# The changing risk environment:

## ideas for a new Australian policy framework for handling risks


An Australian Academy of Science Project

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# Foreword

Our modern world is undergoing change at a much greater rate than ever before. In a single lifetime a person might experience many technological changes that alter their life dramatically. Most of these changes are beneficial, but some are not — whether through accident or by deliberate intent. The level of risk in modern life is thus also greatly increased, and new patterns and parameters of risk require new strategies to address them.

This report considers the important factors that influence risk assessment in a modern Australian context, and analyses five case studies of different types of risk that have become practical problems or disasters: drought, bushfire, industrial disease, unknown and possibly hazardous substances, and terrorist bombings. The case studies demonstrate the preparations and responses that were successful and the problems that arose, giving leads that can be used by risk managers at all levels in the future. The Academy hopes that the report will thus be a useful tool for many risk managers in many public and private sector organisations.

The study was made possible by support from the Australian Research Council through the National Academies Forum. It has been guided by its Steering Committee, including Professor Sue Serjeantson (Project Director, Australian Academy of Science); Dr Paul Barnes (Queensland University of Technology); Professor Leon Mann and Dr John Beaton, representing the Academy of the Social Sciences in Australia; Professor Barbara Caine and Dr John Byron, representing the Australian Academy of the Humanities; and Dr Ian Chessell and Dr John Dodgson, representing the Australian Academy of Technological Sciences and Engineering. The Project Officer was Dr Paul Ferrar. The report has also benefited from comments and advice from many other individuals, too numerous to list here, to whom we are very grateful.

Professor Philip Kuchel FAA
Chair of Steering Group
Australian Academy of Science

# Executive summary

Risk in the modern world is changing. The greater interconnectedness of modern life and its processes means that risks are now more complex than before, with a wider range of indirect consequences when they eventuate.

Nations are now re-examining their risk assessment frameworks. The present study examines five diverse cases in the Australian experience, drawing on the combined knowledge of the varied disciplines represented in the National Academies Forum.

The report presents some key features in risk assessment that should underpin any new Australian risk assessment framework. It then analyses five case studies:

- the 2002–03 drought in south-east Australia;
- the ACT–NSW bushfires of 2003;
- asbestos-related mesothelioma;
- the white powder scares of 2001 and subsequent years;
- the Bali bombings of 2002 and 2005.

Each is considered under the standard risk assessment steps of Analysis, Prevention, Preparedness, Response and Recovery, followed by an analysis of lessons learned from the case study.

The report concludes that overall Australia has performed quite well in responding to problems that have arisen in disaster situations. New policies and practices have been introduced in many different areas, though not all problems have yet been addressed effectively. Some areas in which additional research is needed are indicated.

# Introduction

### Perspective

We live with risk in every moment of our lives. The nature and magnitude of risks vary greatly with time of day and the situation (eg, whether at home, outside or travelling), and for two people in the same situation the risks might be quite different (eg, because of different physical abilities or different genetic make-ups).

Most people agree that it is desirable to minimise risk. Some people, however, actually seek increased risk for its entertainment value, as with bungee jumping, skydiving and other extreme sports. Not all people aim to remove risks from their lives, although all would probably wish to be able to control them.

Coping with risk is an essential element of our existence. Minimising threats has never been easy and, despite many technological advances in recent times (including in the area of safety), it has not become much easier because of an increase in the technological complexity of modern society. Change in the world now is unparalleled in its extent and rapidity, and risks and threats are changing concomitantly.

Some modern technological advances have resulted in greater safety, but others have increased the extent of risks. Examples are climate change resulting, in part, from increased combustion of fossil fuels by humans, greater global mobility of people and goods, extensive interconnectedness of infrastructure (between as well as within countries), and communication technologies that are enormously powerful but are also more vulnerable to disruption.

Modern terrorism has also significantly changed priorities in risk assessment. Relatively recent terror campaigns, such as that by the Irish Republican Army (IRA), with its bombings in London, involved telephoned warnings before attacks. More recently, car and truck bombs have been detonated without warning, often in multiple and strategically targeted sequences, while suicide bombers deliberately take their own lives along with many others. This last factor — the readiness of humans to sacrifice their lives for political and ideological goals — has elicited a particular fear response in communities. This is because such acts are mostly beyond the comprehension of mainstream members of society, so these events are unpredictable and all the more frightening.

In 2003, the International Futures Program of the Organisation for Economic Cooperation and Development (OECD) explored the changing nature of major risks, and the implications of those developments for societies worldwide, in the 21st century.[1] The report presented, among other things, five case studies of risks or disasters that affected OECD member states in recent times. These were: 1) flooding in France; 2) nuclear accidents, exemplified by that at Chernobyl in Russia; 3) infectious disease, especially malaria; 4) terrorism, in particular the incident in New York on 11 September 2001; and 5) food safety, exemplified by bovine spongiform encephalopathy (BSE) and Creutzfeldt-Jakob Disease (CJD) in the United Kingdom and Germany.

These case studies showed that the indirect consequences of a hazard can be considerably larger than the direct ones, and indirect consequences must be factored

into risk assessment if the assessment is to be effective. The OECD case studies are of interest to Australia, but there is an urgent need for a new framework for assessing risk in the uniquely Australian context. The Council of Australian Governments (COAG) recommended a complete re-evaluation of natural disaster risks in Australia,[2] and it seems timely now to examine the broader range of risks facing the nation. The present study examines five diverse cases in the Australian experience and draws on the combined knowledge brought to the project by the many disciplines represented in the National Academies Forum.

The five case studies are: 1) the 2002–03 drought in south-east Australia; 2) the New South Wales–Australian Capital Territory bushfires of 2003; 3) asbestos-related mesothelioma; 4) the white powder scares of 2001 and subsequent years; and 5) the Bali bombings of 2002 and 2005.

Retrospective analysis is useful for emergency managers and for scientists, including social scientists, for developing tools for risk assessment. This report aims to provide this analysis and feedback to those Australians who are concerned with risk management in all its guises.

Optimism that creative solutions will be found derives from the fact that Australia is a well-educated country with a long tradition of resourcefulness in tackling unique situations. Therefore many excellent practices have been developed to cope with and minimise threats. This report identifies the problems and the positive advances made towards their solutions.

