

THE MFB'S HUMAN BEHAVIOUR RESEARCH PROJECT¹

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ABSTRACT

Over the period July 2001 to December 2002, the MFB conducted research into human behaviour in fires to assess whether community safety strategies help influence people to minimize the risk of fire and what actions individuals take in a residential fire.

Throughout the research period data was collected from victims of residential house fires.

The research found that the community's perception of fire-risk differs to that of the MFB with much more emphasis placed on how to react to a fire, rather than how to prevent a fire. As a result, three recommendations have been tabled:

1. There is a need to highlight how and why fire is a danger to the community.
2. There is a need to emphasise preventative fire safety messages, without negating reactive messages.
3. There is a need to highlight to the community the roles of different fire suppression and warning systems in the home.

The fire services need to highlight how fire can lead to immediate risks to the community as well as how seemingly inconsequential events have the potential to create deleterious consequences. The community often perceives fire risk as a consequential event, rather than as a potential event often due to a lack of fire experience. In order to improve the ability of fire-safety messages to be remembered and acted upon, the fire service needs to define the term 'fire' in a consistent manner so that the community can understand the consequences of fire better; whilst fire services view heat and smoke as dangerous, members of the community often only perceive flames as a threat. Changing the community's understanding and risk perception will be the greatest challenge.

There is need to place more emphasis on prevention in order to decrease the incidence of fire ignition in homes. However it is important to still emphasize reactive measures to help individuals cope with fire situations when they arise.

There is the need to highlight to the community the roles of different fire suppression and warning systems in the home. Fire services need to address how to promote home fire-safety suppression systems (fire extinguishers and fire blankets) and to assess whether or not it is adequately explained to the community how and when to use them safely. The role of smoke alarms as an alerting mechanism only needs to be reinforced whilst ensuring that the community understands that it is only one of a number of means of enhancing fire safety.

¹ This paper is based on research detailed in the 'Human Behaviour in Fires Research Project' report.

1. INTRODUCTION

The MFB is committed to ascertaining how individuals behave in a real fire situation. This research analyses human behaviour before and during fires and explores how public safety campaigns affect human behaviour before and during fires.

While the number of fire-related fatalities and injuries is decreasing, the incidence of fires within residential dwellings in the MFB's jurisdiction increased by 25.8% over the period 1991–2000, despite the range of public safety campaigns that have been implemented (Figure 1). The number of fires increased more than growth in the population (5.6%) and the number of occupied dwellings (10.7%). In 1991, there was one residential fire for every 1,364 persons; by 2000, this figure had worsened by 16.0% to one residential fire for every 1,145 persons. In 1991, there was one residential fire for every 476 occupied dwellings; increasing by 12.0% by 2000 to one residential fire for every 419 occupied dwellings.

