – what really happens? By way of Case Study, this presentation will provide insight into what can actually happen during a fire in an operating theatre from first hand experiences. It looks into the response of the medical team in dealing with a fire emergency and the steps they must take in a situation in which they have limited control. The presentation investigates how the building design, whilst compliant with the Compliance Document C/AS1 was not necessarily sufficient to provide for life safety in this specialist occupancy. It also details an investigation and re-enactment of the fire which enabled the owners, medical team, fire protection contractor and the fire design engineer to better understand what occurred in the building and how to prevent situations like this in the future.	**Insulated Sandwich Panel Construction** ***Richard Fowler, East Sussex Fire and Rescue Service*** Methods of construction and construction materials have evolved rapidly in recent years and this trend shows little sign of slowing. Insulated sandwich panels have been used in various sectors for many years now, and in particular in the cold storage and food processing industries. More recently, panels are being used in the construction of factories, offices, large retail premises, schools and storage buildings. A number of large fires have occurred in buildings constructed using insulated sandwich panels in recent years, often resulting in the total loss of the building with the panels normally being blamed for that loss. My work has concentrated on evaluating insulated sandwich panels when involved in fire and determining the factors that were relevant to the loss of the building in each case. My findings show that the materials and construction methods used range from the non-flammable, practical fire-safe to the highly flammable and downright dangerous.
4.00 pm	**Sprinklers for the Home Will Revolutionise Sprinklers Everywhere!** ***James Firestone, Fire Engineer, New Zealand Fire Service*** Fire safety is everyone's business, but for many years it has mainly been centred in the commercial arena. Sprinklers are considered the Rolls Royce of protection. Home sprinklers are not only a reality, but have the potential to leverage this technology to be mainstream within the entire built environment. Around the western world home sprinklers are gaining in popularity. This talk will illustrate how new Zealand can retake its rightful spot at the forefront of this initiative by learning from the lessons of the leaders overseas.	**Death from Fire in a Sprinkler Protected Building – Going Beyond Cause and Origin** ***Tim O'Brien*** While automatic fire sprinklers are arguably the best fire protection for life safety, property and business continuity, they are not a panacea. Tim O'Brien presents a summary of the New Zealand Fire Service investigation report into one of a recent spate of fire deaths in sprinkler protected buildings. This presentation goes beyond cause and origin, discussing a probable time-line of events, supported by FDS fire modelling, with specific emphasis on the investigative process, sprinkler system performance, human element issues and compliance. Every fire provides an opportunity to learn. Sometimes we learn something entirely new, but more often we learn what we do well, and perhaps more importantly, what we don't do as well as we might. The fact that deaths from fire in sprinkler protected buildings are relatively rare events is the very reason that their occurrence warrants more than an investigation into just fire cause and origin.
4.30 pm	**Closing Plenary**	
4.45 pm	**Finish**	

Conference Speakers

Ross Aitken, *General Manager Installation and Technical Support, Chubb NZ*
Ross Aitken has worked in the New Zealand Building Construction and Service environment for more than 35 years in a variety of positions inclusive of Design and Project Management, then leading onto Branch, Regional and General Management.

Ross's current role also includes a significant responsibility in the ethical leadership of Chubb New Zealand and Directorships of a variety of associated Fire Protection companies for which Chubb has a shareholding. Ross has a New Zealand Certificate in Engineering (Mechanical) and along with his roles in Chubb he has actively supported the goals and strategies of the Fire Protection Association NZ for many years.

David Barber, *Principal, Arup Fire*
David is a Principal with Arup Fire based in Melbourne Australia, where he leads the Australasian practice, managing a team of over 50 Fire Safety Engineers, across five offices. David has been involved in the fire safety engineering on numerous national and international projects. Over the last 8 years David has been project managing the consortium writing the new performance based fire code for Hong Kong and has interest in the development of performance based regulatory systems and the evolution of fire safety codes.

David is currently a member of the Building Appeals Board in Victoria, a member of the Board of Directors of the Society of Fire Protection Engineers, and is the Treasurer for the Australian Society of Fire Safety.

Jean-Marc Berthier
Dr Jean-Marc Berthier is currently the director of TTROPEX Pty Ltd and operates as a freelance road operation expert. Jean-Marc's significant international experience in Toll & Tunnel Road infrastructures allows him to provide expert advice to the full range of stakeholders at every stage in the design and operation of large infrastructure projects including the relevant Authorities, Owners, Financers, Bankers, Engineers, Builders, Concessionaires, Operators and Emergency Services.

Paul Compton, *BSc MBA CEng MCIBSE, Colt International Ltd*
Paul is a member of CIBSE and has been a Chartered Engineer for over 15 years. He has held a variety of sales and technical jobs within Colt, covering smoke control, heating, ventilation and solar shading. For the last 10 years he has been an active member of various British, European and American smoke control committees and has contributed particularly to the development of the EN 12101 and BS 7346 series of standards.

He is currently an active member of the working groups producing new European Standards on car park ventilation, pressurisation systems and SHEVS design using time dependent fires and is chairman of the working group on control equipment.

Martin Feeney, *Principal, Holmes Fire & Safety*
Martin Feeney is a Principal and Senior Fire Safety Strategist with consulting fire engineering firm Holmes Fire & Safety, based in Auckland and holds a Masters Degree in Fire Engineering from the University of Canterbury. During his 27 years of consulting engineering he has developed a particular expertise in performance based fire safety design for a wide range of building types.

Like many Aucklanders, he is happy to express his opinion when asked, and often when not. He is passionate about performance based design and motivated to push for continual improvement in standards of applied fire safety. He is a Chartered Professional Engineer in New Zealand and Past-President of the New Zealand Chapter of the Society of Fire Protection Engineers.

James Firestone, *Fire Engineer, New Zealand Fire Service*
James Firestone is a Fire Engineer with the New Zealand Fire Service and is currently Convenor of the New Zealand Home Sprinkler Coalition.

Charles Fleischmann, *Associate Professor, University of Canterbury*
Charles Fleischmann started using fire models in 1985 as an undergrad at the University of Maryland. He continued his fire modelling research with early zone models at the University of California during his graduate studies. Charley is now an Associate Professor at the University of Canterbury in Fire Engineering where he continues his research on the validation of computer fire models.

Jo Fowler, *East Sussex Fire and Rescue Service*
Jo Fowler graduated from Leeds University in 1997 with a BEng(Hons) in Fire Engineering, joining East Sussex Fire & Rescue Service in 1998 as a Fire Engineer. Jo has been involved in the promotion of sprinklers for most of her career, representing ESFRS on the National Fire Sprinkler Network since 2002 and joining the Executive in 2010.

Jo was very proud to be selected as the Bernadette Hartley Memorial Award winner 2009, for her significant contribution made to the increased use of water based fire suppression systems in the East Sussex area and her wider contribution to the promotion of sprinklers nationally.

Richard Fowler, *East Sussex Fire and Rescue Service*
Richard Fowler joined East Sussex Fire & Rescue Service in the UK in 1998 and is currently serving as an operational officer. Richard works in the Fire Safety Department managing a small team of technical officers undertaking legislative and enforcement work.

He is currently in the role of Group Manager. He has a number of additional specialist references, including fire investigation and maritime firefighting. Richard graduated from the University of Central Lancashire in 2003 with a BEng(Hons) in Fire Engineering, and is currently studying for an MSc in Fire Investigation with Anglia Ruskin University in Cambridge.

Richard is a Member of the Institution of Fire Engineers and is the Branch Secretary of the South Eastern Branch in the UK. He also represents that Branch on the International General Assembly.

Craig Hiscock , *Parsons Brinckerhoff, Australia*
Craig is a Senior Fire Safety Engineer with Parsons Brinckerhoff. Craig has 25 years of experience in the fire engineering, fire protection and fire safety industries. Craig was a senior fire engineer on Brisbane's Airport link tunnel project, which at 5.8 kilometres in length and intertwined with the Northern Busway tunnel projects, is currently Australia's largest infrastructure project.

He is currently the Fire Safety Design Lead on the Victoria Park Alliance in Auckland New Zealand. The Victoria Park project is highprofile due to the fact that it will construct Auckland's first road tunnel and affect a number of highly visible heritage sites. The tunnel will be open to traffic by 2012. Craig's experience includes working for Queensland Fire and Rescue Services (QFRS) where he was involved in the approvals process of fire safety design within major infrastructure projects.

Craig has presented at the Australian Tunnelling Society tunnelling short course and on tunnel fire safety to the Master of Engineering Fire Engineering course at New Zealand's Canterbury University.

Dave Houlihan and Co-Presenter Tanya McAlister,
Emergency Management Advisor, Auckland District Health Board
Dave Houlihan is currently an Emergency Management Advisor and is employed by the largest health care provider in New Zealand (Auckland District Health Board). Part of Dave's "business as usual role" is the management of Fire Safety including evacuation advice and staff fire safety training for the health board.

Dave has gained an extensive knowledge of fire safety within the health care environment spanning over the last 10 years. His accomplishments include the establishment of evacuation plans for large multi-level hospital buildings. Dave also has recently completed an Emergency Management Post Graduate Certificate from Auckland University of Technology.

Tanya McAlister has been providing Fire Evacuation Consultancy advice for the past 16 years in New Zealand and has spent the past 8 years employed as Waitemata District Health Boards Fire Safety and Emergency Management Officer.

Tanya has qualifications in Fire Alarm and Detection Systems including testing and maintenance. Tanya is one of two New Zealand health care fire safety officers to complete an Australian qualification as a Healthcare Industry Fire Officer and Fire Safety Advisor.

Both speakers are members of the Northern Region Health Boards Fire Safety Advisory Group.

Benjamin Hughes Brown & Christopher Jurgeit, *NSW Fire Brigades*
Benjamin Hughes Brown is the senior engineer for the NSW Fire Brigades, Chartered Professional Engineer with Engineers Australia and Member of the Institution of Fire Engineers. Benjamin is registered with the National Professional Engineers Registry and has completed a Masters of Fire Safety Engineering, Bachelor of Engineering Mechanical and two Diplomas of Engineering.

Benjamin joined the NSWFB two years ago and with the support of the structural engineer, surveyor and Fire Safety Officers has made several improvements in the communication between the NSWFB and industry.

With over five years of private practice in Fire Safety Engineering Benjamin is focused on improving fire safety for Persons, Property and the Environment within NSW and Australia as well as improving the role of the NSWFB in industry. In June this year Benjamin toured central Europe reviewing historic buildings and their fire safety provisions and precautions.

Chris Jurgeit is a career firefighter of 32 years currently holding the rank of Superintendent with the NSW Fire Brigades. He is the recipient of the Australian Fire Service Medal, Police Overseas Service Medal and several other National and service awards.