Our aim is to stimulate discussion on a new framework for risk assessment and, through debate, refinement of that framework. This will be a continuing process because the one thing that is certain is that unpredictability and change are ever present.

# Chapter 1

# The risk assessment and risk management context

There is a large literature on risk-management theory and practice and any Australian risk strategy needs to take account of this body of knowledge and experience.

The next section summarises the key features that the Academies contend should underpin a new Australian risk assessment framework.

# The risk assessment and risk management context

A large body of literature exists on risk, risk assessment and risk management. It is not the purpose of this report to review the subject in detail, but some key factors relating to the case studies are noted below.

Two recent Australian reviews of risk in relation to specific subjects are relevant to the present study, and each provides more detail on and discussion of the nature of risk and the factors affecting it. Botterill and Mazur[3] have presented a review of literature on risk and risk perception relating to agriculture, and the Office of the Gene Technology Regulator[4] has published a Risk Analysis Framework relating to gene technology and genetically modified organisms (GMOs). Australia and New Zealand also have a Risk Management Standard,[5,6] which provides definitions of risk and describes the steps involved in risk management.

From much of the literature, it is clear that there is no single accepted definition of risk. The Australian Standard on Risk Management (ANZS 4360)[5,6] defines risk as the chance of something happening that will have an impact on objectives or planned outcomes — expressed in terms of likelihood and consequences. From a more technical perspective, this can be expressed as the probability of occurrence of a specific instance of damage and the extent of that damage.

For the purposes of this report, a basic definition is:

Risk = a Function of the Likelihood of an Event and the Consequences if it occurs.

Depending on the problems being examined and the professional knowledge sets used, the basic model will vary. Renn[9] has given a detailed examination of international frameworks of risk-related terms.

In this definition, risk can be either positive or negative, because some risky behaviour could have positive outcomes.[3] As Botterill and Mazur[3] have noted, however, in the past 15 years or so the term has come to have a much more negative association, with what they describe as a stronger 'dread' element. This has coloured the public perception of risk, which is now generally seen to relate to disasters, potential or actual.

Risk assessment and risk management have been human activities probably for as long as humans have existed,[7] but formal risk analysis is a relatively recent activity, dating back to the early 1900s.[8] The subject then began to be studied in relation to technological developments, including industrial processes, and in relation to natural disasters.[8] Golding[8] has described the development of the subject, particularly in relation to the social sciences and research and practical programs.

Risk assessment studies fall into two broad categories. The first is technical assessment of risk independent of any human reaction to the risk. This might utilise mathematics (probability theory), physical sciences and biological sciences other than psychology. It aims to define the physical and technical parameters surrounding the risk, and the chance of it occurring.

However, as many authors have pointed out (eg, the OECD report[1] and Renn[9]), human behaviour is in most cases a prevailing factor in risk. Indeed, Renn wrote that 'risks are mental "constructions". They are not real phenomena but originate in the human mind.'[9]

Similarly, Slovic[10] wrote that 'risk does not exist "out there", independent of our minds and cultures, waiting to be measured. Human beings have invented the concept "risk" to help them understand and cope with the dangers and uncertainties of life.'

The human mind exaggerates some risks and diminishes others compared with what a physical risk assessment would indicate,[3] and thus it is important to study the human dimensions of risk and responses to it, in addition to the physical dimensions.

Significant factors relating to technical and social assessments of risk are summarised below.

## Technical assessment of risk

The elements of risk assessment and management are usually summarised[11,12] as:

1. Analysis
2. Prevention (sometimes also called Mitigation)
3. Preparedness
4. Response
5. Recovery

This simplified framework departs somewhat from that given in the Australian Standard on risk — a more detailed framework is given in Section 3.2 of that publication.[5]

### *Analysis*

Analysis of a risk situation is often the most valuable stage of risk management because it requires the analyst to look carefully at all the factors involved, and to dissociate the parts of the risk situation and identify how they fit together and interact. It is a complex subject with many factors to be taken into account in the assessment and has been covered in detail by Renn.[9]

Summarising from various sources, aspects requiring consideration in the analysis include:

1. What measures are appropriate for estimating the risk?
2. What are the origins or sources of the hazards?
3. What is the probability of the risk eventuating?
4. What might be the extent of damage (eg, death, injury, property loss, production loss)? How persistent will the damage be? Can the damage be reversed?
5. What are the characteristics of the risk system, and what agents and influences act on the system? What other outside factors impinge on or affect the core hazard?
6. How accurate are the data on which the analysis is being made?
    - Are they complete?
    - Is there a possibility of ambiguity or different interpretations?

7. What are the social dimensions?
   - Fear levels
   - Equity considerations (eg, city versus bush, different gender or age groupings)
   - Other social dimensions?
8. Will there be indirect consequences (eg, outbreaks of BSE and foot-and-mouth disease in the UK had major effects on tourism, trade and politics as well as on the infected livestock)?

The social factors affecting risk are considered in more detail below.

*Prevention*

For hazards, seven major control interventions[13] are possible:

1. Modify wants
2. Choose alternative technology
3. Prevent initiation of events
4. Prevent releases
5. Restrict exposure
6. Block consequences
7. Mitigate consequences

Solutions to risk are not necessarily technical — sometimes it can be the increasing of public understanding or trust to accept the risk and what is being done about it.

*Preparedness*

Keys to effective preparedness[6] are:

1. sound analysis so that the risk manager knows what is being prepared for;
2. early detection of hazards before they become disasters;
3. a comprehensive survey of vulnerabilities where the nature of the risks cannot be foreseen, and steps taken to reduce those vulnerabilities;
4. effective response strategies able to cope with any disaster situation;
5. advance planning of strategies to assist affected communities to recover.

*Response*

More important than ever these days is the availability of well-equipped and well-trained emergency services[2] able to cope with the diversity of disaster situations that might occur. Required elements are:

1. Good integration of all the different forces — fire services (urban and rural), ambulance, State Emergency Service and police. Agreed command systems need to be in place in advance so that there is no need for negotiation after an event has taken place.
2. Availability of specialists to cope with particular hazard situations, such as HAZMAT teams trained and equipped to cope with exposures of hazardous materials.
3. Personnel available who are trained to work under fire in terrorist incidents and to be aware of possible follow-up attacks.