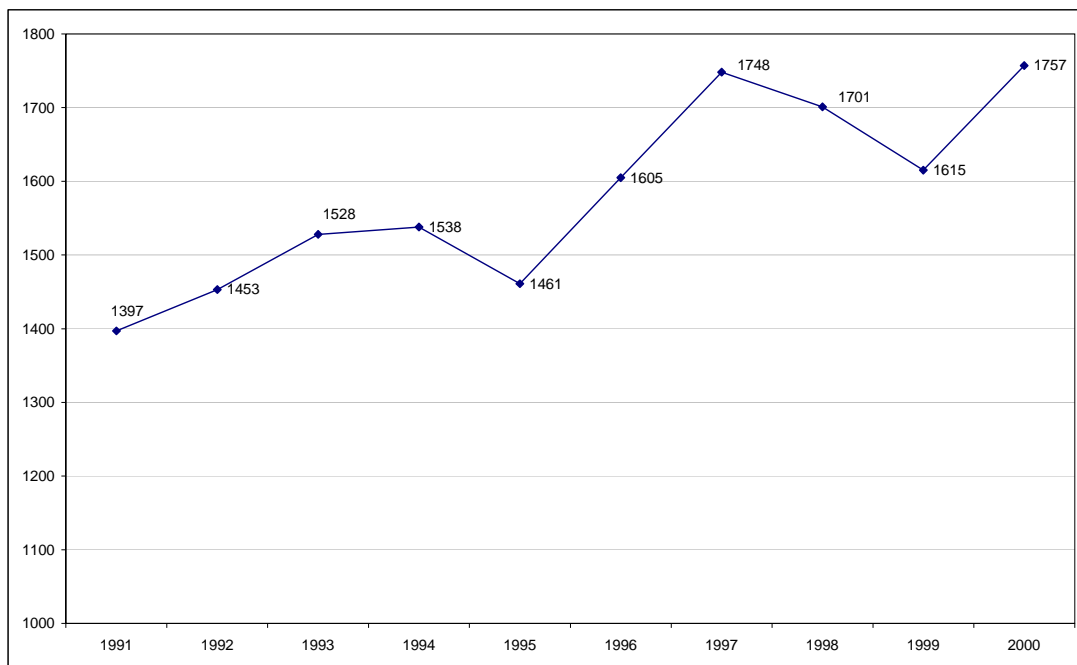


Figure 1. The incidence of structural fires involving residential premises, 1991–2000.

Although quantitative data can provide statistical details of fire trends, it is difficult to ascertain certain inherent characteristics of people's behaviour, for example, how individuals contributed to the outbreak and outcome of a fire. It is difficult to analyse the effectiveness of public safety campaigns on the community unless the community has been involved in specific situations that require knowledge of those campaigns, in this case, a fire. This study attempted to construct a method and analyse more specifically how people react in a fire situation, to evaluate the effectiveness of public safety campaigns, and compare the intended theoretical perceptions and outcomes with actual outcomes.

Human behaviour and its impact on, or as result of, fire situations has been researched academically since the 1970s and more recently within firefighting organisations. The majority of research is in progress and often appears to involve residents of multiple-

occupancy dwellings (e.g. apartment blocks and units). Very little research that addresses fire victims only has been conducted by firefighting organisations within Victoria; however, some research is currently underway into human behaviour based on fire incidents.

The purpose of this research was to analyse and assess the effectiveness of public safety programs in influencing the behaviour of individuals who have experienced a fire situation in the home (both single and multiple occupancies). The key aims were to analyse:

1. Whether the MFB's strategies helped to influence people to voluntarily change behaviour to minimise the risk of fire ignition.
2. What actions individuals have taken when confronted with a residential fire.
3. How individuals' actions were influenced as a result of a fire.
4. Whether attitudes and perceptions to fire risk changed once an individual has been involved in a residential fire.
5. Whether findings within the research can improve the effectiveness of fire safety and other community awareness and preparedness strategies.

This research sought to provide the MFB with representative views of their stakeholders in order to improve the delivery of community safety programs. It attempted to better understand how people react to, and behave in, a fire. It addressed people's recall and awareness of fire safety messages; the relevance of fire safety messages to specific situations; and any voids between the intended outcomes of fire safety messages and the reality. Such an understanding will help the MFB improve service delivery by using a more evidence-based decision making process to support anecdotal evidence.

2. METHODS

The research focused on residents who have experienced a house fire. Specifically, it analysed the behaviour and actions of individuals who were involved in a structural fire within domestic premises. The analysis sought to determine how the fire occurred, and how individuals exacerbated or minimised the potential for harm to themselves and their property.

Research involved primary and secondary data analysis that was conducted between July 2001 and December 2002. Secondary data was used to provide a conceptual framework to the research, as well as to support or refute findings from the primary data analysis. The primary data analysis involved the collection of data from victims of house fires. The research investigated and reported on the following issues:

- What types of fires respondents experienced.
- The factors that contributed to the outbreak of fire.
- How occupants reacted to a fire situation; how they discovered the fire, and whether their actions, following discovery, were consistent with the MFB's recommendations.
- Whether strategies helped to influence people on how to react safely in the fire event.
- Whether, in hindsight, individuals who had been involved in a fire believe that the MFB's information is appropriate in helping people to minimise the risk of fire.