Chris is a Member of the Institution of Fire Engineers and is an Engineering Technician with the Engineering Council of the United Kingdom. He has attended and commanded numerous large structure fires as well as major bushfire and natural disaster campaigns.

He has worked in the Brigade's Structural Fire Safety Unit for ten years and is the manager of the Unit. His fire safety experience includes extensive work in the assessment of performance based building design and in the development of policies relating to fire safety. Chris also worked during the 2000 Olympics as fire service advisor and Brigades commander for three venues.

Chris wrote a blueprint for the re-building of the Solomon Islands fire service and in 2003/4 spent five months in the Islands as Chief Fire Officer implementing that plan.

Chris is currently involved in working groups within the NSW Government on reforms to the alternative solutions regime, water pressure reduction management and recycled water for firefighting use. He is also working with Government and industry in improving the performance of insulated sandwich panels.

He is also a committee member of the NSW Heritage Council's Fire Access and Services Advisory Panel.

Chris Kane, *Strategy, Innovation and Quality Manager, BRANZ*
Chris is responsible for ensuring that the information BRANZ delivers to the industry meets the needs of the industry. By definition, that also means meeting the needs of New Zealand as a whole, because buildings last for a very long time by comparison with any other investment – they need to be sustainable,

by every definition of the word. Chris is a senior manager at BRANZ, where he has worked for 20 years. He started as a corrosion scientist, and has failed in every attempt to escape since that first day. Working in a vibrant, complex and challenging industry (with vibrant, complex and challenging personalities) has probably been the main reason for this!

As a technical specialist, he has been involved in more than 100 failure investigations, run multinational aid projects, and introduced the term "sea-spray zone" to the industry's consciousness via his work on NZS 3604 and NZBC Clause B2 – Durability.

As a technical manager, he oversaw the weather-tightness, energy, insulation and healthy buildings that made clear the importance of buildings as productive tools – and resulted in the Government's injection of funds to the industry at the height of the global crisis in 2008/9. Now, he is responsible for understanding and articulating the needs of the industry, and helping plot the course into the future.

Chris is an experienced international speaker, and is currently New Zealand's representative to the board of CIB, the world "club" of building research organisations. His position at BRANZ requires him to be abreast of global trends in building techniques, technologies, and opportunities, and to ensure that as far as possible the NZ construction industry is equipped to respond. He claims to have no answers, but some very interesting questions!

Chris Mak, *AON* **& Nigel Robinson**, *Verifire*

Nigel Robinson (BSc, MSFPE) is the Technical Manager for VeriFire. After graduating with a BSc in chemistry from Victoria University in 1978 Nigel worked as a research and development chemist before joining the Insurance Councils technical department in 1987.

With the closure of the Insurance Council regional offices in 1989 he joined Fire Protection Inspection Services soon after it was formed, where he was responsible for inspection and certification of both fire sprinkler and fire alarm systems. Nigel moved to VeriFire in 2005, having spent some time subcontracted back to the Insurance Council in 1999/2000 and assisting with the initial setting up of VeriFire in 2001.

He has been associated with various NZ4541, 4515 and 4517 standards committees over the last 15 years and completed a Victoria University course in fire safety design in 2001.

He has over 20 years experience in all aspects of sprinkler system and fire alarm system certification and assumed the role of Technical Manager for VeriFire in 2008.

Chris Mak has over 25 years experience in the fire protection industry in engineering and management positions. He is currently employed to head Aon's Sprinkler System certification business unit. Previously, he was the engineering manager for NZ's largest fire protection installation and service company. He is a Chartered Professional Engineer and is the current President of the Society of Fire Protection Engineers (NZ Chapter). He has been involved in the preparation of numerous fire protection standards, including Chairing the committee that drafted the latest revision of NZS4541 "Automatic Fire Sprinkler Systems".

Andre Mierzwa, *Chief Engineering Technical Specialist, FM Global*

Andre Mierzwa has been with FM Global for 35 years in many roles and is currently the Operations Chief Engineer in Australia. Andre graduated from RMIT as an Aeronautical Engineer, has a Post Graduate Diploma in Management from Deakin University and a Post Graduate Diploma in Fire Engineering from Victoria University and is a Fellow of the Institution of Engineers Australia. He is a member or chair on most fire related Australian Standards Committees. Andre is also the chair of the Insurance Council of Australia's Built Environment Committee and Chair of the Victorian Branch of FPAA.

Tim O'Brien

Tim has more than 15 years experience in the fire protection industry having worked as a senior loss prevention consultant and large loss investigator for FM Global, a fire engineer for the Building Research Association of New Zealand (BRANZ), a Sprinkler System Certifier (SSC) as manager of VeriFire Limited, and as a fire engineer with the New Zealand Fire Service Engineering Unit, and as a fire engineering consultant. He has contributed to the development of numerous New Zealand fire protection standards and has served on the Executive of FPANZ.

David Prosser

David Prosser is currently fire detection Product Manager for Tyco Safety Products, based in Christchurch New Zealand.

Since graduating BSc with honours in both Electronics Engineering and Physics he has enjoyed a professional career spanning 26 years specialising in the design, manufacture, and engineering of fire detection, evacuation alerting, and signalling equipment. Over this period he has developed an extensive knowledge of fire detection practice, both in New Zealand and overseas.

David has been involved with fire Standards since 1993 and currently chairs both the New Zealand Fire Detection and Alarm Standards committee (NZS 4512), and its associated Interpretations group. He also coordinates NZ's input to ISO standards on Fire Detection and is an active member of Standards NZ's Fire Industry Advisory Group. He is the current President of the NZ Fire Equipment Manufacturers' Association and an executive member of the Fire Protection Association (NZ).

Shan Raffel, *AFSM EngTech CMIFireE, Acting Inspector, QFRS, Churchill fellow 2009*

During his 27 year career in the Fire Service, Shan Raffel has maintained a strong operational focus and a dedication to improving operational efficiency and safety. He has conducted a number of international study tours and was instrumental in introducing 3D water-fog techniques to Australia.

Shan has been a member of the Institution of Fire Engineers since 1983, and has held a number of executive positions on the Australian Board. He currently holds the position of Acting Inspector, Major Infrastructure Development with the Queensland Fire and Rescue Service in Brisbane.

Nick Saunders, *Senior Advisor, Department of Building and Housing*

Nick Saunders is a Senior Advisor at the Department of Building and Housing. He has been associated with the fire profession for over 20 years, firstly in the UK and the past 11 years in New Zealand, the last five of which has been at the Department with the responsibility for fire engineering matters. He has been closely involved in the review of the Building Code and the development of a new framework for fire compliance.

Debbie Scott, *Fire Engineer/Director, OnFire Consulting Limited*

Debbie Scott is a one-eyed Cantabrian who now lives in the Waikato. She is the owner of On-Fire Consulting Ltd, a successful fire engineering consultancy based in Te Awamutu with projects throughout New Zealand. She has been a consulting engineer for over 10 years.

Debbie is a Chartered Professional Engineer, a previous governing Board Member of the Institution of Professional Engineers New Zealand, the Vice President of the NZ Chapter of the Society of Fire Protection Engineers and has a Masters of Fire Engineering with Distinction from the University of Canterbury.

Steve Turek, *Assistant Commissioner, Fire Safety Regulation, London Fire Brigade*

Steve is currently Assistant Commissioner, Fire Safety Regulation with the London Fire Brigade where he is responsible for ensuring compliance with Fire Safety legislation across the UK's capital.

As well as his role as a senior operational commander, he heads a 250 strong Fire Safety Inspectorate and a number of specialist groups dealing with fire safety policy support and enforcement, fire engineering, petroleum licensing and transport fire safety.

His current role also sees him actively working on a range of fire safety issues both at national level through the Chief Fire Officers Association's national protection committee and internationally as a member of the European Fire Academy based in Brussels.

He joined London in 2006 after serving for more than 30 years with the New Zealand Fire Service where he served throughout the country in a range of roles from firefighter to Commander of the Auckland Fire Region. Prior to this he was Director of Operations and Training based at the National Headquarters in Wellington.

Steve is a Graduate of the Institution of Fire Engineers and has a Masters degree in Public Policy and Administration.

Anthony Wilson, *ED*, BE, FIPENZ, FICE, FCIWEM, FIEAust, CPEng, IntPE(NZ)*

Anthony Wilson is a civil engineer with over 30 years' experience, 18 of which were as the Water Utility manager and 10 as Chief Engineer for New Plymouth City/District Council.

He is a recognised authority on the institutional arrangements for the water sector both internationally and in New Zealand and is a past president of both Water New Zealand and IPENZ. He has chaired several Standards New Zealand Committees for Standards covering water supply engineering.

John Woodcock, *BSc(Eng) CEng FIFireE Institution of Fire Engineers International President*

John graduated in Mechanical Engineering in 1973 and his first job was as an Acoustics Research engineer with Westland Helicopters in Yeovil. In 1975 he joined Factory Mutual (now FM Global), as a property loss prevention engineer. From 1975 to 1987 John was promoted to increasing senior posts, including account engineer, group manager and senior head office engineer.

In 1987 to 2007, John worked for Sedgwick and then Marsh. From starting as Property Technical Manager he moved through a variety of risk consulting roles, becoming a Managing Director and Chief Operating Officer of Risk Consulting in 2004.

In 2006, he was appointed Head of European Business Development. During this period he developed, project managed and delivered one of the largest Enterprise Risk Management projects to a major Russian company, which lasted 18 months. John took early retirement from Marsh in November 2007.

He is a Board Member and Trustee of the Institution of Fire Engineers, a member of the Institution's management committee and International President for the year 2010/11.

John was first elected as a Divisional Board member of the Institution in 2000 and became Divisional Chairman in 2003. He is also a Board Member of Fire Conferences and Exhibitions Ltd. John chaired a Research Group for the Insurance Institute of London, which developed a recently published guide to Business Continuity for the Small to Medium Enterprise (SME) sector in the UK.

Martin Wooton, *Technical Director – Fire, Beca Carter Hollings & Ferner Ltd* **& Michael Dixon,** *Director, Stephenson & Turner NZ Ltd*

Martin Wootton has been in the fire industry for over 27 years and has had experience in both the fire protection contracting side of the industry as well as within the fire engineering and protection consultancy side.

Martin has had hands-on fire engineering design and fire engineering management experience in relation to the fire engineering requirements of the transportation (rail) infrastructure and rolling stock, commercial (buildings and factories), onshore/offshore, petrochemical, marine, power generation, construction, automotive and food sectors, and has covered roles from Engineer/Draughtsman, Design Engineer/Senior Design Engineer, Project Engineer/Manager, Applications Engineer/Manager and Branch manager/ Director and is currently employed by Beca Carter Hollings & Ferner Limited as Technical Director – Fire.

Michael Dixon has been in the building industry since 1987 in roles that include building maintenance and operation as well as design and construction. His original training is in Mechanical Engineering with a BE (Hons) from Auckland University and he subsequently gained a Masters Degree in Fire Engineering from Canterbury University.