4. Plans formulated in advance for units from other regions to be made available when local services cannot cope, with advance planning for how the units will integrate, what the command structures will be and relevant insurance being in place.

Tight control of emergency scenes is vital, not only for safe and effective rescue and response but for preservation of evidence if a situation might involve later legal proceedings.[14]

Good management of information flows is also vital.[15,16] Communities that are aware that an event has taken place but feel themselves uninformed about it might take actions that impede rather than assist the recovery effort. Conversely, a good flow of accurate information can assist the recovery process, as during the 2003 ACT bushfires when ABC Radio 666 (2CN) provided a flow of information that even the emergency services were using at times.[35]

It is desirable that the media report events accurately and with minimal sensationalism. Government information should also be honest and accurate — the consequences if authorities are found to have been dishonest can be disastrous. If a population becomes alienated from authority, it is hard to achieve effective recovery. Conversely, it can be very effective for recovery situations for a major public figure who is a good communicator and is respected and trusted by the community to be put in charge. For example, after Cyclone Tracy struck Darwin in December 1974, Major General Allan Stretton, Director-General of the Natural Disasters Organisation, played a strong role in reuniting a devastated community and restoring services and life in the city.[17] General Peter Cosgrove has played a similar role in the aftermath of Cyclone Larry in north Queensland;[18] he was also in charge of the peacekeeping International Force for East Timor in 1999–2000.[19]

*Recovery*

Factors to be considered[1] are whether or not insurance covers damage and losses suffered; whether or not compensation may be claimed; whether government loans may be justified, and under what conditions; and whether counselling services are required and who should pay for their provision.

## Human and social parameters of risk

Risk is a socially constructed phenomenon. Risks where there is a strong element of dread tend to be rated more highly than they might merit; for example, most people rate shark attacks as a high risk for swimmers because each attack receives a lot of publicity and there is a strong visceral reaction to the thought of the damage that a shark can inflict. However, in 2000, only five people were killed by sharks in the world — not a high risk when compared with the number of people who went swimming.[3]

People also discount known or familiar risks and overrate unknown risks. For example, most people feel that there is a much greater risk of flying than driving, even when they can see the statistics that show that there is more chance of death or injury from driving than from flying. In this case, it is also the belief that a driver has control over the driving situation (even though this is not always the case in accidents), whereas when flying the control is out of passengers' hands.[9]

The tendency for people to overestimate certain risks has been termed the *social amplification of risk*, and a broad introduction to this subject has been given by Kasperson et al.[20]

### The importance of risk communication and public trust

Renn[9] noted that risk communication is of major importance throughout the entire risk-handling chain. It involves people more directly in the risk evaluation and response process, and airs the physical and social factors that are involved. Effective risk communication fosters tolerance for conflicting viewpoints, provides the basis for their resolution and creates trust in the institutional means for assessing and managing risk and related concerns.

Perceptions of risk might be influenced strongly by the nature of media coverage of the risk, directly and in terms of loss of trust in the authorities who are managing the risk. The OECD report[1] wrote that

> the public's perception of risks depends on the mass media rather than on expert opinion, and the tendency in these media is shifting away from information and towards entertainment. As a result, issues are framed in terms that are readily assimilated rather than informative (mad cow disease for bovine spongiform encephalopathy, Frankenstein foods for foods containing genetically modified organisms). Poor communication can turn a crisis into a major disaster, especially if decision makers are slow to react or are discovered to have lied.

The COAG report[2] on reforming mitigation, relief and recovery arrangements after natural disasters emphasised the importance of public trust if disasters were to be handled effectively. The report noted that risk management is a shared and cooperative activity, and it is not only government and corporate bodies that must cooperate — there must be full cooperation from all members of the public too. For effective risk management, the general public must be prepared to obey instructions and, where appropriate, help with mitigation efforts. They can also be effective information and intelligence gatherers, as long as they trust authority and are prepared to cooperate.

To achieve this, the public must be broadly in agreement with the actions being undertaken. This should result in part from good risk communication, as noted above, but it also requires public trust in 'the authorities', whoever they are. Equally important is trust between the agencies that need to cooperate to respond to a disaster.

## How Australia differs from other parts of the world

No two sets of risk situations are exactly the same, and every grouping of human activities, whether as a nation, a local government, a company or other, must make its own analysis of its risks and decide what to do about them. Australia faces most of the risks that are common to the whole world — natural disasters such as floods and storms, industrial accidents, food safety risks and increasing terrorism — but it also has some unique features. As the COAG report[2] on natural disaster management recommended, Australia must make its own analysis of its risk situation.

Features in which Australia differs from other parts of the world include:

1. Australia is an island continent isolated from land contact with other countries. The implications for risk are, on the positive side, that this provides a useful barrier against many bio-security invasions, but on the negative side it gives the nation an extremely long and relatively unprotected coastline to monitor for unwanted incursions.

2. Australia is the driest inhabited continent on Earth, and also has greater variability in its climate than many other countries. Given the increasing variability of weather from global climate change, this gives Australia particularly high risks in relation to agriculture and food supply, climate, water supply and bushfires.

3. Australia has a very small population (about 20 million) relative to the size of the land that has to be protected, which also has implications for risk management. Population size is significant in that it determines the size of the pool of human talent from which to draw ideas (although Australia is a well-educated and resourceful society), it limits the number of trained individuals available to cope with disasters and emergencies, and it limits the funding available for disaster management compared with larger nations with bigger tax bases.

4. Although all countries have administrative subdivisions of their nations to an extent, the nation of Australia is a commonwealth of fairly independent states and territories, each of which has quite a degree of autonomy. For many matters, the states and territories are separate jurisdictions with responsibility for emergency management within their borders — more so than in most other nations. This can lead to some complications when an emergency requires cooperation across state/territory boundaries.

5. Australia's mix of energy sources differs considerably from that of many other countries. Australia derives no power at present from nuclear reactors, most coming from coal-fired power stations, with some hydroelectric and a small amount from wind generation. This gives Australia a particular set of factors relating to power availability in the future, and environmental consequences relating to power generation.

6. Australia has a high proportion of its population living on or very close to the coast, many in low-lying areas. This has implications for risks from natural disasters, especially tsunamis, cyclones, other storms and flooding.