All residential addresses that had had a structure fire attended by the MFB, within their jurisdiction were targeted. It included fires where someone was, or was not, at home at the time of fire, where there may have been injuries, but not fatalities or arson, and fires that create exposures but not those resulting from exposure.

Two methods of data collection were used when sourcing information. First, a questionnaire was distributed to all members of the household where no-one was at home during the time of the fire. The survey analysed the effectiveness of, and attitudes towards, MFB safety campaigns and advice. It was designed to determine whether the MFB's strategies helped to influence people to voluntarily change their behaviour to minimise the risk of fire ignition, and whether attitudes and perceptions to fire risk changed once an individual has been involved in a residential fire. Second, a sample of occupants who were home at the time of fire was recruited to conduct in-depth interviews analysing their behaviour prior to and during the fire incident. The interview was designed to determine what actions individuals have taken when confronted with a residential fire, and how individuals' actions were influenced as a result of a fire.

The questionnaire aimed to provide perspective in regard to the *strategies* used to deliver community safety information to the public – what programs and messages does our sample know of, how did respondents receive these messages, is fire safety important to them? The interview aimed to provide perspective into the *contents/types* of information required to inform the public – how did people react to their fire incidents, did they react in a suitable manner, are there behaviours that require addressing through community safety education?

A quota sampling method was used whereby five separate demographic groups were identified for particular analysis, according to pre-determined definitions. Due to the unpredictable nature of fire, and the lack of demographic data profiling fire incidents, it was difficult to determine adequate sampling selection criteria in order to stratify samples. As a result, predetermined target groups had been formulated based on the needs of how the MFB target groups for differing educational needs. Four categories were chosen in which to scope potential interview respondents:

- Elderly (over 65 years of age)
- Parents of young children (under the age of 15 years of age)
- Children under the age of 18 years
- Young adults between 18 and 30 years of age.

These categories were identified as specific groups required for analysis; residents not belonging to these categories were also recruited for interview (the fifth category).

3. RESULTS

A very high response was gained for the questionnaires of 84% of the houses targeted, and interviews were conducted with 11% of households.

3.1 Findings of research into human behaviour in fires

Risk perception

Literature suggests that, generally, people underestimate the dangers of fire [1, 2]. People tend to have a higher perception of fire risk in 'foreign' buildings than in their own home, even though the risk of fire or injury/fatality from fire is greater in the home [1]. Therefore, when a domestic fire does occur, people are often insufficiently prepared [3].

People also underestimate why fire is such a risk; it has been estimated that in 90 to 95% of all cases smoke is the main cause of death rather than heat. Direct flame contact and burns

are rare and most victims die in rooms distant from where the fire originated. Often the hazard is not recognised early enough or there are no safe escape routes available [4]. Compounding this problem is insufficient understanding of the real ability of fire detection and suppression systems to quickly reduce the adverse effects of fire. Knowledge of how to use fire safety equipment is often incomplete, even though occupants might have the equipment at home [5].

The use of smoke alarms illustrates how people consider the risk of fire. Evidence suggests that many fire alarms are found to have either dead or missing batteries (this is found to apply more to lower income groups) [6]. Almost all respondents (99.6%) in this study stated they had a smoke alarm in the home. However, anecdotal evidence indicates that in some cases these measures may be prevalent due to 'push' factors, such as legislative requirements [7]. The majority of respondents stated they could hear the smoke alarm from all rooms and bedrooms, when the doors in their homes were closed (88.7%); 10.4% were unsure.

