Background briefings on emerging issues for fire managers from AFAC and Bushfire CRC.

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FIRE NOTE

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# HOW BUSHFIRE FIGHTERS THINK ABOUT WORST CASE SCENARIOS

## SUMMARY

This project investigated how worst case scenarios influence the decision-making processes of Australian bushfire fighters. A failure to consider worst case scenario possibilities has been implicated in a number of high-profile investigations into Australian bushfire disasters. Three interview studies explored this seldom-studied research question: how do bushfire fighters identify and act on such scenarios? Findings indicated that bushfire fighters inconsistently consider worst case scenarios and identified a number of potential barriers to worst case scenario. While all fire fighters can be influenced by such barriers, expert incident managers appeared to have developed strategies to reduce the impact of worst case scenario barriers. These included: (a) developing back-up plans with trigger points indicating when to change plans; (b) managing their mental workload to minimise overload; and, (c) encouraging team members to critique plans. Recommendations developed for fire agencies were based on the decision-making skills displayed by these domain experts.

## ABOUT THIS FIRE NOTE

This research is part of the Safe Behaviour and Decision Making project, within Program D: Protection of People and Property.

The author: Claire Johnson is a PhD candidate at La Trobe University and the recipient of a Bushfire CRC scholarship. Her thesis was submitted for examination in March 2011.

For more information about this project contact Claire Johnson at ce2johnson@students.latrobe.edu.au or clairej_os@hotmail.com

## CONTEXT

**This PhD research aimed to (a) investigate how Australian bushfire fighters think about worst case scenario events, (b) discover what factors might prevent decision makers from identifying or preparing for such events, and (c) identify methods with the capability to improve worst case scenario thinking.**

## BACKGROUND

Worst case scenarios are an important part of the prediction and planning that is essential for effective decision making (McLennan, Omodei, Holgate & Wearing, 2007). A failure to adequately prepare for the worst has been raised in a number of investigations into high-profile Australian bushfire disasters (such as the ACT fires in 2003, and the Wangary South Australia fire in 2005).

Worst case scenario thinking involves identifying possible worst case events and implementing actions to prepare for those events. A good example of worst case scenario thinking is defensive driving. There are a range of benefits to thinking this way, which include:

- To avoid being surprised by unexpected events.
- To highlight faulty assumptions and errors in decision making.
- To identify possible actions to mitigate the severity of consequence if worst case events cannot be avoided.

While receiving little previous research attention, worst case thinking is a critical skill that is challenging to develop and difficult to execute. This PhD research explored the role of worst case scenarios in bushfire decision making in three sequential interview studies.

## BUSHFIRE CRC RESEARCH

### STUDY 1

Study 1 involved an analysis of 54 interviews, which were chosen from a larger set of post-incident interviews collected previously by the Bushfire CRC research group at La Trobe University. The 54 interviewees were paid and volunteer bushfire fighters who: 1) had a range of

experience levels, ranging from five to 50 years; and 2) made decisions at a range of command levels, from crew leader to incident controller.

Interviews were carried out as soon as possible (usually within 24 hours) after a non-problematic incident using the Human Factors Interview Protocol (Omodei, McLennan & Reynolds, 2005). Analysis identified numerous worst case scenarios, which were all spontaneously reported by interviewees because no interview questions specifically asked about such events.

Most interviewees (83 per cent) reported considering worst case scenarios, to some extent, when recounting a past incident. However, the reporting of such events was not consistent: some interviewees did not report any, while others reported several (up to 10 per interview). All worst case scenarios reported by interviewees focused on one of three topics: (1) a possible outcome causing harm to the community (for example, civilian fatality), (2) a possible outcome causing harm to firefighters (for example, firefighter fatality), or (3) a possible outcome causing the fire to become more difficult to contain and control (such as fire escaping a containment line).

Analysis also identified a wide range of factors with the potential to prevent worst case scenario thinking. The most commonly discussed barrier related to inadequate experience, which had the potential to have a major influence on worst case thinking. Similarly, lack of local experience could interfere with the ability to consider worst case scenarios accurately. Other barriers were of two main types.