**Some new dimensions of risk**

Many human activities in the modern world are interconnected in ways that they have never been before. The most obvious form of interconnection is electronic. Most global financial transactions nowadays are virtually instantaneous and electronic, and there is also huge linkage of databases in many different directions and for different purposes. The speed and interconnection has added vast power to such systems, but has also introduced much more risk if disruption occurs. Physical interconnection might fail, or the software behind the systems might fail, either from design faults or from malicious intervention. And given the degree of interconnection, the ramifications of failure are likewise enormous and diverse.

For example, a strong earthquake struck the Japanese city of Kobe on 17 January 1995, and one of its indirect consequences was the collapse of the British Barings Bank. One of the bank's derivatives futures traders in Singapore (Nick Leeson) was engaged in risky trading that relied on stability in the Japanese stock market to avoid major losses. The Kobe earthquake, however, caused the Nikkei Index to drop by 7 per cent in one week. Barings' losses escalated rapidly, in the end reaching £1.3 billion, which bankrupted the bank.[21]

The OECD report[1] quotes an estimate that a large earthquake in Greater Tokyo (an earthquake-prone area) 'would entail damage of between US$1,000 billion and US$3,000 billion, equivalent to 25%–75% of Japan's GDP'. Such a monumental loss would have huge financial implications for the rest of the world, and there would be flow-on effects to many non-financial activities as well.

A risk with this type of complexity and ramifications has been called a 'systemic' risk.[1] Systemic risks are a novel type of risk, where any risk to human health and the environment is embedded in a larger context of social, financial and economic consequences, and there are increased interdependencies across risks and between their various backgrounds. Such risks require novel approaches to analyse and manage them.

Many emerging systemic risks are global in nature, which means that national strategies to manage the risks are likely to face difficulties, and international solutions for each case will need to be developed. This is a field of risk management in which sound and creative thinking is urgently needed. Such global risks include:

1. Trans-boundary risks (risks originating in one country and affecting other countries, such as air pollution).

2. International risks (risks originating in many countries simultaneously and leading to global impacts, such as carbon dioxide emissions for climate change).

3. Ubiquitous risks (risks that occur in each country and that might necessitate a coordinated international response, such as air safety).

# Chapter 2

# Five case studies of risks that affected Australia

## **Case study 1:** The 2002–03 drought

From April 2002 to January 2003, many parts of Australia suffered severe rainfall deficiencies, some places receiving the lowest rainfall since records began in 1900. This drought reduced primary production, exports and Australia's GDP, left many rural families and small businesses in financial hardship, and caused social problems in rural areas.

Some alternatives to the system of drought relief funding and payment have been suggested, and are outlined here.

# **Case study 1:** The 2002–03 drought

**The event**

During the 10 months from April 2002 to January 2003, many parts of Australia suffered serious to severe rainfall deficiencies.* A large area through central Queensland and northern NSW had the lowest rainfall since records were started in 1900, and most of Queensland, NSW, Victoria, the southern Northern Territory, south-west Western Australia and the far east of Tasmania fell into the serious to severe deficiency category. In south-west Western Australia this was the third successive year of rainfall deficit.[22]

According to the Bureau of Meteorology,[23] this was a weak to moderate El Niño event (see under Analysis below) that had a very strong impact in Australia. The rainfall deficiencies in the 2002–03 drought ranked in severity and areal extent with the extreme droughts of 1902 and 1982–83. Practically all parts of the country were affected, and in southern areas this exacerbated the effects of several preceding years of dry conditions. The extreme dryness coincided with exceptionally warm conditions: average maximum temperatures established new records by a wide margin for the post-1950 era in each of the seasons of autumn, winter and spring. Severe bushfires in eastern NSW, Canberra and the mountains of south-east NSW and eastern Victoria, and widespread water shortages, were some of the main outcomes.

In February 2003, widespread rainfalls that were above to very much above average occurred,[23] raising hopes of a consistent period of wet weather to erase the effects of severe drought. This was not to be. Totals for the remainder of 2003 were insufficient in many areas to overcome existing rainfall deficiencies — especially in parts of Queensland and south-east Victoria.

Such a long and widespread reduction of rainfall causes major drops in primary production, and significant economic and social consequences for people in rural communities. The economic costs and social impacts of this and other droughts have been described and analysed in detail by Alston and Kent.[24] Quoting mainly ABARE reports and estimates, they noted that the following economic downturns resulted from the 2002–03 drought:

1. The rate of economic growth for the whole of Australia was reduced by about 0.9 per cent, or about $6.6 billion.

2. The drought and its flow-on effects removed about 1.6 per cent of Australia's GDP.

3. Grain production was down by 60 per cent from the previous season.

4. Specialist beef producers' cash incomes were down by 67 per cent.

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* The Bureau of Meteorology's Climate Glossary defines a **serious rainfall deficiency** as rainfall that lies above the lowest 5 per cent of recorded rainfall but below the lowest 10 per cent for the period in question; a **severe rainfall deficiency** is when rainfall is among the lowest 5 per cent for the period in question.

5. There was a reduction of 12.8 per cent in farm exports for 2002–03. Lamb exports dropped 6 per cent and beef exports dropped 5 per cent. Fodder costs for producers were, on average, 61 per cent higher.

6. The net value of farm production for 2002–03 was estimated to have dropped by 80 per cent to $2 billion, from a record of $9.8 billion in 2001–02.

7. Some 40,000 jobs were estimated to have been lost as a direct result of the drought.

The Bureau of Meteorology[25] statement on 'Living with Drought' notes that drought can:

- reduce primary productivity;
- disrupt cropping programs;
- reduce breeding stock;
- threaten permanent erosion of the capital and resources of farming enterprises;
- lead to vegetation loss, soil erosion and permanent damage to the environment;
- lead to reduced water quality;
- threaten the sustainability of agricultural industries;
- affect the national economy (particularly but not only through reduced exports of commodities).

Among the social impacts recorded by Alston and Kent[24] were:

1. Serious erosion of incomes for farms and small businesses.

2. Increasing rural poverty (see below).

3. Increasing workloads on and off farm for those remaining on the land (many employees had to be laid off, and many farmers sought off-farm employment).

4. A need to seek alternative income.

5. Health (including mental health) and welfare issues.

6. Declining access to education for farm children.

7. Increasing isolation for members of farm families, especially for men who had to spend enormously long periods working outside.