He is the Immediate Past President of SFPE NZ Chapter. Michael is currently a Director of Stephenson & Turner NZ Ltd – a combined architectural and building services engineering consultancy practice – and is responsible for all fire engineering activities undertaken by the company as well as managing building services projects generally.

Is "Effective Fire Venting" EFFECTIVE?

Paul Compton
BSc, MBA, CEng, MCIBSE, Technical Director of Colt International Limited in the UK, is an active member of smoke control standards committees in the UK (BSI), Europe (CEN) and America (NFPA).

Here he discusses the limitations of fire venting and the benefits of considering smoke ventilation instead.

As a foreigner I am used to the terms "fire venting" and "smoke venting" being used interchangeably. I was therefore stunned when I first saw C/AS1 requiring 15% effective fire venting – this seemed incredibly high compared to a typical European smoke ventilation system, which rarely exceeds 2%. With better understanding of how the terms are used in New Zealand the separation is clear, although just how "effective" current fire venting practice is may be open to question.

C/AS1 (clauses 4.2.4 and 4.2.5) allows fire venting or sprinklers as methods of preventing roof collapse in large firecells with no steelwork protection. The aim is certainly laudable, no-one wants their building to collapse in a fire, but the methods just do not match up.

Effective fire venting has traditionally been considered in New Zealand as providing roof lights that are expected to fail and vent heat and smoke at temperatures well below the thresholds for flashover or steelwork collapse. Information from the manufacturers indicates initial softening at about 180°C and failure at 300°C to 400°C. With flashover typically occurring at 550°C or higher the roof lights should fail first and provide some protection. However, with a prescriptive area requirement, no test standards, no provision for make up air and uncertain operation it is hard to find a real justification for any claim of effectiveness. Recent reports from BRANZ (SR198 Effective Passive Roof Venting using Roof Panels in the Event of a Fire) confirm that this position is unsatisfactory.

Sprinklers on the other hand are tested and have a known operating temperature (which is much lower than the roof light failure temperature). They also provide much better protection as a sprinkler controlled fire will remain small enough for the fire service to be able to extinguish it, with much less damage than from an uncontrolled fire. They are also much more expensive.

There are therefore two very different options allowed, with very different effects and performance. So is fire venting under-specified or are sprinklers over-specified, or both? That's a matter for the New Zealand Building Code regulators, but I'd have to say both, based on the very limited aims set out in C/AS1.

Taking the presumption that sprinklers are a good, if expensive, solution, is there another suitable alternative? I'd suggest smoke ventilation, now known throughout Europe as SHEVS: Smoke and Heat Exhaust Ventilation Systems.

Here I'm describing an engineered system typically consisting of automatic natural smoke ventilators, automatic air inlet provision, smoke barriers to limit smoke spread and a smoke detection system to provide initiation. The primary benefits over fire venting are reliable and repeatable operation early in the fire, establishing a relatively cool smoke layer at high level with clear air beneath. And of course the products can be tested and certified to one of the many national and international product standards available, e.g. ISO 21927-2, and the system can be designed to one of the many design standards, e.g. BS 7346-4.

So what can this system achieve?

- limited smoke temperature to avoid flashover and building collapse
- limited smoke temperature to avoid injury to evacuating personnel
- clear visibility to aid evacuation
- clear visibility to aid fire fighting
- limited area of smoke damage

What it doesn't do is limit the fire size as sprinklers will. However, the improved access for fire fighters significantly improves their ability to do their job; search the building, find the fire and extinguish it. The overall effect is therefore similar, provided that the fire service can arrive in a reasonable time and the fire growth rate is not excessive. These restrictions are important; if the nearest fire station is too remote or the fire will grow too fast, e.g. in high racked storage, the system cannot be designed to maintain clear conditions to aid the fire service, but it will still provide true effective fire venting, the air inlet provision ensuring that the limited area of vents can effectively exhaust smoke and heat.

It's probably worth mentioning here that the effects of changing the inlet area can be calculated from formulae in BS 7346-4. These indicate that 15% roof vent with 1% inlet is approximately as effective as 1.5% roof vent with 1.5% inlet for normal through flow ventilation. What is the value of 15% roof openings if there is no provision for air inlet? They will vent, but probably in a pulsing manner, alternately venting and sucking in fresh air, significantly reducing efficiency and ensuring that the building stays smoke logged.

I hope it is clear from this description that a smoke ventilation system has many performance and reliability advantages over fire venting and is much nearer in its advantages to a sprinkler system. And how much does this cost? Well, on a recent project all 3 options were costed and the smoke ventilation system was the cheapest.

While I appreciate that in these buildings the safety of people escaping is covered by other recommendations, it still seems odd that a vent system that does not take effect until conditions are already disastrous is recommended in C/AS1 when a vent system that operates earlier and provides additional benefits to the fire service and the building operator is easily available.

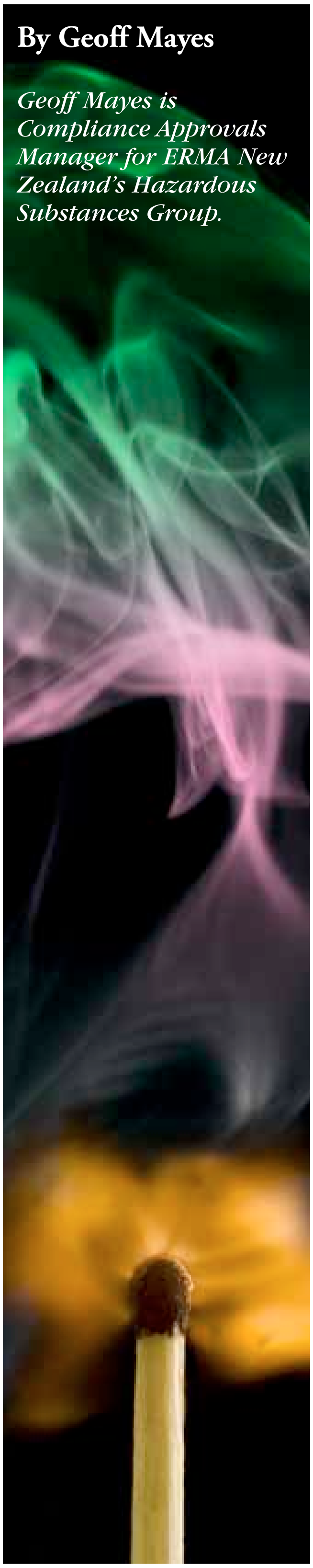
Nevertheless the New Zealand Building Code allows fire engineering solutions so you don't need to wait to take advantage of a smoke ventilation system. Oh, by the way, with some additional controls it can also be used for day to day comfort ventilation – two systems for the price of one.

HSNO

protecting property, saving lives

By Geoff Mayes

Geoff Mayes is Compliance Approvals Manager for ERMA New Zealand's Hazardous Substances Group.



We all know the fire risks posed by flammable and oxidising substances, but do we know how to prevent them?

The Hazardous Substances and New Organisms (HSNO) Act and Regulations are the legislation which manages and prevents these risks.

The Act covers building and fire extinguisher requirements; emergency planning; secondary containment; approval of diesel burners and bulk tanks; and the prevention of ignition of hazardous substances.

These rules help to protect property and save lives and must be followed where flammable liquids, gases and oxidising agents are stored or used. The Building Act alone does not cover the risks posed by these substances.

FLAMMABLE LIQUIDS AND GASES

Fires involving flammables and oxidisers have additional hazards to the normal contents of a building. They:

- are much more volatile and give off more than twice as much heat as ordinary combustibles with a faster rate of temperature rise;
- spread rapidly when the flammable material is released from its containers and the containers can explode in a fire; and
- can float and burn on top of water.

Because of these hazards, special precautions are required when storing, handling and using flammables and oxidisers.

The HSNO Act covers ignition sources, building construction, and the separation distance required from buildings in which flammables are stored or used.

The Act generally requires a higher fire resistance rating for buildings holding flammables and oxidisers, typically 240/240/240.

Fire walls must be structurally sound (plaster board usually not acceptable), and parapets and wing walls may be required.

Fire doors may also require a higher fire resistance rating than for normal buildings. Such doors may need to be specially ordered.

But good planning can reduce costs. By considering the legislative requirements for the following variables, it may be possible to reduce the fire resistance rating required for the building:

- Flammability classification of the substance/s.
- The mixture of substances in the building.
- The total quantity held in the building.
- Size of containers.
- Whether the containers are opened or permanently closed.
- The neighbouring occupancies – both on and off site.
- The separation distance from neighbouring occupancies.
- Whether there are process containers or tanks in the building.
- Whether fixed fire fighting protection is available.

A fully effective sprinkler system could allow a reduction in the required fire resistance rating. But to be effective, the system would usually need to supply foam, and in warehouse storage situations it would need to provide in rack protection. Such a sprinkler system would need to be assessed by ERMA New Zealand if the normal legislative requirements for separation distances could not be met.

FIRE EXTINGUISHERS

The number of fire extinguishers, their location and capability are all covered by the Hazardous Substances (Emergency Management) Regulations 2001.

Fire extinguishers themselves must also be approved. Portable fire extinguishers are required to meet a product standard in terms of effectiveness, as well as meeting safety requirements for cylinders. Large fixed extinguishers (cylinders) are also covered by HSNO.

EMERGENCY PLANNING

A place holding hazardous substances greater than specified minimum quantities, which can be quite small, must have an emergency

response plan. This is a requirement of the Hazardous Substances (Emergency Management) Regulations 2001 and doesn't just apply to flammables but to all hazardous substances.

A key element of an emergency plan is to identify all fire fighting equipment. The plan must also be available to every emergency services provider identified in the plan and it must be tested every two years. So if the plan involves the Fire Service, it should be tested with the Fire Service every two years.

These regulations also require a place holding hazardous substances to have a sign advising the action to be taken in an emergency.

ERMA New Zealand has two publications available on our web site which can assist users with their emergency planning:

- A Quick Guide to Emergency Management http://www.ermanz.govt.nz/resources/publications/pdfs/er-qg-24-1.pdf
- An emergency management flip chart http://www.ermanz.govt.nz/resources/publications/pdfs/ERMA%20Flip%20Chart.pdf

SECONDARY CONTAINMENT

Leaks and spills must be retained and be recoverable (subject to unavoidable wastage). This means that a building holding flammable liquids must be constructed to retain any leaks. ERMA New Zealand is currently developing a code of practice that will deal to these issues and this will shortly be available for public consultation.

TANKS

Bulk tanks holding flammable liquids or gases must be provided with fire fighting facilities and they must have fixed fire fighting protection if over a certain size. They may also require compliance with some parts of AS 1940 (Australian standard for the storage and handling of flammable and combustible liquids).