First, barriers related to general information processing tendencies, including:

- Underestimation of risk (such as risk of a burnover).
- Underestimation of time and space (such as distance a fire will travel).
- Tunnel vision (for example, fixation on a particular task or perspective).
- Suboptimal attitudes to risk and safety (for example, assumption of a best-case outcome).
- Interpersonal issues (such as tensions between locals and non-locals).

Secondly, barriers related to specific characteristics of the firefighting situation, including:

- Time pressure.
- Fatigue.
- Stress.
- Lack or uncertainty of information (such as poor information flow).
- Lack of coordination and control (such as role confusion).
- Lack of physical resources (such as no aircraft available).

Some incident controllers appeared reluctant to recommend upgrading an incident from a Level 2 to a Level 3 incident. Failure or delay in this process may reduce capacity for effective incident management because upgrading releases a range of greater resourcing options. In a small number of interviews, this observed reluctance was linked to:

- Fear of losing control of the incident to "outsiders".
- Feelings of weakness, failure, and helplessness at "losing" the fire.
- Perceived implications of "crying wolf" or "scaremongering".

**STUDY 2**

Interviews in Study 2 differed from Study 1 because they:

1. Explicitly asked interviewees about worst case scenarios.
2. Targeted expert decision makers with extensive experience in managing bushfire situations.
3. Focused on the incident management level of decision making.
4. Discussed critical incidents from the past five years that interviewees felt had challenged their decision-making skills and required all their expertise to manage.

The Worst Case Scenario Interview Protocol was specifically developed for the purposes of this study, based on the Critical Decision Method (Crandall, Klein & Hoffman, 2006). Thirty highly experienced personnel (volunteer and paid staff) from five Australian fire agencies were identified by peers and recruited for interviewing.

The majority of interviewees reported that worst case thinking was a critical aspect of incident management. Interviewees argued that bushfire fighters must consider:

## FURTHER READING


Crandall, B., Klein, G., & Hoffman, R. (2006). *Working minds: A practitioner's guide to cognitive task analysis*. Cambridge, MA: The MIT Press.

Klein, G. (2003). *The power of intuition: How to use your gut feelings to make better decisions at work*. New York: Currency/Double Day.

McLennan, J., Omodei, M., Holgate, A., & Wearing, A. (2007). Human information processing aspects of effective emergency incident management decision making. In M. Cook, J. Noyes & Y. Masakowski (Eds.), *Decision making in complex environments* (pp. 143-151). Aldershot: Ashgate Publishing Company.

Omodei, M., McLennan, J., & Reynolds, C. (2005). *Identifying the causes of unsafe firefighting decisions: A human factors interview protocol* (Bushfire CRC Project D2.3 Safety in Decision Making and Behaviour, Tech. Rep. No 1). Available at www.bushfirecrc.com.au

Elliott, G., Omodei, M., & Johnson, C. (2009). *How human factors drive decisions at fire ground level*. Bushfire CRC Firenote, Issue 44. Available at www.bushfirecrc.com.au