Alston and Kent[24] also noted that resentment built up in rural communities because small businesses did not have the same access to benefits as farms did, and this caused tensions in the communities.

They noted that the poverty of the farm families and associated small businesspeople was not only economic, it was what they called psychological poverty or poverty of spirit. This included lack of access to services, withdrawal from the community and community activities, a feeling of mistrust of the government, and a feeling that the rest of the nation did not understand their plight. Perhaps, most of all, it led to loss of self-esteem, which is the motivator for so many other human activities.

## Analysis

Drought is a regular feature of the Australian climate, and its likely appearance can now be predicted several months in advance from the El Niño effect and measurement of the Southern Oscillation Index (SOI).[26] The 2002–03 drought was in fact predicted by these means.

El Niño is extensive warming of the central and eastern Pacific Ocean, resulting in a major shift in weather patterns across the Pacific. The effect in Australia and the islands of the western Pacific is rainfall well below average (but above average in southern North America and northern South America).

The opposite effect is La Niña, where there is extensive cooling of the central and eastern Pacific, with the climatic effects opposite to those of El Niño (i.e., above-average rainfall in Australia and the western Pacific).

The SOI is calculated from the monthly or seasonal fluctuations in the air pressure difference between Tahiti and Darwin. Sustained negative values of the SOI often indicate the onset of El Niño, and positive values indicate La Niña.

Other analysis is revealing that human activities, such as burning of increasing amounts of fossil fuels (releasing greater amounts of carbon dioxide into the atmosphere) and release of other greenhouse gases, are increasing the extent of global climate change.[27] There are differing expert opinions on the extent of the change that has already occurred, and on its implications for primary production, for other human activities and for the environment. There are few, however, who do not now accept that this change is happening, and that it is a very serious matter that needs urgent responses.

## Prevention

There are no known ways to prevent individual droughts, which are a regular phenomenon in Australia's weather patterns. There might well be ways, however, to reduce or even eliminate the harmful global climate change that is occurring at the moment.

The drought effect scenario that needs to be prevented is the tendency for graziers to stock land to its full carrying capacity in good times (for understandable maximisation of income), and then to have problems when times are dry and breeding stock have to be sent to agistment on other properties, sold off or slaughtered. One means by which this could be influenced would be an effective government drought policy, and this is discussed under Preparedness below.

## Preparedness

There has been a tendency in Australian primary production to stock or crop well in good years without taking account of the possibility of bad years, yet drought is a regular feature of the Australian climate. The Australian Bureau of Meteorology[25] defines drought as a prolonged, abnormally dry period when there is not enough water for users' normal needs. The bureau notes that research has shown that severe drought affects some part of Australia about once every 18 years, though even that is variable — drought-free periods can vary from four to 38 years.

As early as the 1860s, George Goyder, the Surveyor-General of South Australia, identified the limits to safe cropping in South Australia from natural vegetation associations.[28] He drew a line on the map of South Australia, known as 'Goyder's Line' (which closely follows the 10-inch or 250-mm isohyet), and declared that cropping should only occur south of the line — to the north the land was suited only to pastoralism. Nevertheless, settlers pushed north of Goyder's Line, only to experience disastrous crop failures 10 years later.

Strategies have been defined by which primary producers can minimise the harmful effects of drought: livestock owners can de-stock, growers can decide not to sow field crops or plant horticultural crops, or they can make provision for irrigation if water is available. Those responsible for water supplies to residential and industrial areas can impose advance restrictions on water use so as to conserve supplies. However, this degree of seasonal variability is a challenge for even the best farmer to manage, and the Australian Government has accepted that there are times when drought assistance or relief is appropriate. A comprehensive history of Australian drought relief policy and practice has been given by Botterill,[29] who noted that in recent times the principles behind the policy have been that unviable properties should not be supported, and that viable properties should receive loans in preference to grants. However, for political reasons noted below, the Government has not generally been able to adhere to these principles.

The typical effects and impacts of drought were apparent in the 2002–03 drought, and for many the effects were particularly severe because there had been a series of droughts in the years before, with too few good years in between to enable solid recovery. Many farm families were having difficulty finding their living expenses, and TV news reports increasingly showed distressed families, starving livestock and parched and barren landscapes.

This coincided with government attempts to use drought policy for rural restructuring (persuading unviable producers to leave the land). A negative response from the public to what was seen as government hard-heartedness towards battling Australians then led to a television station launching the Farmhand Appeal,[30] a charity to which Australian urban dwellers contributed money to help rural families in difficulty. A total of $24.1 million had been raised when the fund was closed early in 2004.[31] This was well intentioned and generous, but in principle worked at cross-purposes to the aims and principles of Australian Government drought policy[29] (though in practice the amounts per property would not have been enough to reverse government intentions).

### Response

No definition of when dry weather becomes a drought has ever been agreed to. The recording of a particular set of meteorological conditions has been accepted as the point at which government drought relief measures can be implemented, though the particular set of conditions has varied over the years. Botterill[29] gives a comprehensive description of the conditions. In 2003–04, a National Drought Policy was in place, and under it drought relief payments could be made to properties in drought-declared areas. The additional public response through the Farmhand Appeal has been noted above. Proceeds from that appeal were distributed to needy families on the land or in associated rural businesses. A government decision at the time allowed donations from the Farm Hand Appeal not to be considered as income when Centrelink relief payments were calculated for individual families. Despite the Government's attempts to toughen up its drought relief program, relief measures in 2002–03 were in fact particularly generous.[29]

### Recovery

The response measures noted above are intended to promote recovery by providing at least a subsistence income to enable primary producers to sit out the worst of the drought. However, many of the areas affected by drought in 2002–03 have not received consistent good rainfall since and, at time of writing this report (July 2006), many were still experiencing rainfall deficiencies.[32]

### Comment

For many years, the Australian Government has been trying to implement the principle that money should not simply be handed out as grants to all rural properties in drought-declared areas. Some of the properties would not be viable under any circumstances, and government policy has been that such properties should not be propped up. In other words, drought policy should be one tool for implementation of rural reconstruction.[29]

Those properties that are well managed and viable should be kept going in the national interest (on primary production and environmental grounds), however, the preferred mode of support is some form of loan rather than a grant. Many of those properties will have an income over time that is well above that of the average Australian taxpayer, and it would not be equitable to give such properties grants paid for by taxpayers with lower incomes.[29]