A further issue for bulk tank storage is the bunding or secondary containment. What will happen if a fire occurs in the bund? Will the bund hold a liquid that is on fire? And what would happen to large amounts of fire water that may be applied? The proposed code of practice on secondary containment will address these issues.

BURNERS

All burners for flammable liquids must be approved under HSNO.

HSNO also controls the installation of a burner and the fuel tanks that supply the burner. If the supply tanks are located inside a building, HSNO requires certain types of construction around the tank.

PREVENTION OF IGNITION

Fire prevention is the aim of HSNO rules around preventing ignition. They require a hazardous area to be defined where a flammable mixture of vapour or gas may occur.

The regulations then control how these areas are managed, and particularly the type of electrical equipment that can be used.

OTHER LEGISLATION

The HSNO legislation sits alongside and works with many other pieces of legislation.

Consequently ERMA New Zealand works with the other government agencies involved to ensure any overlaps are managed, and as much as possible users experience a seamless approach between the legislation.

Other key legislation is:

- Health and Safety in Employment Act which covers general safety issues.
- Building Act and the issue of building consents which takes into account HSNO Act requirements through clause F3 of the Building Code.
- Gas Act which approves gas burners.
- Electricity Act which specifies the type of electrical equipment to be used in a hazardous area that has been delineated under HSNO.
- Resource Management Act which is also concerned with spills, leaks and fire water runoff.

HOW TO GET HELP

If you would like more information on any of the HSNO requirements you can call the ERMA New Zealand Helpline 0800 376 234.

Alternatively you can contact a test certifier, an independent person approved under the HSNO Act to certify locations and people where flammables and oxidisers are used.

A list of test certifiers can be found on the ERMA New Zealand website http://www.ermanz.govt.nz/Find/TestCertifierSearch.aspx.

The ERMA New Zealand website also provides information on many specific situations www.ermanz.govt.nz.

LIFE OF A BUILDING

Introduction

Preventing
Advice offered to the community and businesses:
• Fire Fighting Crews
• Promotion & Education teams
• Fire Safety Officers
• Fire Engineers

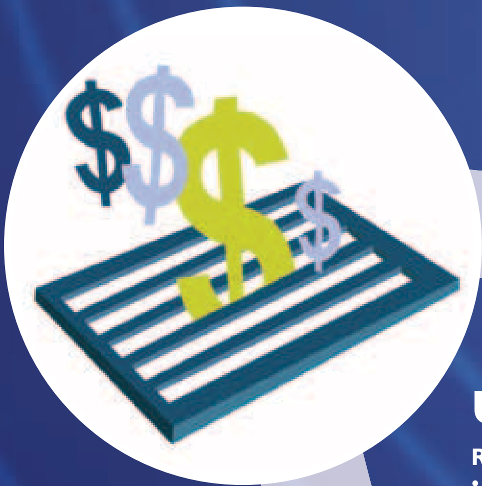
Protecting
Best solutions for:
• Planners
• Designers
• Owners
• Occupiers

Responding
We respond to all emergencies. However proactive measures in prevention and protection will save lives and minimise loss.

Fire Safety

Fire safety is the responsibility of all building owners.

- Means of Escape
- Fire Fighting Equipment
- Active Fire Systems
- Evacuation of Buildings
- Appliances



Unwanted False Alarm Acti

Recommendations for the Fire Alarm Contractor

- Offer professional advice to owner.
- Correct and appropriate installation.
- Prevent false alarm activation.
- Determine cause, not just reset system.
- Attend meetings with owners and Fire Service to address u
- Gain Fire Service assistance when required.

Evacuation Schemes

Approval Process
The scheme approval process is managed by a National Unit. The responsibility for the scheme is placed squarely on the applicant. The Fire Service has to be confident that the scheme as submitted will work. Refer to http://evaconline.fire.org.nz for more information.

Building Survey
In schemes were evacuation to a place of safety inside the building is proposed, the Fire Service may need to survey the building to ensure that the place or places of safety meet the Fire Service criteria.

Scheme Maintenance
If building owners are not providing notification of trials or training at the appropriate time, this could trigger the need for a building survey under Section 21F of the Fire Service Act 1975.

Fire Engineering

Good documentation = improved profitability

A range of organisations within the New Zealand construction industry have realised that poor documentation impacts heavily on the profitability of a building project.

Fire Fighting Facilities

The "Fire Service Operations in Buildings" guide is updated at regular intervals and can be found on the Fire Service website at www.fire.org.nz

Building Act

The Engineering Unit is required to provide advice to the Building Consent Authority on the fire engineering design of the Gazetted buildings. This advice is in the form of a memorandum covering the following matters:

- Provision for means of escape.
- The needs of the Fire Service to enable it to undertake fire fighting.

vation

nwanted alarms.

Building Survey

Building Fire Safety Survey

Building surveys form the backbone of Fire Service strategy for managing fire risk within building stock. Buildings may have a lifetime of 100 years or more, and the fire safety risks within that building need to be managed over the life of the building.

Fire

Get it right first time.
Businesses fail after significant fire.

Fire Engineering Challenges

FROM SUSTAINABILITY

John Woodcock
BSc(Eng) CEng FIFireE
International President
Institution of Fire Engineers

As International President of the Institution of Fire Engineers, I want to cover two areas in this article. The first is what the Institution is doing and the second is what challenges face the professional fire engineer from sustainability issues.

The Institution continues to grow, provide member benefits and increase the voice of the profession. We are particularly pleased with a number of recent achievements and opportunities. We continue to increase the registration of engineers in all three grades: Chartered Engineer; Incorporated Engineer; Engineering Technician. Registration is growing in Hong Kong and Australia and we hope to increase the number of New Zealand registrants. We have examinations that are now nationally recognised (in the UK). We have established successful registers of Fire Risk Assessors and Auditors, to help guide those who want assessments of premises for which they are responsible and want to know of competent advisers. We are developing a National Fire Research Community, to bring together data on research and to permit researchers to network. We are also working on alliances with suitable partners around the World, including: Hong Kong Institution of Engineers; Engineers Australia; Society of Fire Protection Engineers.

My second area is Sustainability. This is the theme of the Institution this year and, in particular, how fire engineering needs to play a key part. We started with a conference in London in July. There is an increasing trend for new and refurbished buildings to be of sustainable construction, which is often combustible. Now the majority of this is timber, including lightweight engineered timber framing. This is resulting in buildings that have a significantly lower time to flashover – as low as 20 minutes. We are seeing threats to the continued use of current fire retardants, due to the toxicity and environmental impact they have in a fire, with replacements less effective.

We are being challenged through cost-cutting, aesthetic and management considerations, to minimise the installed fire protection to that which is necessary for safe evacuation. This leaves evacuated buildings more likely to suffer complete burn-out, with consequent high airborne emissions and the resultant huge costs and environmental impacts. The fire and rescue services will be challenged through more fully-developed fires on arrival, as well as changes fire growth dynamics from these sustainably constructed buildings.

This is an issue being seen across the globe and the fire profession needs to work hard to remain fully part of the initial design, as well as ongoing maintenance. The Institution is forming a Special Interest Group to help collate thoughts and ideas, as well as promoting the importance of fire engineering.

From the Presidents

The Institution of Fire Engineers New Zealand Branch is honoured that our own Immediate Past President, Brian Davey has been elected to the Institution of Fire Engineers, Board of Directors.

Brian's first board meeting of a three-year term is in the United Kingdom (UK) in October and we wish Brian well as he and the other directors continue to provide governance to the IFE globally.

As we draw closer to the conference, a reminder that applications for IFE examinations should be received at Institution of Fire Engineers, Executive Director, PO Box 3961, Wellington by the end of October. The examinations, which are increasingly providing the underpinning knowledge that support fire professionals in their role, are held during the second week in March each year. Look at the main IFE website www.ife.org.uk to view the range of papers available at each level. Candidates should start their study programmes early to enhance your opportunity for success. The New Zealand Branch Council will provide a series of evening study seminars which will be finalised once candidate numbers and locations are known.

Two exciting developments are the focus on providing exam opportunities for fire industry providers in the near future and the move to the Qualifications Credit Framework (QCF) which will make the IFE examinations internationally interchangeable.

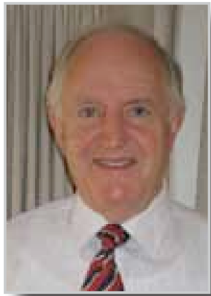
The IFE International President John Woodcock will be a keynote speaker at our FIRE-NZ conference this year and we will also be privileged to have the Leader and Vice-leader of the International General Assembly, Mark Reilly and Richard Fowler attending. Mark is the President of the Australia Branch and Richard the secretary of the South-Eastern Branch (UK).

During his time in New Zealand John Woodcock will be delivering training to members of the IFE Registrants Group. Under its Engineering Council licence, the IFE is authorised to register suitably qualified members as Chartered Engineers (CEng), Incorporated Engineers (IEng) and Engineering Technicians (Eng Tech). In December 2009 the Quality Assurance Committee of the Engineering Council issued an outstanding audit report for the IFE. The Engineering Council found the IFE approach to remote interviewing to be thorough and an example of good practice which others institutions could benefit from. It also determined that the IFE is a well run institution with good processes and procedures.

The training John will provide will enable local interviewing of applicants giving a more convenient and efficient process. Registration with the Engineering Council through the IFE indicates that your competence, and your commitment to professionalism, have been assessed by other engineering professionals. Check the IFE website to see which is the most appropriate level you can apply for, maintain currency in your continuing professional development and start the application process.

I look forward to seeing many of you at the FIRE-NZ conference to be held on the 3rd and 4th of November at the Christchurch Convention Centre. Delegate registration is now open and the exhibition has over 25 companies covering 41 exhibition sites, promoting and demonstrating the latest technology and equipment for our fire engineering, fire risk management and fire prevention future.

Gary Ward M.I.Fire E
President, NZ Branch
Institution of Fire Engineers



The Fire Protection Association NZ has grown considerably and still continues to grow as an organisation. The FPANZ National Executive has recognized this growth and in June 2010 decided that the next step to further strengthening the structure of the Association was to establish a Governance Board.

The key role of the Governance Board is to implement a Governance structure that improves the operational efficiency, maintain and improve growth of the Association and to enhance the confidence of the Association's Members in the Governance of the organisation. The Board will also work toward developing a set of relationships between the Association's management, Executive, Members and other stakeholders and to encourage the efficient use of resources and equally to require accountability for the stewardship of those resources. A board charter has been produced which clearly lays down the responsibilities of the Board. However, the National Executive remains responsible for the overall organisation of the Association with the Board reporting directly to them.