Of the nine most common fire safety measures that questionnaire respondents had in the home, only 5.9% involved preventative measures such as maintaining electrical wiring. Fire safety measures mainly involved reactive measures including the evacuation from, and suppression of, a fire. In these cases, the ownership of fire safety equipment was low (28.5% of respondents had a fire extinguisher, 13.5% owned a fire blanket) and the level of confidence in using such equipment was even lower (33% of respondents who owned a fire blanket lacked confidence in using it). 22.6% of respondents stated that they had a home escape plan, however no elaboration of what the plans entailed occurred. Less than one-third of interview respondents had some form of pre-planned idea about what they might do in the case of a fire. Often these plans had to be ignored as the fire was growing in size or because respondents were not prepared for the specific fire risk that resulted.

Evacuation and decision making

Awareness

Many domestic fires are discovered shortly after ignition [5]. The clearer the cues that there is an impending danger, the more likely and more quickly the occupant will respond by evacuating the building [8]. The concept of risk denial is important during the awareness stage as individuals might attempt to avoid an unexpected signal and therefore deny that a fire is occurring, by ignoring the danger signals and looking for a rational explanation for the phenomenon [9, 10]. As there is ambiguity involved in detecting a fire people will often investigate an alarm or smoke, rather than take the initial steps of evacuating [11].

In 96.4% of the residential structure fires investigated, someone was home at some stage during the fire. Fires often resulted from seemingly 'unremarkable' events that could be considered as daily domestic activities, such as cooking or using candles.

Many questionnaire respondents and potential interviewees did not believe that they had actually had a fire. In some cases, there was smoke from a burning pot, but no flames. This raises the important issue of what exactly is a fire. It appears that the perception of fire, and hence fire risk, differs significantly depending on whether the perception is based on fire-fighting experience or not. From a fire services perspective, it is very easy to detail how seemingly inconsequential accidents, such as leaving a stove unattended, can create deleterious consequences. Therefore, it may be necessary for the fire services to approach the definition of a fire and fire risk in such a manner that highlights the potential, rather than merely stating the effects, of a fire.

Awareness of the fire leads to the stage of reaction and the decision-making process of whether to evacuate or not.

Reaction

In many cases, the time taken to start an evacuation is often greater than the actual time of evacuation, because people do not recognise fire cues [12].

Commitment is identified as a behavioural trait, during reaction, in which it is assumed that people will finish one activity before paying attention to another, even if that other activity has the potential to put their lives in danger [9, 10]. Research indicates that people are less able to react to ambiguous clues to the presence of fire if they are absorbed by some activity, such as eating a meal or watching entertainment [11].

It has been identified that once an individual has assessed the fire scenario and determined the seriousness of the situation, they will *probably* attempt to evacuate the premises or attempt to fight the fire [13]. However, the ability to adequately determine the potential severity of the situation and make proper judgments about how to react is influenced by factors such as the types and number of warnings and the physical layout of the premises, including the availability of egress points [14].

Evacuation

There are a number of factors that help explain occupants' behaviour during a fire [15]:

- Alertness: the occupants' ability to react.
- Commitment: it is common for people to interrupt evacuation to retrieve personal effects, attempt to fight the fire or to observe the fire fighting activity [16, 13, 17].
- Focal point: most people do not like to be in a state of uncertainty. Once a decision is made and action is taken, attention is likely to be focussed on information which confirms the decision. Thus a decision to stay may delay recognition of danger and further delay any move to leave [18].
- Physical and/or mental capabilities: research suggests that a group can be expected to move at the speed of the slowest member [19, 9].
- Role: during various stages of evacuation, some occupants may have domineering roles that influence how others behave [20].
- Occupants' familiarity with either the building or with emergency response: people have a tendency to act in a way that is familiar to them. Thus, unless directed otherwise, they will use familiar routes, even if these routes are inappropriate in the circumstances [17, 11, 19].
- Social affiliation: affiliation relates to role, in that occupants may wait for those who are with them to evacuate at the same time, rather than evacuate themselves [9].
- The condition of the fire situation: the condition of a fire situation involves the type of fire, length of ignition and its behaviour. This can change over the course of the fire [15].