However, because of the great public emotion associated with severe drought — increased by regular TV news pictures of starving or slaughtered animals, parched landscapes and impoverished families — to date, it has never been possible for the Government to implement the rational but firm principles outlined above, which were agreed to by all parties during discussions in less severe and less emotional times. Drought used to receive a bipartisan political approach, but has now become political, with opposition claims that the bush has been forgotten, deserted or sold out. This too makes it harder for the Government to be anything other than lenient or generous, and 2002–03 was no exception.[29]

With properties that are considered viable, the earlier scheme of distributing grants had its critics, who maintained that it was easy for wealthy properties to minimise their incomes and be given grants that were not justified or needed. Even the idea of a loans scheme was felt to be not beyond that type of financial manipulation. More recently, however, Chapman et al.[33] and Botterill and Chapman[34] have put forward the idea of a drought relief loan scheme that would operate similarly to the HECS loan scheme of support for higher education fees. They have proposed that the timing and amount of the loan should be calculated from the Business Activity Statement (BAS) that every farm property (and other business) in Australia must submit regularly to the Australian Taxation Office.

# Five case studies of risks that affected Australia

**Case study 2:** The 2003 ACT–NSW bushfires

On 18 January 2003, a devastating bushfire swept through parts of Canberra, killing four people and injuring others, destroying 478 homes, burning out almost 70 per cent of the ACT's parks, forests and pastures and extensive areas of government pine plantations. Damage was estimated at about $300 million.

# **Case study 2:** The 2003 ACT–NSW bushfires

**The event**

The sequence of events leading up to the Canberra bushfire has been described in detail by the McLeod report[35] commissioned by the ACT Government.

On 8 January 2003, an electrical storm passed over the mountains to the west of Canberra and lightning strikes started several fires. During the next week, firefighters were unable to extinguish the fires; the fires gradually moved closer together and nearer to the urban edges of Canberra.

On 17 January, the air temperature rose, the relative humidity fell and the wind speed increased, leading to a total fire ban and mounting official concern about the fire threat to Canberra. On 18 January, wind speeds increased to gusts of 78km/h, the temperature rose to 37.4ºC and the relative humidity fell as low as 4 per cent, leading to an extreme level of fire danger. Winds were blowing towards Canberra and, as the day progressed, the separate fires joined into a single broad fire front heading towards the western edge of Canberra.

At 2.45pm, a State of Emergency was declared (the first in the history of the ACT), and about 3pm the fires reached the outer streets of the suburb of Duffy. The fire was spread by a combination of glowing embers and 'burning brands' (larger pieces of burning matter), and a firestorm passed through parts of Canberra, causing significant damage from the force of the storm.

Impacts of the fire included:

1. Almost 70 per cent of the pastures, forests and nature parks of the ACT were severely damaged (160,000ha, plus another 100,000ha in NSW), with great loss of wildlife as well as vegetation. The Tidbinbilla Nature Reserve was also severely burned and almost all animals in the enclosed areas were killed.

2. Four lives were lost, and other people were burned or otherwise injured.

3. Approximately 500 homes were burnt out and more were severely damaged (this figure was later revised to 478 homes destroyed[36]).

4. Much of the famous Mount Stromlo Observatory on the urban fringe of Canberra was burnt, and some of the damage and loss will never be rectified.

5. Some commercial premises — a service station, a veterinary hospital, the RSPCA animal refuge — and some infrastructure were destroyed. In the veterinary hospital and RSPCA premises, many pets and other animals were burnt to death, as were many livestock in rural areas.

6. All government pine plantations west of the Murrumbidgee River were burnt out.

7. Damage was estimated at about $300 million.

8. Immediately after the fires, about 30,000 ACT residents were without power and telephone services, some for a week or more.[37]

9. More than 5,000 people were evacuated to emergency centres directly after the fire.[37]

10. The two main water supplies into Canberra were temporarily non-operational, as was the sewage-treatment plant.[37]

The comprehensive and thoughtful report by R.N. McLeod[35] provides good information for an assessment under the five headings of Risk Management.

**Analysis**

Fire behaviour is complex and outcomes are difficult to predict with accuracy. Nevertheless, fire modelling is sufficiently advanced that broad predictions can be made based on climatic forecasts and knowledge of fuel loads in the area in question. In the case of the 2003 ACT fires, the Australian Bureau of Meteorology accurately predicted the weather forecast, and the fuel load was known to be very heavy and unusually dry.[35] In some places, the fuel load was said to be 35–50 tonnes per hectare, which is about as heavy as any recorded load.[35]

There had also been signs earlier in the bushfire season from fires in northern NSW that this was likely to be a fire season with unusual behaviour, but the McLeod report[35] believed that this did not translate to higher than usual attention in the ACT.

In mid-2002, the Bureau of Meteorology warned that severe drought would prevail in south-east Australia, and that temperatures would be higher than normal. The October–December 2002 rainfall in the ACT was less than one-third of the normal levels — the third-lowest reading on record. These weather observations, too, should have warned of high danger.[35]

One point made by the McLeod report[35] was that it would have been good to have had an automatic weather station recording in the Brindabella Ranges west of Canberra. There are automatic stations in Canberra, but the next station to the west is a long way away at Young. Given that much of Canberra's weather comes from the west and north-west, the report recommended that a station be installed in the ranges. The cost of a station is about $40,000, and the cost of the damage that could be prevented would be very much greater.

Nevertheless, the weather was predicted well in advance and accurately. Indeed, on 17 January — the day before the fires reached Canberra —fire planners were able to predict with great accuracy what was about to happen. Unfortunately, by that time it was too late to stop the disaster.

The situation of analysis was thus good, but in the view of the McLeod report[35] there was insufficient forward action to prevent the disaster, and the failings were in prevention, preparedness and response, rather than in analysis.

## Prevention

As the McLeod report[35] points out, fires develop from a combination of heat, oxygen and fuel. Humans are not able to control air temperature or oxygen levels in nature, so the only factor amenable to human intervention is the size of the fuel load in areas close to urban concentrations.

Physical removal of the fuel is not feasible, and the normal method is to use controlled burning under favourable weather conditions. However, this is (and long has been) a very contentious subject. The McLeod report[35] discusses the subject in some detail, and notes the following factors.