During the process of developing the Governance, re-writing the FPANZ Constitution and Rules has become necessary and a special General Meeting on the 22 September 2010 to ratify the new Constitution has been called. The Constitution has been re-written to remove the regional structure and provide a Constitution suitable for a modern organisation. In removing the regional structure, most clauses of the Constitution were affected. The opportunity was therefore taken to lay out the clauses in a more coherent order and at the same time the National Executive are seeking agreement to formalize the election and to cap the size of the National Executive to 21 persons. The Executive believe that a mix of 14 delegates elected at the AGM plus 7 representatives of the associated interest groups such as the Fire Service and Insurance Council of New Zealand will be the best mix representing all members of our industry. Members of the Fire Protection Association will be sent details of the changes and asked to vote accordingly. This new constitution will then take affect in time for the AGM to be held on 4th November 2010 in Christchurch.

Also at this time, we would like to take the opportunity to thank Bob Taylor for his service to the Fire Protection Association NZ and to recognize his input to the growth of the Association over the past 13 years. Bob retires at the end of this year and it seems only appropriate, to take a moment to thank him for his valuable contribution.

Over the next few months our emphasis will be final preparations for and processing of registrations for the upcoming FIRE-NZ 2010 Conference and Exhibition. Exhibition stands have sold extremely well and at the time of writing we will have the largest ever number of exhibitors and sponsors for our conference. The conference registration brochure was sent out on the 25th August 2010 and registrations are now starting to flow in. We would suggest, if booking flights and accommodation, that you take advantage of the accommodation rates offered by Rydges or Holiday Inn and also any cheaper flight deals available.

This will be a great event and we look forward to seeing you there.

Kevin Kennedy
President, Fire Protection Association NZ

Looking For Lost Water Supplies FOR FIRE SPRINKLER SYSTEMS

ROSS AITKEN
General Manager Installation and Technical Support
Chubb New Zealand Ltd | FPA Chairman Water Supply Sub-group

They say that New Zealand is God's own, a special country with all the benefits that nature bestowed on us, most especially - abundant water. That's certainly been the case for the last 100 years and until recently, water taken for granted and delivered in reticulated pipework infrastructures to most domestic and commercial users has provided the backbone for fire sprinkler systems, now totalling some 7000 in New Zealand. I would imagine that no one would deny the benefits. Sprinkler systems provide personal life protection to tens of thousands of New Zealanders in their business premises and homes every day. They provide protection for a number of New Zealand's very significant infrastructures assets, not to mention many other everyday businesses, thereby providing ongoing business continuity and improved insurable risk.

Now at this stage, and I know this might sound strange, but fire sprinkler systems do not, in the main, use very much water. They certainly don't use water like you see in the Hollywood movies where all the heads in a building go off simultaneously, because it takes a certain amount of concentrated heat to set a sprinkler head off and this is usually only over the seat of the fire itself. In fact, if there were no sprinkler systems present in any given building where a fire was involved, (there are at least two fire saves per week from sprinkler systems in New Zealand) the resultant use of water by the NZ Fire Service to fight the fire, and the environmental damage from the fire itself, would be significantly greater than if a sprinkler system was present and controlled the fire as designed.

Back to my point that fire sprinkler systems do not use very much water at all.

While we have fire sprinkler system saves every week in New Zealand, most fire sprinkler systems sit passively waiting, day by day, minute by minute, to provide this huge assurance of personal life and property protection while the general population goes about their daily life. However, what these fire sprinkler systems do require, and what has been adequately provided over the last 100 years (in most cases) is the ongoing potential of water pressure and flow to meet the needs of the fire sprinkler system. I might be drawing a long bow here, but my point is that most of the requirement is potential, while at the same time actual water use itself is very very low. I make this point because water is a precious commodity in this world and I do not want people thinking that fire sprinkler systems sit there continually using this resource wastefully or without conscience.

As mentioned, fire sprinkler systems need water flow and pressure potential, but in reality use very little of New Zealands' water resource. The infrastructure that has provided this potential for the last 100 years is our everyday town and city water mains and what a wonderful job they have done.

Water supplies in general have provided pressure in the 500 – 700 KPa range with volume often around 2000 – 4000 litres per minute and more. This potential has had a huge benefit for the New Zealand economy because it has allowed the vast majority of sprinkler systems to be built cost effectively, and using these town main water supplies has meant we have had little requirement for the additional cost of pumps or water tanks or the physical room that these would need. I should probably also mention that the inclusion of pumps and tanks in general will also reduce the reliability of sprinkler systems and for the life of the sprinkler system considerably higher maintenance and running costs.

The problem we are currently facing is town main water supply systems for use by fire sprinkler systems are now at risk for two reasons.

1. **Ageing Infrastructure**

   The first and most easily explained is age. These underground water mains have been installed in New Zealand towns and cites for up to 100 years and in some circumstances sections of the ageing infrastructure need more gentle management via intentional pressure reduction than others. This reduction is being managed by various Territorial Authority's or Water Supply Authority's (WSA's) via pressure reduction projects which involve the installation of a series of pressure reducing valves in a given area. I am advised that the reduction of water pressure does allow these areas to reduce both system water losses as well as help extend the life span of the pipework. Both points are very important and easy to understand.

   Equally however, it is important to note that sprinkler systems installed within these intentional pressure reduced areas may have their design criteria (based on the use of previously available water pressure), compromised, and could be rendered non compliant to their consented design thus not meeting Building Warrant of Fitness (BWOF) requirements. This is a significant concern for building owners, Territorial Authorities, the insurance industry and sprinkler system installation and maintenance companies and needs to be closely managed before any intentional water pressure reduction project go ahead.

   As noted in the start of this article fire sprinkler system are designed and installed to save life and property. This is a significant consideration when pressure reduction is considered. Presently the Fire Protection Association NZ has advised all Territorial Authorities in New Zealand of their commitment to work alongside those with these types of projects, to ensure that the integrity of installed fire sprinkler systems is not compromised.

2. **Ongoing Responsibility to Supply Water Pressure and Flow**

   The more difficult issue to be resolved for the future of fire sprinkler systems off town's mains water supplies is the ongoing "responsibility" to supply water pressure and flow. This is difficult

and complex subject where the history of sprinkler system design and installation in New Zealand for the last 100 years (and documented as an acceptable and consented approach within New Zealand Sprinkler Standards) has been to use a de-rated percentage of the available water supply pressure measured at the time of installation.

This approach has served the economic environment well, in that it has allowed sprinkler systems to be installed without pumps and tanks and has provided cost effective management of fire protection in buildings. Alongside new intentional water supply pressure reduction projects to extended the effective life of water supply systems, then both considerations are valid and need to be considered.

Most water supply authorities (WSA) are beginning to take a very conservative approach to the provision of water supply (pressure and flow) for fire sprinkler systems. With the increasing complex nature of accountability, they are taking an approach where guaranteed water supply pressures are so low, that as a result, invariantly all fire sprinkler systems of the future would need to be installed with pumps and tanks. This, in itself, would be a very large increase in cost (as well as a number of physical space issues in buildings) for end users and if this was required for 100% of all newly installed fire sprinkler systems, would represent a significant future investment cost to New Zealand infrastructure.

In my mind, this issue needs to be researched and resolved with help from Central Government. I do not believe that any party have special rights that make the other parties position invalid. I do believe however, that "in general" most water supplies will never be reduced to the minimum guaranteed water supply pressures being advised by WSA's so there needs to be fair debate and accommodation of risk to the parties involved. Without this, the additional cost to New Zealand infrastructure, based on a conservative no risk approach by WSA's will be significant.

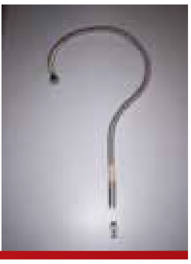
In summary, the future use of fire sprinkler water supplies via town's main systems in New Zealand will change, but there is a challenge to establish an approach that balances all the factors involved. It will possibly be more important to take a more conservative approach to the use of town's main water supplies than is presently allowed within New Zealand Fire Sprinkler Standards.

While WSA's may not be able to guarantee the use of these pressures, and provided building owners of new systems understand the risks of using the available (de-rated) water supply, a continued use of towns mains water pressure and flow should be allowed. If, due to circumstances, water supply pressures lower such, that on some systems further fire system amendment or a fire pump installation is required in the future, this cost will need to be meet by the building owner. The alternative is to install fire pumps and tanks in the building owner's premises in the first instance (even though suitable water supply pressure and flows are available) and this cost would have been expensed anyway, although at that time I would suggest unnecessary. This issue needs to be resolved at the highest level.

There are cost savings to be made by WSA's who wish to use reduced pressures and this is important. There could be additional and unnecessary costs, which would be borne by building owners who cannot use (to a reasonable agreed level) the available water supply pressures and flows. Both aspects count as a cost to New Zealand as a country and needs to be considered and managed. Let's get on with this consideration and find a way forward for the betterment of all.

Flexible Sprinkler Drops

BE AWARE - OR BEWARE



Nigel Robinson
BSc MSFPE
Technical Manager
VeriFire

Are flexible sprinkler drops the panacea allowing quicker, cost effective, installation of sprinklers?

Do they allow for easy relocation of sprinklers during tenancy fitouts?

Are there hidden dangers associated with their use?

Although in principle their use is straightforward, recent industry experience has shown reality to be somewhat different.

Flexible Sprinkler drops are widely used overseas and were first listed for use in New Zealand sprinkler systems in 2000. Since the first flexible drops were listed by the Insurance Council their use has become more prevalent, and the range of drops has increased significantly.

Everybody involved in specifying, designing, installing or inspecting flexible sprinkler drops needs to be aware of the many issues involved with their use.

What are flexible sprinkler drops?

Flexible drops are designed to connect sprinklers to the water distribution pipework, particularly when installed in commercial suspended ceilings. The basic components are:

- Listed flexible sprinkler drops are made from thin wall stainless steel tube, with a typical wall thickness of 0.3mm and nominal bore of 20mm or 25mm.
- Tubes are formed with corrugations to produce a bellows that allows the tubes to be bent by hand.
- Both braided and unbraided drops are available. Stainless steel braiding over the outside of the tube provides additional mechanical protection to the drops but is not required to resist system pressurisation.
- Some drops are corrugated along their entire length while others have alternating corrugated and straight sections (not always obvious with braided models).
- Drops are attached to fixed pipework via a nipple fitting that comes as part of the assembly, with a nut and integral washer attached to the drop itself.
- Sprinklers are screwed into an outlet nipple, which is either an integral part of the drop in some models or is attached by another nut assembly in others.
- The outlet nipple is attached to the ceiling grid using a proprietary bracketing system that is an integral part of the listed assembly.

Why are they used?

The main advantage of flexible drops from a contracting perspective is seen as speed of installation, particularly when compared with hard piped sprinkler drops. This is their main selling point.