Approximately one-third of respondents contacted the MFB after taking initial actions, whether it was suppression or evacuation. Few respondents re-entered their premises. In such cases, the primary purpose was for suppression. The majority of respondents who attempted fire suppression were confident in their abilities and garden hoses were typically used, which resulted in respondents exiting the premises in order to fight the fire.

Panic

Anecdotally, panic is a common preconception of how people will react in a fire situation. However, research has found that panic is an exception [13]. It was found that people tended to behave in a controlled and rational way in fire incidents. However it is important to understand that fire will create stress in people often exacerbated by time pressure and the effects of autonomic activation (e.g. an increased heart rate) [14].

3.2 Findings of research into fire safety education and behavioural change

Literature suggests that people will not instantly adhere to fire safety education; but that behavioural change, resulting from education, involves the processing of various stages [21]:

- Contemplation: people are actually thinking about and evaluating recommended behaviours.
- Preparation: people have decided to act and are trying to put in place whatever is needed to carry out the behaviour.
- Action: people are doing the behaviour for the first time, or first several times.
- Confirmation: people are committed to the behaviour and have no desire/intention to return to earlier behaviour.

To reach the stage of confirmation, a variety factors contribute to the effectiveness of implementing community education programs and campaigns:

- The dynamics and changing needs of target groups.
- The attitudes of target groups.
- The ability of the target group to understand and realise program objectives.
- The evaluation of community education programs.

Of respondents who could recall a fire safety message, 95.6% stated that the messages they had been exposed to were significant to their lifestyles. However, when prompted to explain why they were important, the most common answers provided were vague and generalised; often respondents cited 'safety' as the reason that fire safety messages were important, however they could not expand on what 'safety' actually meant. 19.4% of respondents stated that fire safety messages were important as they explained what to do in the case of a fire; few responses stated that fire safety messages helped to reduce the likelihood of fire. When combined with data that highlighted that the majority of fire safety messages respondents recalled were reactive (e.g. 'dial 000', 'get down low and go, go, go') it could be concluded that, generally, fire safety messages fail to specify how and why fires can occur and how people can minimise the initial risk.

When assessing the attitudes of fire victims, 92.3% of respondents stated that it was possible that a fire may occur again. However, only 64% stated that the risk of fire was worth making the home more fire safe. In an attempt to make the home more fire safe in the future the majority of respondents cited reactive, rather than preventative, measures; home safety is viewed in terms of how to react to a fire, rather than how to prevent it.

4. DISCUSSION

Research highlighted that there are differences in the perceptions of fire risk between the community and members of the MFB these differences result from the different understanding

that both groups have of fire. It is important to remember that the community does not receive the same exposure to the unintended consequences of fire that the MFB does.

Several generic lessons emerged from this research. Recommendations include:

1. There is a need to highlight how and why fire is a danger to the community.

- Community safety programs need to take into account how the community perceives the risk of fire and ensure that those perceptions are addressed. In addressing the differences in perception it should be recognised that the community may not understand the ramifications of small-scale fires and their ability to evolve into large uncontrolled events. The lack of understanding of the potential for fire risk may make people less receptive to particular community safety programs and messages.
- It is important that the community has a common understanding of the risk of fire in the broadest sense. It should be conveyed, in a consistent manner, that fire is a risk. This will help ensure that the community understands the potential for serious ramifications of fire, even from seemingly non-hazardous events.
- The potential dangers of fire including smoke and convective heat and how these impact on the health and safety of people and property need to be highlighted and that the community understands that the risk to health is not necessarily attributable to flames. If people are required to maintain and react to smoke alarms, it needs to be highlighted why prompt reaction is necessary and how health and safety can be affected in fire situations.
- Effective prevention and reaction to fire risk needs to be promoted by encouraging more involved participation in community safety programs and messages to increase the awareness of the impact of fire on health and safety.