Firstly, fire has long been a feature of the Australian environment. There have always been summer lightning strikes and, given the flammability of the Australian bush, there have always been bushfires. In addition, the setting of (usually benign) fires was a common practice among Aboriginal Australians.

It is thus argued by many that regular fire, set under favourable weather conditions, is beneficial rather than detrimental to the Australian environment. However, some environmentalists are still strongly opposed to any controlled burning in national parks on the grounds that it harms vegetation and wildlife. But, as McLeod noted,[35] the harm from a catastrophic and very high-intensity fire, like that of 2003, was infinitely more damaging to plants and animals, and it will be many decades before the bush recovers. A complete lack of burning is thus not a good option.

McLeod[35] also notes that there is always some degree of risk in controlled burning in that weather conditions can change unexpectedly and convert a controlled burn to one that is out of control.

Secondly, a majority of experts and the general population accepts that some controlled burning is necessary, but the authorities still encounter hostility when it is done because of smoke drift across urban areas. Furthermore, smoke levels might even contravene current strict air pollution legislation. However, McLeod[35] notes that there are usually only about 25–30 days in any season when all conditions are suitable for controlled burning, so it might not be possible to take account of public nuisance factors. The lesser evil might be outweighed by the greater good of preventing a major bushfire.

## Preparedness

The McLeod report[35] identified a number of ways in which the ACT had not been best prepared for the 2003 bushfire emergency. These were:

1. Maps of the fire areas supplied to local and interstate firefighting teams were of an inappropriate scale and/or were out of date.

2. Some critical fire trails for access to the fires were overgrown, making them either impossible to find or impossible to access. In some cases, the trails had been allowed to grow over, either to prevent unauthorised access to water catchments or to keep the general public out of certain national park areas.

As the report noted, there are other ways of restricting access, such as locked gates. The report further noted that some park staff were reluctant to put fire trails throughout national park areas, and it recommended that a strategic network of tracks and fire trails be re-established and regularly inspected and maintained.[38]

3. The Emergency Services Bureau headquarters building in the suburb of Curtin was inadequate for a major emergency in a number of ways. The building was previously the North Curtin Primary School and its existing layout did not facilitate the performance of emergency service (ES) functions. There were internal courtyards that were wasted space in that context. The public access was too great and there was insufficient security for ES vehicles, and not enough parking spaces for large numbers of emergency vehicles plus all the other people required to attend to an emergency. Curtin was also one of the suburbs along whose edge the fires were burning, and there was at least some threat that the fire might have spread to the ES headquarters.

   The building also did not have sufficient backup power generation. Curtin was one of the suburbs that lost power when the above-ground reticulation system was burnt out, and there was sufficient backup generation available only to power the operations and communications part of the HQ.[39]

   The HQ was also located close to buildings in a congested part of a suburb that was under threat from the fires (homes at the edge of Curtin not far from the HQ were burnt). The McLeod report contrasted that situation with the Winchester Police HQ in the urban area of Belconnen that was purpose-built for emergency management functions, had adequate space and protection and full emergency power backup. That building was also used during the bushfire emergency, and it was able to function much more smoothly.

4. One of the major failures in preparedness was in the communications systems. The McLeod report details the problems,[40] which included overwhelming of the communication centre, congestion on various networks, inadequate ground-to-air communication, insufficient amounts of equipment, and difficulties with interoperability between the various units involved. This was partly between units within the ACT service, and partly between the ACT, which follows Australian Federal Police nationally determined standards, and NSW, which uses a different statewide NSW Government standard. The question of interoperability is one that needs to be addressed by all Australian emergency services as a matter of urgency, since many emergencies will involve cross-jurisdictional aspects.

   At the height of the emergency, reports from fire observers on the ground could not be heard by all because of the overload, and the Police Operations Centre had difficulty securing a phone line to the Emergency Services Bureau. In the end, one line was left permanently open and a single phone handset was passed from person to person within the Police Operations Centre.

5. More helicopter support could probably have been requisitioned earlier than it was. When requested, it was made available with the assistance of Emergency Services Australia and the defence forces, but it was not asked for soon enough.

6. Public preparedness was not as good as it might have been, because, in the view of the McLeod inquiry, the information to the public was for too long reassurance that the situation was under control rather than advice on preparing for a worst-case scenario — which is what did in fact eventuate.[41]

7. There appeared also to be some problems with the fire tankers that were in service. Plastic door handles melted in the heat, and exposed nylon air-lines were extensively damaged; also, burning embers that were sucked in set fire to paper air filters, putting two tankers out of action and destroying a third. These potential problems turned out to have been noted by other jurisdictions, but the information had not been passed to the ACT bureau.[42]

8. One other aspect in which preparedness could have been better was in regard to evacuation policy and protocols. The policy of the bushfire authorities was that able-bodied people should stay and defend their properties if they were suitably equipped to do so and if the fire was not likely to overwhelm them. The policy of the police was mandatory evacuation. Both sets of advice were being provided to the community simultaneously, and this caused confusion and anger. Submissions to the McLeod inquiry[35] also noted that evacuation could sometimes be more dangerous than staying because vehicles could be caught by fires on open roads. The instructions given by the police did not advise people as to where they should evacuate to nor which roads were open and safe. Quite a number of roads were closed during the emergency, again raising risks of people being trapped in vehicles if they encountered a closed road when fire was nearby.

   Most people wished to stay with their properties if they were fit to do so and subsequent discussion has indicated that this is the best policy and should be the one that operates in future bushfire situations.

9. The McLeod report noted that some of the lessons for better preparedness could have been learned from similar but less severe fires that broke out around Canberra in December 2001.[43] Those fires burned out significant areas of pine plantation close to residential suburbs, and threatened homes in a number of suburbs. Problems of evacuation policy, interoperability of communications and communication centre difficulties arose then, and the problems had not been resolved a little more than a year later when the more severe bushfires engulfed Canberra.

**Response**

The McLeod report praised the huge, professional efforts made by a large number of people involved in all aspects of the response. It was not through lack of effort that problems arose, but a number of problems in response provide useful lessons for the future.