Some advertised advantages are:

- Cost savings due to quicker installation
- Ease of installation, with more tolerance for locating centre of tile etc
- No measuring or thread cutting
- Easy to relocate if necessary (within limits)
- Useful in tight ceiling spaces, giving access to difficult sprinkler locations and changing ceiling angles.
- Minimal mess during "second fix"

A further advantage is that sprinklers can be installed at the "first fix" stage, which allows pressure testing to be completed before ceilings are installed and thus reducing the "second fix" work as ceilings installation progresses. This is also seen by some contractors to give an advantage with programming, where the speed with which ceiling panels can be installed is faster than hard piped sprinklers can be fitted.

While drops listed in New Zealand are intended primarily for use in commercial suspended ceilings they do have other potential uses. Factory Mutual have drops approved specifically for use in clean room ceilings and for duct protection, where vibration and differential movement between piping and sprinklers can be catered for. These uses have not been commonly encountered in New Zealand to date, although there is potential for their use in certain circumstances.

The Pitfalls
(lessons that have been learned so far!)

The main disadvantages of flexible drops fall into two general categories:

- Installation faults by sprinkler contractors at the time of initial installation
- Post installation issues caused by other trades, potentially at any time in a buildings life after installation.

Installation faults

There are a number of installation requirements for flexible drops which are published in manufacturers data sheets, and in some cases in listing certificates. In addition, requirements vary between manufacturers , between models from a single manufacturer and at times between listing organizations.

Installation requirements are therefore specific to the particular drop being considered. Faults can and do occur with any of these requirements and the majority of faults identified to date have been the results of not adhering to the manufacturers data sheets and listing certificates.

Specific listing requirements include:

- The maximum number of bends allowed (typically 3 x 90 degree bends, but variable)
- The minimum permitted bend radius (typically 75mm but variable)
- Tightening torque for tube attachment nuts (typically little more than hand tight – over tightening can damage the sealing gasket and / or the swaged flange)

The bracketing system to be used to secure the drop to the ceiling grid. This is an integral part of the listing and must be the correct type for the sprinklers used and must be the correct type for the ceiling grid profile. Alternative brackets require SSC approval

- In some cases the tightening torque for bracketing bolts is specified
- There are limits on maximum unsupported horizontal lengths

Further factors have also been identified from local experience, which need to be considered when using flexible drops:

- Selecting the correct length to avoid making unnecessary bends to "use up" excess length
- Avoiding the use of long steel drops to feed flexibles, or fitting seismic restraint to the steel drops where these are unavoidable
- Coordination of pipework to minimize the number of bends needed
- In some cases the use of elbows where feeding from fixed pipework, or in some models at the sprinkler nipple, to avoid unnecessary bends
- Careful handling of drops and attached sprinklers after first fix and prior to ceiling installation (excessive bending of drops is to be avoided and care needs to be taken to ensure sprinklers are not damaged)
- In general no more than one flexible should be taken from a single 25mm feed unless proven hydraulically and included in completion documentation

Further information can be found in Aon Sprinkler Certification Technical Note09-01 issue 2 (October 2009), which is endorsed by VeriFire, plus manufacturers data sheets and listing certificates.

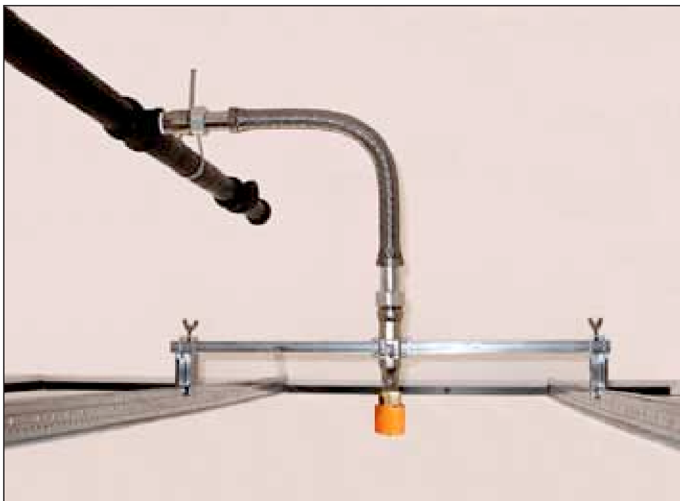
Post installation problems

There is growing evidence from within New Zealand and from overseas that flexible drops lend themselves to abuse by other trades, both during initial installation and at any subsequent time.

Problems that have been identified to date include:

- The ease with which drops can be pushed out of the way to provide clearance for other services, often with little regard for damage or misalignment of the drops (hard piped sprinklers minimize the possibility of other trades damaging or interfering with the installation)
- Inadvertent damage or misalignment by people working in or moving through the area, particularly in confined spaces
- Easy relocation of sprinklers by non-approved persons to accommodate other ceiling features such as light fittings or air vents, with little regard for sprinkler positioning or damage to drops

Photo 1 – Not the way to do it - an incorrectly installed drop



- Relocation of sprinklers during tenancy fitouts, without the involvement of sprinkler contractors. There are limits on how far drops can be moved and how many times a drop can be relocated. Excessive or frequent moving of drops will lead to damage, premature failure and water leakage

As these events can occur at any time in the life of a building the question of who is responsible and who is liable will be difficult to determine. Was it installed correctly in the first place? Who has been there since to interfere with it? Who is responsible for fixing it?

These issues have already occurred on new sites, how many more will surface in years to come?

Hydraulic design considerations

An important design consideration is hydraulic loss through flexible drops, which can be considerable. For example a 1.2m long flexible drop may have a pressure loss equivalent to 25m or more of steel pipe.

As with other design criteria the actual pressure loss allowances for individual drops are specified in manufacturers data sheets, and in many cases are derived from the original international approvals such as FM or UL certificates.

The correct allowances need to be included and shown in hydraulic calculations that are submitted to the SSC.

Conclusions

In our discussions with contractors there is divided opinion concerning the use of flexible drops.

When installed correctly the advantages of speed and ease of use for general sprinkler protection is seen to be valid, and there is scope to use flexible drops in other specific applications where mechanical isolation from vibration etc is a concern.

However industry experience to date is that "installing correctly" has been a challenge.

It is to be expected that with careful design, training and supervision of installation staff, plus adequate inspection, flexible sprinkler drops can be used effectively. The challenge is to educate the industry on how and where to use them.

The long term viability of flexible drops will also rely on the wider building industry understanding how they are used. Building managers and other service trades will need to be made aware of the consequences of interfering with flexible drops, and the potential liability if they are damaged. This may also lead to insurance industry considerations in the future.

In short, if they are installed correctly and maintained correctly they will work correctly – that is the challenge!

Fire Death in a Sprinklered Rest Home

By Tim O'Brien

BE(Hons), MSFPE, MNFPA, MIEEE

Tim is a former executive of FPANZ and IANZ accredited signatory for Sprinkler System Certification (SSC) and fire resistance testing.

Tim has expert knowledge in loss prevention, automatic fire sprinkler protection (including special hazards), fire resistance testing, fire safety systems compliance and fire investigation. He has made significant contributions to Standards New Zealand and training in the fire protection industry in New Zealand and overseas.

Tim is currently an independent fire engineering consultant having previously been employed with the NZFS, VeriFire Limited, BRANZ Limited and FM Global.

Structural fire deaths in New Zealand are comparatively rare events (New Zealand Fire Service statistics[1] from 2002 to 2007 show an average of 22 deaths per year). Some might argue that the rate of fire death in New Zealand is at, or below, the level of statistical noise however, records from jurisdictions in North America shows that the automatic fire sprinkler protection can further-reduce fatalities from fire. Indeed, fire deaths are almost unheard of in buildings protected with compliant sprinkler protection.

All unintentional fires provide an important learning opportunity for the fire engineering community, particularly those fires where the outcome was in some way unexpected or unusual. It is only through post incident analysis that we can gain an understanding of how fire safety systems performed (what went wrong and, of equal importance, what worked). The results of such analysis allow us to reinforce those aspects of regulations and Standards that were proven, and in some instances improve the design basis for fire safety systems.

In October 2009 a fire occurred in a bedroom suite of a sprinkler protected aged care home (refer to Figure 1). The fire resulted in the subsequent death of the occupant in hospital. Consequently the New Zealand Fire Service (NZFS) conducted an Post-Incident Analysis (PIA) into this fire of interest.

The analysis included a review of NZFS, Police, and Hospital records, compliance documentation, facility emergency procedures and witness statements. Two items of coroner's evidence were visually examined and a scene examination was completed (although much of the evidence had been disturbed by this time).

Examination of the room of fire origin, sprinkler system and compliance documentation identified a number of issues that might have contributed to the fatal outcome of this fire. These included sprinkler Response Time Index (RTI), sprinkler head placement relative to the ceiling and apex of the unusually high-pitched ceiling, and potentially obstructing exposed beams.

The fire sprinkler contractor reported that three sprinkler heads had operated. This was considered unusual for what was essentially a fire in a small room with a fire load considered to be typical for this type of occupancy. Was the cause rapid fire growth, delayed sprinkler operation, shielding of discharge, or a combination of these?

The extent of combusted material was limited due to operation of the automatic sprinklers which fully extinguished the fire. It was not immediately apparent how the fire had spread from the probable first point of ignition, a pillow on the floor in immediate proximity to a portable fan heater, to involve upholstered furniture.

The fire was modelled using Fire Dynamics Simulator[2] (FDS5) to study the probable rate of fire growth, the mechanism of fire spread, gas temperatures and smoke toxicology. Modelling allowed examination of various aspects of the sprinkler system and smoke detection in order to ascertain if any installation aspects had contributed to the fatal outcome of this fire.

It should be remembered that modelling is just that, involving a simplification of what we know and can reasonably assume, in order to develop an understanding of what may or may not have occurred. A significant advantage of modelling after-the-fact is that the model can be developed to be consistent with the available evidence, providing a somewhat higher degree of confidence in the results than might be warranted in the investigation of hypothetical design fire scenarios (this latter use of modelling being the more common fire engineering design challenge).

The room geometry was modelled from actual measurements using appropriate literature data for the thermal properties of the materials of construction as shown in Figure 2. The model mesh cell size was initially selected to be a 50 mm cube with a grid of 1.7 million cells to permit realistic physical modelling of the high pitched skillion ceiling, exposed beams, the fan heater and pillow. The stair-stepping construction limitations of the FDS model results in eddy effects at sharp corners and edges. This is a computational efficiency that results in Lego type construction of inclined planes and curves. Sensitivity analysis of the grid and eddy effects on the inclined planes (the latter using the FDS SAWTOOTH parameter) was completed to validate the selected grid dimensions.

The model was developed by initially considering only the fan heater and the pillow in the room of fire origin. The fan heater was modelled as a ***rectangular*** parallelepiped with an induction vent on the top surface and a heated air discharge

Figure 1. Fire Scene

vent on one side. Air flow and temperature data on the heater were not available so these parameters were estimated based on similar physically sized and power-rated appliances.