2. There is a need to emphasise preventative fire safety messages, without negating reactive messages.

- The way the actual and potential risks of fire are communicated needs to be considered. This point relates to Recommendation 1 as the community needs to understand how and why seemingly inconsequential events can have serious ramifications.
- Further research is required to understand how fires result from human behaviour. In many cases the MFB can detail how fires, due to human intervention, result; however there is the need to address the behaviours that result in the neglect, adoption and reinforcement of appropriate fire preventative actions.
- How and why fire safety messages are delivered needs to be determined in order to promote understanding of the rationale behind fire safety messages.

3. There is a need to highlight to the community the roles of different fire suppression and warning systems in the home

- The use of smoke alarms in the home should continue to be emphasised, highlighting the need to maintain smoke alarms and their batteries as well as correctly locate them.
- The role of smoke alarms as a means of alerting residents to a fire, rather than an item that guarantees safety, needs to be reinforced to ensure that the community understands the role of smoke alarms and that they are only one of a number of ways to enhance safety.
- How home fire safety suppression equipment (fire extinguishers and fire blankets) are promoted and whether how and when to use such equipment are adequately explained to the community needs to be addressed.
- How smoke alarms decrease the risks to health and safety by alerting individuals needs to be reinforced to the community. This will help to minimise the harm to the community and damage to property by improving reaction times.

- People need to be empowered to take control of incidents before they escalate by ensuring an understanding of the roles of home fire warning and suppression equipment.

5. CONCLUSION

From this research it can be seen that individuals underestimate the risk of fire, which can lead to optimistic assessments of the nature of fire. Such underestimations can lead to individuals inadequately identifying a fire when it occurs, or postponing their reaction to a cue, unless the fire cues are obvious (e.g. the presence of flames). In turn, the timing of fire cue identification will impact on how individuals will react as the fire grows in intensity.

Significantly, in 96.4% of residential structure fires someone was home at some stage during the fire. Fires often resulted from seemingly 'unremarkable' events that could be considered as daily domestic activities, such as cooking or using candles.

A more formalised risk-management strategy may be needed to raise awareness towards fire, its likelihood and consequences in order for fire-safety education to capitalise on its ability to encourage behavioural change. Consensus is required to define the term 'fire' and to develop appropriate media to communicate consistently, efficiently and effectively.

A whole-of-organisation approach is necessary, due to the symbiotic nature of the MFB's reaction strategy to fire (suppression) and the preventative strategy (education). At its simplest, the following process of community safety occurs daily within the MFB:

1. Community safety programs are delivered by operational and non-operational staff.
2. These programs help to decrease the risk of and damage from fire, making fire risk safer for the community as well as for the operational staff who attend the fires.
3. Operational staff's efforts are reinforced by positive feedback via the media or the MFB.
4. The MFB, through its operational staff, attends and extinguishes fires.
5. Operational staff may provide safety advice to the fire victim at the scene of the fire.
6. Operational staff report the nature of the fire and may contact various community safety departments to highlight particular issues.
7. The Community Safety Directorate receives the information as anecdote or via quantitative databases, and develops programs to educate the public to decrease the likelihood and severity of fire.

A whole-of-organisation approach also offers an important process to formalise and document the intellectual capital of the MFB to help improve the community safety.

5.1 Establishing the context of the risk of fire

To establish the context of the risk of fire the following needs to be identified:

- Members of the community within its jurisdiction.
- The safety risks to these members in everyday life.
- The current strategies in place to mitigate those risks.

Traditionally the MFB has targeted at-risk groups in the community through the use of fatality data. In this case, the MFB needs to review the strategies used to identify the different resident groups, the particular social and demographic attributes of those groups, and potential programs or methods of education that may reach these groups. The MFB needs to define the

term 'fire' and the objectives and strategies required to mitigate safety risks.

5.2 Identify the fire risks

The different types of fire ignition sources that occur in homes need to be assessed and audited. Auditing may take into consideration the hour of fire, geographic location, type of residential premises, equipment involved in ignition and ignition factor.