## END USER STATEMENT

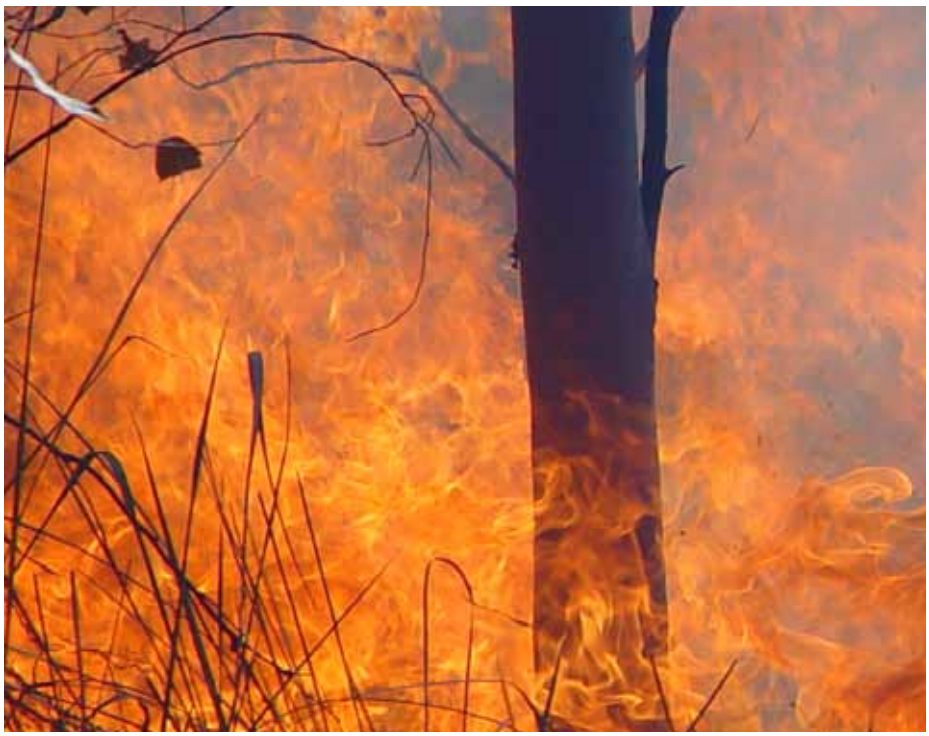
"History has provided us many opportunities to judge, with hindsight, the decision-making process of those involved in serious bushfire incidents and question whether worst case scenarios were taken into consideration. Consequently, a number of recommendations from inquiries have reinforced the need for worst case scenario planning to occur.

"Claire Johnson's research has identified potential barriers to worst case scenario planning and provides fire services with opportunities to refine our decision-making processes by incorporating worst case scenario planning.

"Initial findings from this project have assisted the South Australian Country Fire Service to incorporate worst case scenario planning into doctrine and training from the Tactical Commander through to the Incident Controller and State Duty Officers.

"Outcomes of this research will create opportunities for enhanced decision making and, ultimately, improve the safety of fire fighters and the community."

**– Mark Thomason, Manager, Operational Improvement, South Australian Country Fire Service**



(a) multiple scenarios (such as worst case and most likely), (b) multiple timeframes (such as next few hours and next few days), and (c) multiple perspectives (such as a detailed micro view and a 'big picture' macro view).

In complex situations, the interviewees reported that even expert incident managers could sometimes overlook these important elements of planning and be affected by barriers to worst case thinking (such as tunnel vision). However, interviewees appeared to be aware of the potential barriers and had developed strategies to minimise their influence on effective decision making.

A range of behaviours and strategies enabled experts to effectively prepare for worst case scenarios, including:

**'What if' thinking** – experts questioned the situation and imagined how things could go wrong.

**Back-up plans** – experts developed a number of back-up plans to deal with a range of eventualities, with trigger points indicating when to change plans.

**Self-management** – experts reflected on their own thought processes and took action to manage cognitive overload or stress.

**Critiquing plans** – experts encouraged respectful discussion and dissent to highlight faulty assumptions and check decision processes.

**Adaptive decision making** – experts audited the effectiveness of management structures and adapted standard procedures if required.

**Focus on fundamentals** – experts focused on fundamental rules of safety to ensure internal concerns or external pressures did not undermine planning.

**Motivation to learn** – experts recognised the importance of balanced debriefing and reflected on how their own decision-making performance could improve.

### STUDY 3

Based on the expert behaviours identified in Study 2, some efficient methods were identified for developing worst case scenario thinking skills and incorporating them into incident management practice. Study 3 discussed these methods with eight fire agency personnel who each had substantial experience in training development and operational improvement.

Interviewees reported that the results of the previous two studies successfully reflected the decision making carried out and the challenges faced during bushfire incidents. Interviewees also described a small number of possible negative side-effects of worst case thinking (such as fixation on worst case outcomes or negative emotional reactions), which would need to be addressed in any training developed to improve worst case thinking. Furthermore, interviewees provided advice about the benefits and challenges of potential strategies for developing skills of worst case thinking.

One particularly effective and innovative method discussed in this study was the Premortem Method developed by Gary Klein (2003), which facilitates the identification of possible worst case scenarios and addresses many potential worst case barriers (see breakout box). It can be used in training to develop worst case thinking skills or in operational procedures to strengthen plans. Findings of Study 3 indicated that the Premortem Method, with careful development and implementation, would be particularly useful in training to improve worst case thinking.