Data on combustion of latex foam rubber pillows is somewhat limited and the literature[3] suggests that latex pillows can be difficult to ignite. Had time and resources been available it would have been useful to conduct experimental work on the likely source of ignition and initial fire growth under the effects of fan-forced hot air. In the absence of other data the latex pillow Heat Release Rate (HRR) from the Kransy et al. was used as the basis for initial combustion in the model.

The only other significant contributors to the combustion process were the bedding and mattress and an upholstered foam chair. These were incorporated in the model using combustion data from experimental values cited in the CBUF Report[4] with time to ignition and fire spread determined by material properties and fire growth within the model. It should be noted that this aspect of FDS fire modelling is considered to be in the realm of research, although it can produce intuitively realistic fire growth.

A wood veneered chest of draws and a bookcase had also been burnt, but the extent of fire damage to these items was limited suggesting late involvement in the fire and a minimal HRR contribution. A section of the floor covering had been melted and partially burnt but the physical evidence at the fire scene indicated that this was not a significant contributor to fire spread. The structure of the building was not involved in the fire.

A total of twelve 240 second simulations were completed. These tested aspects of model sensitivity, fire growth rate, and the effects of varying the sprinklers' RTI and location with respect to the ceiling in accordance with the Standards of the day. While the simulation time was typically 24 hours to model 240 seconds from ignition, the model preparation and subsequent analysis required several months to complete outside of the time and resource limitations that exist within the NZFS. The model was run on a Microsoft Windows 7 64 bit platform with a 3.2 GHz Intel Core 2 Quad processor with 8 GB of RAM running FDS5 using Open Multi-Processor (OpenMP) simulation.

The qualitative modelling results were consistent with the post-fire evidence, witness statements and estimated time-lines. The quantitative modelling results gave weight to the assumed mode of fire spread. From the probable ignition of the pillow the fire spread to the bedding through continuity of combustibles aided by forced air flow from the fan heater. Subsequent involvement of the upholstered chair appears to have been through radiative ignition, an aspect of the fire not readily discernable from the physical evidence.

Modelled smoke alarm and sprinkler activation times are summarised in Table 1 below.

From the modelling it is apparent that:

- the delay in sprinkler activation due to response rate and location in relation to the ceiling would have had minimal impact on the fatal outcome of this fire.

Figure 2. Initial FDS Model of Room of Fire Origin

- tenability criteria in the room were maintained away from the seat of the fire to the time of sprinkler operation.
- the rapid development of the fire could reasonably have activated three sprinklers.

It has been established as a matter of fact that the victim was aware of the fire very early in its development, certainly some tens of seconds before the activation of the smoke alarm and in the order of a minute before the operation of the sprinkler system. It is also apparent that the occupant's intimacy with the fire early in its growth and secondary factors including age and heath were the significant contributing factors to the fatal outcome. This is in agreement with the literature[5] that indicates even limited fire exposure for the very young or very old is likely to have fatal consequences.

The NZFS report concluded that:

> *"On the basis of the information available at the time of the investigation it can be concluded that the cause of this fire was the result of an unfortunate and improbable sequence of events and that, but for the wisdom of hindsight, the fatal outcome could not have reasonably been anticipated."*

The full PIA report makes eight significant recommendations that extend beyond the material presented in this article, including matters relating to sprinkler system compliance and the investigation process. The full report can be requested from the NZFS with reference to Incident Number F0524664.

[1] New Zealand Fire Service Emergency Incident Statistics. 1 July 2006 - 30 June 2007. http://www.fire.org.nz/Facts-and-Figures/Statistic-Reports/Statistics-reports-from-2005-onwards/Documents/ce561f469cb477546c1715d6e0bf107f.pdf

[2] National Institute of Standards and Technology (NIST), 'Fire Dynamics Simulator Version 5.4.2 (FDS5)', US Department of Commerce, 2009

[3] Kransy, F.K., Parker, W.J. & Babrauskas, V., 'Fire Behaviour of Upholstered Furniture and Mattresses', Noyes.

[4] Publications, 2001, pp 287 et seq. Sundstrom, B. (Ed.), 'CBUF Fire Safety of Upholstered Furniture – the final report on CBUF research programme', EU Commission, Measurements and Testing Report, EUR 16477 EN

[5] Purser D.A., 'Assessment of Hazards to Occupants from Smoke, Toxic Gases and Heat', Sect. 2, Ch. 6, Figure 2-6.30, National Fire Protection Association, 'SFPE Handbook of Fire Protection Engineering', 4th Ed., Mass, 2002

		Sprinkler		Device Activation Time (s)			
Simulation	Design Fire	Response	Location	Smoke Det.	Sprinkler 1	Sprinkler 3	Sprinkler 5
Molly7.fds	Minimal	Standard	Actual	29.2	-	213.9	223.3
Molly8.fds	Credible	Standard	Actual	29.8	75.8	74.0	68.2
Molly9.fds	Credible	Fast	Compliant	29.8	69.5	62.9	65.3

Table 1. Response Time of Smoke and Heat Detectors

Insulated Sandwich Panels
PROBLEM OR NO PROBLEM?

Richard Fowler
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is a Group Manager with East Sussex Fire & Rescue Service in the UK.

The views and opinions expressed in this article are his own and not necessarily those of his employer.

ISP's are often associated with poor performance in fires and with considerable risk to firefighters. Richard Fowler BEng(Hons), CMIFireE, MCMI considers whether this reputation is an accurate one.

Insulated sandwich panels have been used for many years now to construct a wide variety of buildings. Their use has traditionally been associated with cold storage buildings or food-processing factories but it is now far more widespread. Drive through any town and, although not always obvious, you will see them in warehouses, schools, factories, retail outlets, places of worship and more.

In the title of this article I have asked the question "Problem or No Problem?". In 1993 a fire occurred in a food-processing factory (Sun Valley Poultry Ltd) in Hereford, UK in which two firefighters tragically lost their lives. This incident was arguably the one that brought sandwich panels to the attention of the fire service for the first time. Prior to this, few firefighters would have know what a sandwich panel was and would not have understood the risks that the panels might pose to them at a fire.

Since then, many fires have occurred in buildings manufactured from ISPs, causing serious damage to some, destroying others and, sadly, taking more firefighters lives. These incidents are widely publicised and reported and it is not surprising therefore that firefighters now generally perceive these panels to present a significant risk to them in a fire situation.

However, talk to others who are concerned with their use, such as building designers, occupiers and the panel manufacturers, and they may have a different view. The designers will tell you that they are safe to use because they meet all the relevant 'standards'. Occupiers will tell you they are safe because their building received Building Regulations approval when it was built. And the manufactures will tell you that their product is safe if it is correctly selected, installed and maintained.

So who is right? Well, my view is that all of them are right – some of the time. My research has shown many incidents where panels have burnt in an uncontrolled manner, through hidden voids, causing extensive building collapse. But I have also seen many others where panels involved in fire have performed very well and resisted the spread of fire for extended periods, have not supported internal fire spread and have maintained the integrity of the building throughout the incident.

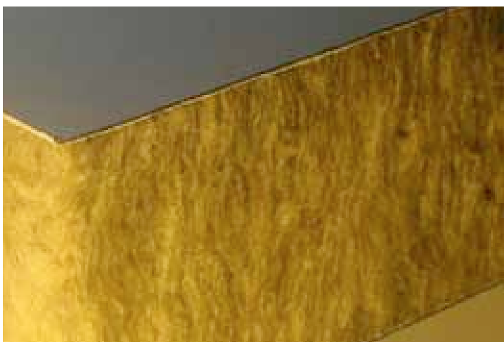
Some panels can, and do, perform well in a fire. Panel construction and core materials (the material used to fill the core of the panel and provide the insulation) vary considerably. Some, like rock wool and polyisocyanurate (PIR), are highly resistant to fire and, if correctly selected, installed and maintained, will provide the requisite period of fire resistance.

However, there are many factors that may influence this, either positively or negatively. These include matters such as the fixing detail used (preventing de-lamination) and the fire load in the internal (or perhaps external) compartments of the building.

The fire load, in particular, can have a very significant effect on the overall performance of the building in a fire. Normal fire testing procedures in any country will subject sample materials to a given fixed and controlled fire load during test. If, in a real fire situation, the fire load exceeds the normal test value, then the insulated panels cannot be expected to perform as they did during the testing process and, therefore, may not provide the expected period of fire resistance.

In situations such as this, which seem to occur very commonly, the panels are often blamed for the resultant fire spread and this, in my opinion, is not a fair assessment of the situation. Most core materials used in the panels are combustible but most burn in a controlled and predictable manner. Even rock wool (probably the least combustible of the products used as insulation) will decompose in a fire, mainly due to the adhesives used to secure the product in place within the core of the panel.

For thousands of years, we have been manufacturing structural columns and beams (not to mention fire doors) from timber, knowing that they will burn in a fire. But we also know how they will burn and their performance is predictable. We are not surprised when they eventually fail in a protracted or severe fire. So why then are we so surprised when insulated sandwich panels fail in a protracted fire, when the burn time exceeds the rating of the panels used, the fire load exceeds that used during the testing process, or the panels have not been installed in accordance with the manufacturers specifications?



I think that the answer lies in our perceptions of the situation, often based on incomplete or inaccurate information. And this problem is not restricted to insulated sandwich panels. If building designers, occupiers, product manufacturers and firefighters all had a greater understanding of the performance of building materials in fires, and we could all 'read' a building from our own, and other's, perspectives, then we should be able to predict how a building is likely to behave in the event of a fire.

Designers should know that they are designing a structure that, whilst providing the requisite standard of life safety, is not likely to remain standing much longer than is necessary to evacuate the occupants safely. And occupiers and owners will know that their building is likely to be lost if a serious fire occurs (very few would currently expect this to occur!). And firefighter could pre-plan to fight fires using defensive firefighting techniques that do not expose them to unnecessary risks – they could plan to allow buildings to burn down whilst protecting surrounding structures.

One might ask if, in 2010, we should be erecting buildings that we know are likely to be lost if a serious fire occurs in them? With Government agendas for sustainable environments and global efforts to reduce pollution, should we not be moving to a world where we are designing buildings in a way that the building, as well as those persons residing in it, will survive any fire that might reasonably be expected to occur?

In the shorter term, what I am suggesting is that those of us that are involved in the development, construction and occupation of buildings, and in firefighting operations in the event of a fire, should develop a greater knowledge and understanding of the nature, characteristics and performance in fire of the materials used for the construction of buildings. 'Education' is the key.

In a world where the materials and construction methods used in buildings are developing and evolving at pace, the need to maintain currency of technical knowledge has never been greater.

TUNNEL FIRE SAFETY

by Craig Hiscock

Introduction

In an era where designs are moving toward reducing their environmental and social impact both now and into the future, tunnels are fast becoming an attractive option, removing infrastructure from the surface and maximising the use of available land.