From the audit, it would be necessary to determine how and why fires occur by developing event trees, as in some cases it is possible that generic fires may have resulted from one of a variety of risk exposures. Based on the differing types of risk exposure, separate educational instructions may be identified, such as the need to ensure electrical equipment is not left unattended, or that the meter box requires a safety switch.

Identifying fire risks is an ongoing process to ensure that community safety programs are adaptable to changing trends, expanding on the process that currently occurs within the MFB.

5.3 Analyse the fire risks

Following the risk audit, the likelihood and severity of the risks arising need to be identified. A risk register should be developed to identify those fire risks arising from audit. Incident data should be used to categorise the severity or importance of these risks and prioritise risks for mitigation via community safety programs. Severity of fire risk may be determined by past injury and fatality data, fire spread data, or cost data or other databases, including ABS socioeconomic data, to determine the relative danger of fires to differing socioeconomic groups. Such analysis would expand on the work undertaken by the MFB's latest strategic plan that analyses fire risk.

5.4 Evaluate the fire risks

The fire risks identified should be evaluated to determine whether or not they support or refute past perceptions of fire risk within the community. Evaluation should also involve determining how community safety programs can approach fire risk.

5.5 Treatment of the fire risks

The MFB is attempting to mitigate the risk of fire via community safety programs. The mitigation process involves reducing the likelihood of these risks and their consequences.

From the analysis and evaluation of fire risk, the MFB can better develop strategies to target specific groups within the community. In some cases, the MFB may be in a better position to encourage the community to reduce the consequence of fire risks (reactive measures), while other programs may have the scope to encourage target groups to reduce the likelihood of fire (preventative measures). The MFB may feel that certain risk exposures be omitted from programs if a greater benefit can be shown from addressing other problems instead, or if the programs in place already suffer from information overload. The MFB may continue to build on strategies with other organisations to address problem groups.

Resulting from the audit and registration of fire risks, incorporating event trees, a variety of community safety strategies can be developed to determine appropriate messages. It would

be advisable to develop some form of performance measure and methodology, where appropriate. An example may be the use of quick tests to determine the retention of fire safety messages before and after a structured community safety program (such as FIRE ED).

Developing community safety programs based on the risk audit and registration would require consideration of the feasibility of the benefits and costs of various messages and media used. These values will often be qualitative and intangible, rather than numeric and easily identifiable. In such cases, methodologies and rationales would require documentation.

5.6 Evaluation of community safety programs

Community safety programs themselves need to be evaluated to determine their success. A similar risk management approach can be taken as in assessing the risk of fire. It could be that the process operates in conjunction with the risk assessment of fire (as highlighted throughout the fire risk management process). However, due to the variety and number of programs, it may be best to consider evaluation once an initial risk analysis of fire exposures is completed.

It is recommended that community safety programs are evaluated consider:

1. **The goals, aims and objectives of each program** to determine whether or not they are appropriate in encouraging community safety. Changing trends in fire pathology and human behaviour may require reassessment and adjustment of goals.
2. **The target audiences** to ensure that appropriate audiences are targeted, and to assess the degree or types of risk the targeted audiences are exposed to, and the ability to communicate to such audiences.
3. **The messages delivered in these programs** to ensure that they address the aims and objectives, and that target audiences receive and remember the messages. Evaluating the content of messages will help determine their focus (as reactive or preventative messages) and whether or not adjustments are required.
4. **The strengths, weaknesses, opportunities and threats of the programs** to aid in deciding about potential adjustments to specific programs. Such documentation, when assessed against the SWOT analysis of other programs, may help identify common themes, enabling the transfer of evaluation solutions from one program to another.
5. **The consistency of ability and training of community safety staff who deliver the programs** to ensure that consistent messages are delivered to target audiences.
6. **The resourcing, managing and coordinating of individual programs**, including staff, the quantity and geographic spread of programs delivered, and the satisfaction of the end-user (the target audience), to ensure their efficiency and effectiveness.