### RESEARCH OUTCOMES

The research findings described in this *Fire Note* highlight the importance – and challenge – of adequately preparing for worst case scenarios. However, the reported inconsistency of worst case thinking suggests further effort is required to ensure all decision makers adequately identify, plan and prepare for such scenarios.

Based on the decision-making skills displayed by domain experts, practical recommendations have been developed for fire agencies. Recommendations refer to the development of a training regime and decision tool to improve worst case thinking, as well as describing the agency practices important for facilitating worst case thinking (such as learning culture).

Some recommendations validate current fire agency practice, whereas others indicate areas where agencies require further work to ensure effective worst case thinking and improved decision-making skills.

This research also emphasises the value of reviewing past bushfire incidents. Every incident provides a substantial resource for organisational learning. All agencies should be identifying and exploring the successful decision making displayed by their personnel, as well as the mistakes that are inevitably made. The interview techniques used in this research (Human Factors Interview Protocol, Worst Case Scenario Interview Protocol) could be valuable for fire agencies interested in performing robust incident reviews.

## HOW THE RESEARCH IS BEING USED

This research has produced both theoretical implications for decision research (such as the development of a model of worst case scenario thinking) and practical outcomes for fire agencies (such as recommendations for improving worst case scenario thinking). Research findings have been presented at various national and international workshops and conferences.

There has been considerable interest in this research from both rural and urban fire agencies. In addition, these ideas have been recognised as having implications for decision making in other domains with similar characteristics (for example, aviation).

In particular, the Premortem Method (see breakout box, this page) has attracted considerable attention from within the fire industry. Premortem activities to facilitate worst case scenario thinking have been successfully trialled at several workshops with considerable success and participant endorsement.

## FUTURE DIRECTIONS

Given that worst case scenario thinking can be challenging for experienced incident managers, it is likely that community members may also find anticipating extreme events problematic.

### PREMORTEM METHOD

*Developed by Gary Klein; see his book 'The Power of Intuition' (pages 98-101).*

A post-mortem tries to determine the causes of death or failure. In contrast, the Premortem Method is a group exercise to identify the 'fatal' elements of a plan *before* it is implemented. The purpose is not to criticise the planner or discredit the plan but to collaboratively identify (a) weaknesses in the plan, and (b) markers that will indicate when the plan is no longer working as intended. The Premortem assists team members to identify worst case scenarios and strengthen plans to cope with future situations.

The Premortem has six steps:

1) The team is informed of the current situation and the proposed plan.
2) Each team member imagines that the plan has catastrophically failed.
3) Each team member individually writes a list of possible reasons for failure. Be open minded – even good plans have weaknesses that can lead to unsuccessful outcomes.
4) The team consolidates the possible reasons for failure by listing all the reasons identified by every group member.
5) The team revisits the plan to address the identified weaknesses.
6) Periodically, the team reviews the list of possible reasons for failure to ensure the plan is strong.

The author was involved in post-incident research carried out by a Bushfire CRC taskforce after the February 2009 Black Saturday fires in Victoria. As part of the taskforce, she interviewed many community members affected by the fires.

Although worst case scenario thinking was not the focus of the taskforce research, it was clear from some of the interviews that, prior to the fires, many people were unable to imagine how the situation could quickly deteriorate into disaster. Many survivors reported difficulties in planning for extreme outcomes and developing back-up options. Therefore, an important application of these concepts of worst case scenarios may be in community decision making. Further research could investigate factors that might prevent community members from preparing for such scenarios and provide guidance for developing new ways to improve worst case thinking.

## ACKNOWLEDGEMENTS

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**Bushfire Cooperative Research Centre**
Level 5/340 Albert Street
East Melbourne VIC 3002
Telephone: 03 9412 9600
www.bushfirecrc.com

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**Australasian Fire and Emergency Service Authorities Council**
Level 5/340 Albert Street
East Melbourne VIC 3002
Telephone: 03 9418 2388
www.afac.com.au

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