There are currently two draft standards in production for tunnel fire safety (DR AS.4825 Tunnel fire Safety - 2009) and the Austroad's report (Guide to Road Tunnels - 2009). These documents, like many international codes and guidelines, are performance-based documents providing a raft of performance objectives but no benchmark requirements.

New Zealand has taken one step further than Australia by identifying tunnels as auxiliary buildings within Section A8.1 of the New Zealand Building Code (NZBC)[1]. This therefore requires tunnels to comply with the building code and sets a legislated framework for design approvals. Satisfying the NZBC[1] can be achieved by either the meeting the performance requirements of the building code or satisfying the requirements of an acceptable solutions (AS).

Given that fire life safety considerations for tunnels differ greatly from ordinary buildings, and that the NZBC's[1] acceptable solutions are generally not applicable to tunnels, designers are left with only the performance requirements of the building code for guidance. With no minimum benchmark provided by these documents designers find themselves in the difficult position of demonstrating that each design is acceptably safe. This article outlines a risk based approach to fire safety analysis (specifically for tunnels) developed and applied to a major tunnelling project currently under construction in New Zealand.

Guidance on Acceptable Risk

In providing compliance documents it is implicit that the NZBC[1] accepts some level of residual risk as no building is ever 100% safe in a fire. This conclusion is also consistent with the IFEG (2005)[2] which states "absolute or zero risk is not achievable". The handbook to the NZBC[3] defines acceptable risk as "the level of risk the public is prepared to accept without further management". When evaluating if this definition can be satisfied by a level of societal risk, consideration is given to NZBC[1] and the Building Code of Australia[4]. Both these documents require guidance to be taken from the AS/NZS.1170[5].

AS/NZS.1170[5] provides ultimate limit states for structures, in which post disaster buildings such as roads, bridges, hospitals and the like are classified as importance levels 4. Further guidance from the Handbook to the BCA[6] states that "for structural designs based on standards, the risk of structural failure per year is in the order of 10-6". This figure is consistent with levels of societal risk published by Barry (2002)[7]. If a designer were to undertake a full quantitative risk assessment (QRA) of a selected tunnel design, this may be a useful comparison or benchmark to measure against.

However, the NZBC[1] provides further guidance on risk acceptance through the use of an AS/NZS.4360[8] risk assessment process within Section E2[1] as part of Acceptable Solution one (AS1)[1]. Whilst, E2/AS1 relates specifically to weathertightness of buildings, it does provide guidance on the acceptance and /or tolerance of risk through the use of a risk ranking matrix. The risk assessment process basically states that if a design receives a score that classifies it as a "very high risk", then the building design should be changed.

Section 7.4 of Handbook.436[9] (companion document to AS/NZS.4360) provides guidance on risk acceptance by stating that risk may be tolerated rather than accepted, this would be in line with the process set out within E2/AS1[1]. Section 7.4[9] goes on to provide guidance on tolerable risk by diving it into three distinct bands;

a. An upper band where the risk is intolerable.
b. A middle band where the risks and benefits are evaluated before determining if the risk is tolerable; and
c. A lower band where the risk and benefits are negligible.

Therefore, it can be concluded that the NZBC[1] is clearly comfortable with the use of risk as a process for satisfying its performance requirements. In doing so, the NZBC[1] accepts that there is no such thing as zero risk and that based on the examples provided within E2/AS1[1], dividing the risk into bands (low, medium, high and very high) is an appropriate way assessing the risk associated with a given design. It is also important to note that the NZBC[1] also determines that a "very high risk" is an unacceptable risk and requires design change.

Risk Evaluation Process

A risk assessment methodology and process should be developed to evaluate what fire and other scenarios shall be utilised to test the proposed tunnel design. This methodology should include measures of likelihood and consequence. These measures should become inputs into a risk evaluation matrix that evaluates and ranks the risks associated with each scenario (following the NZBC's guidance[1], as low, medium, high and very high).

Scenario analysis should determine how scenarios are to be treated with regard to their impact on the proposed tunnel design. One example of this process may be to divide the fire scenarios into three distinct bands. These bands may look like;

- Base case scenarios - those likely to occur within the life of the tunnel and thereby directly impacting on the tunnels design;
- High challenge scenarios - those likely to occur beyond the life of the tunnel, but that are still considered credible and therefore still having an impact on the design; and
- Extreme events - those events that are considered to be almost incredible. These events may not form part of the design considerations, however, they should not be ignored and the proposed tunnel design should still consider the impact of these events on the design including how the design may assist in mitigating or reducing this impact.

Statistical analysis is one method of determining the likelihoods or return periods associated the various scenarios (as one input into the risk ranking and evaluation). Refinement of these scenarios bands can

be achieved by combining them with return periods or likelihoods that are associated with each scenario as shown below.

- Base case scenarios – occurring more frequently than a 1 in 100 year event;
- High challenge scenarios – occurring less frequently than a one in 100 year event, but more frequently than a one in 10,000 year event.
- Extreme events - those events occurring less frequently than a one in 10,000 year event.

Once the scenarios have been evaluated, they can be ranked (through the use of a risk ranking matrix) according to the return period (likelihood) and consequences associated with that scenario. It is suggested that even though the risk assessment ranks the risks (as low, medium, high and very high) the actual risk analysis is done through the use of a full QRA (for reasons discussed later). However, caution should be exercised when using a full QRA in the manner scenarios are selected, the number of scenarios created and be limited to scenarios that have a direct impact on the design.

Risk Treatment

At the completion of the risk evaluation process, there will be a number of scenarios all with differing risk rankings dependent on the likelihood and consequences of the various scenarios. However, this still leaves designers in a position of demonstrating that the attendant residual risks are acceptable safe. Using the methodology within the NZBC and AS/NZS 4360, the figure below has been developed as a manner of treating risk to allow designers to demonstrate that their designs are acceptable safe.

Designers may still find themselves in a position where they are required to demonstrate that a high risk is acceptable safe. Within the treatment strategy, a high risk would be required to be driven toward the lower end of the scale using the ALARP (As Low As Reasonably Practical) principle. To utilise the ALARP principle, designers need to firstly understand the root cause of the residual risk associated with a scenario (e.g. what is causing occupants to be exposed to smoke).

This is where the use of the QRA comes back into play. A design can be shown to perform equal to or better than an alternate design by looking directly at the number of exposures within the proposed design and an alternative consistent / similar design. An example may be that one tunnel has a very basic warning system (Tunnel A) and another has a very structured warning system consisting of multiple manners of repeating the same emergency warning message (Tunnel B). If pre-movement time was determined to be the root cause of the exposure, and it was determine that Tunnel A had a greater pre-movement time than Tunnel B, the QRA could show the exact difference in residual risk between the two designs.

Design Justification

However, designers may still find that if the alternative design provides better response (or a lower exposure) than their own design, that they're required to justify not undertaking the additional design changes and expenditure. One method may be to simply look at the return period and write the scenario off as being such a rare event or having such a long return period that it's not worth the additional expense. However, key stakeholders including designers, approval authorities, asset owners, asset operators and emergency services agencies need to exercise extreme caution with this approach.

One reason why relying on a return period may not be appropriate, is that one cannot understand the context of a risk simply by its associated return period. As an example, if a scenario had a return period of 5500 years, was a high risk, with a low number of exposures and was expensive to modify the design to reduce the risk, it may be deemed to be acceptable. However, to truly understand this event in context, all parties should be aware of the probability of that particular event occurring within the life of the tunnel, as this may mean the scenario is viewed in a completely different manner.

If the example scenario were further evaluated and it could be shown that the example scenario had a 47% chance of occurring within the 100 year life of the tunnel, it may be considered unacceptable to "not" change the design (dependent on the cost). Conversely, if the same event only had a 2% chance of occurring in the 100 year life of the tunnel, it may be considered acceptable to leave the design unchanged.

If the example event did have a 47% chance of occurring during the design life of the tunnel and it was very expensive to modify the design, a cost benefit analysis may be required to determine if the residual risk is in fact tolerable. Again, the QRA provides the benefit of being able to demonstrate the number of exposures associated with the event. Additional measures may need to be evaluated to determine if mitigation of the event can be provided through management measures/procedures to reduce either the likelihood or consequences associated with the event in question.

This information combined with the cost benefit analysis will allow the Key stakeholders such as approval authorities, asset owners, asset operators and emergency services agencies to make an informed decision as to whether the residual risk is tolerable or if there is justification for additional expenditure.

Conclusion

This article provides a method for demonstrating through the use of a risk based process that tunnel designs are acceptably safe. As major infrastructure projects invariably involve governments as a partner in the process in one form or another (either directly involved in the project or providing funding for the project), the attendant residual risk must be communicated and understood by all parties.

Quantitative Risk Assessments provides a powerful tool in assisting to demonstrate that the attendant residual risk is acceptably safe and in allowing the key stakeholders to make informed decisions with regard to the tolerance of the attendant residual risks. However, the attendant residual risk must be presented in a manner that can be understood by average individuals, so that risk can be understood in context to the root cause and the mitigation measures.

Appreciations

I would like to thank my colleagues within Parsons Brinkerhoff who have assisted in the development and refinement of this risk based process. In particular I wish to acknowledge and thank Mathew Bilson for co-developing this risk based process for application on tunnel projects. I also wish to acknowledge and thank Kyle Johnson and Andrew Purchase for their input in developing and reviewing this process.

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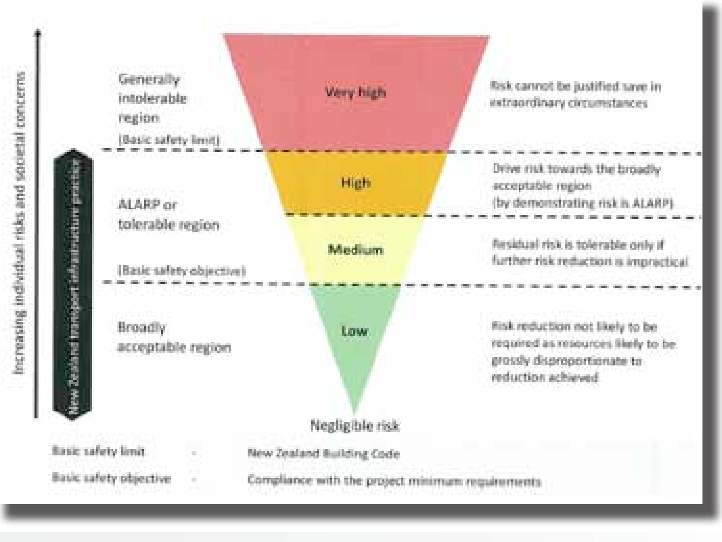


WARNING
RISK OF FIRE
We've been reducing the risk for 120 years.