Once the initial evaluation of community safety programs has progressed, the identification of fire risks and members of the community who have not been addressed by at least one program (not campaigns), is required to target programs to suit their needs.

Community safety programs need to be evaluated to ensure that their aims are appropriate. Appropriate audiences need to be targeted and information needs to be communicated in an appropriate manner. The evaluation of such programs will ensure that they are continually improved to effectively empower the community to reduce the risks of fire. Evaluation also helps the Community Safety Directorate understand the ongoing need to improve its abilities in encouraging the community to address behaviours that will make everyone more fire safe.

ACKNOWLEDGEMENTS

Members of the Steering Committee, including David Nicholson and Lyndsey Wright of the MFB, and Robyn Betts, Department of Justice, Office of the Emergency Services Commissioner. Staff at the Centre for Environmental Safety and Risk Engineering, Victoria University, and the New South Wales Fire Brigades.

REFERENCES

1. Grisanzio, J.A. What do Americans know about fire safety? *NFPA Journal*, May **1996**
2. Fire and Emergency Services Authority of WA (FESA). *Short report on the Community Safety Survey 2000*, **2000**
3. Rohrmann, B. Effective risk communication for fire preparedness: a conceptual framework, *Australian Journal of Emergency Management*, Spring **1995**, 10(3)
4. Wittbecker, F. Smoke detectors and escape times, *Fire*, March **1997**
5. Reynolds, C. Fire research news. www.homeoffice.gov.uk/fepd/frn/frn19/frn11.htm, n.d.
6. Birch, D. Smoke alarm policy - is it working? *Fire Engineers Journal*, March **2001**
7. Queensland Fire and Rescue Authority (QFRA). Community Awareness of Fire Issues. Summary of Results for Central Region from the Survey of Community Fire Safety Perceptions, *Awareness and Behaviours*, **1998**
8. Yung, D., Proulx, G. & Benichou, N. Comparison of model predictions and actual experience of occupant response and evacuation in two highrise apartment building fires, *Human Behaviour in Fire - Understanding Human Behaviour for Better Fire Safety Design*, 2nd International Symposium, Boston, **2001**
9. Ockerby, P. Evacuation of a passenger ship - is panic a major factor? *Australian Journal of Emergency Management*, Autumn **2001**
10. Proulx, G. Human response to fires, *Fire Australia*, August **1994**
11. BRE Digest. Human behaviour in fire, *BRE Digest*, November **1993**
12. Brennan, P. Perception of Threat, *Human Behaviour in Fire*, 1st International Symposium, Belfast, **1998**
13. Lo, S.M. People in fires - a study of the behavioural reactions of people in a fire incident in Hong Kong, *Fire Engineers Journal*, July **1996**
14. Saunders, W. Psychological factors influencing exit choice - a brief review of research findings, *Fire Australia*, February **1995**
15. Fahy, R.F. & Sapochetti, J.I. Human behaviour modelling as part of an engineered design, *Interflam '99*, 8th Fire Science & Engineering Conference, **1999**
16. Brennan, P. Victims and survivors in fatal residential building fires, *Fire matter*, **1999**, 23
17. Murdoch, P.B. Behaviour of People During Emergencies, in Combined Emergency Service 19th Annual Seminar, **1998**
18. Brennan, P. Community response to a bushfire threat, *Proceedings - Australian Disaster Conference*, **1999**
19. Gardner, J. Building design and human behaviour in fires, *Fire Engineers Journal*, July **1996**
20. Horasan, M. & Saunders, W. Human behaviour research - what information do the fire safety engineers really need?, *Human Behaviour in Fire - Understanding Human Behaviour for Better Fire Safety Design*, 2nd International Symposium, Boston, **2001**
21. Young, J. A social marketing framework for the development of effective public awareness programs, *Proceedings - Australian Disaster Conference*, **1999**