The most significant area where the report felt that there had been inadequate response[44] was in the fighting of the initial fires ignited in the Brindabella Ranges by lightning strikes on 8 January 2003. These could and should have been fought more actively and intensively while they were still small and isolated. The fire at Mount

Gingera was quite accessible, but was not tackled by the ACT services because it was thought (incorrectly) to be in NSW. Night-time firefighting was not carried out on safety grounds, yet, as the report points out, it had been done in similar terrain on other occasions (including the 2001 Canberra fire noted above), and conditions for firefighting are generally better at night. On subsequent days the effort also fell short of what might have been done. The report noted that even if the initial response had been more aggressive the disaster might still have occurred, but the chance of stopping it would have been greater.

Firefighting efforts were further hampered on several occasions by vehicle accidents blocking the only access to the fires.

The report felt that the best use was not made of aerial resources, and that medium-sized helicopters should have been used in preference to light ones because of their greater water-carrying capacity. Although it costs a significant amount to have such resources held on standby for emergencies, the cost of the damage that can be prevented by their availability is very much greater.[45]

The report also noted some problems with the command structure during the firefighting operations, which are discussed more fully in the report.[46]

Gas meters proved to be a hazard at homes that were burning, and there appeared to be no system by which the gas supplier was advised where supplies should be cut off.[47]

There was also a problem with the system that transmitted faxes to radio stations and other places from which information and warnings would be supplied to the public. For example, faxes to radio stations were transmitted at 1.45pm, but the one to ABC Radio was not received until 2.31pm.[48] There was also a strong feeling that there was not enough prior warning and 'education' of the public on what to do if and when an emergency eventuated.[49]

### Recovery

The McLeod report[50] considered that the recovery operations were generally well organised and effective. Four evacuation centres were established in sixth form colleges, and these offered first aid, shelter, food, clothing, personal support and housing. About 5,000 people were accommodated in these centres during the first 48 hours. Immediate financial assistance was offered to victims, and various local organisations, businesses and members of the community were generous in provision of goods and services.

Extensive lengths of power reticulation were burned out and more than 40,000 ACT residents lost utility services during the fire,[51] some for days. A number of suburbs also nearly lost their water supply and sewage-treatment service because the power line to Canberra's Lower Molonglo water-treatment plant was burned out. However, the electricity services made heroic efforts to restore services, and rebuilt the lost infrastructure in a remarkably short time (including restoring water pumping just before the suburban hilltop tanks were due to run dry).

The McLeod report also noted that the ACT Government had established an ACT Bushfire Recovery Taskforce to handle longer-term recovery from the bushfires. However, as the report was handed down six months after the bushfires, it was not able to judge the effectiveness of the long-term recovery activities.

As well as houses in Canberra, all but one of the 18 homes in the ACT rural forestry village of Pierce's Creek were burned out. The ACT Government[52] considered that an 18-home settlement was not viable and decided that 50 new homes should be built there.The ultimate planning approval for the settlement, however, resided with the National Capital Authority (NCA), which would agree to only 12 homes being rebuilt there. The whole matter became an unseemly political wrangle, much to the distress of the residents who wished to return there. In April 2006, the ACT Government stated that because the NCA would not agree to more houses at Pierce's Creek, no redevelopment at all would go ahead.[52]

One aspect of recovery that has been studied in detail is the role of communication in achieving good and lasting recovery. The subject was studied by Nicholls and Glenny,[37] who gave the ACT Government (and the various emergency response and recovery groups that it set up) a very good assessment — in fact, apart from one negative aspect, they believed that the operation came close to being best practice.

Nicholls and Glenny[37] noted that recovery from a major disaster such as the bushfires is a long process, with immediate 'hard-hat' recovery activities such as safety, food, water, shelter, medical aid and restoration of infrastructure needed first. Recovery does not end, however, when all the services are operating again and everyone is safe. There is a continuing and longer-term need for personal support, counselling, public meetings with credible spokespeople, and community events with an emphasis on rebuilding social connections and personal morale.

One of the successful aspects of the communication noted by Nicholls and Glenny[37] was that it avoided slick public relations and was a genuine and two-way communication between government and community. They noted that the Government had been particularly receptive to community concerns, and took action to resolve matters. As an example they cited the fact that after the fires there was an unexpectedly high level of community worry about asbestos dust released as a result of the fires. The Government installed air-measurement mechanisms in affected suburbs, which demonstrated that there were no grounds for concern, but also showed that the Government was willing to listen to the community's concerns.

The only negative aspect of communication noted by Nicholls and Glenny[37] was that it tended to be largely with the two suburbs that had been most affected by the disaster (Duffy and Chapman). Quite a number of other suburbs were affected to a lesser extent (and lost homes) and the residents of those areas felt that they were not getting a fair share of attention.

### Continuing inquiry

Because lives were lost, a coronial inquiry into the bushfires was required. The inquest opened in June 2003 and, at the date of writing the present report (28 July 2006), it has not been completed. It was delayed for a year when nine ACT public servants and the

ACT Government sought to have the ACT Coroner, Maria Doogan, dismissed from the inquiry on the grounds of perceived bias. The Supreme Court eventually dismissed the application, but the long delay caused much distress and anger in the ACT community. The ACT Government was seen as delaying and obstructing the process of a fair inquiry into an event about which many in the community had concerns.[53]

**Lessons learned**

The McLeod report made 61 individual recommendations for future action based on its study of the 2003 ACT bushfire disaster,[54] relating in particular to fuel management, fire access, aerial operations, the Emergency Services Bureau headquarters (upgrading and, if possible, relocation), incident command and control procedures, relationship between fire management and land management agencies, public education and information, and a clear policy on when to evacuate and when to stay.

One conclusion from this case study is that governments are either slow to learn from previous events or they do not learn from them at all. Sometimes this is a matter of inertia; sometimes a lack of political will. The McLeod report noted[55] that a number of lessons could have been learned from the December 2001 fires that burned out much of the pine plantations close to the edges of Canberra, but the messages were generally not acted on.

A further conclusion is that in bushfire-prone areas it is highly desirable to have power and communication lines below ground. In Canberra, this is now occurring in the newer suburbs, but many older suburbs still have all their lines above ground. During the bushfires, long lengths of power supply were burnt out, including some main power reticulation lines in the lower Cotter area on the south-western edge of Canberra. This cut power to the Lower Cotter water-pumping station, threatening a number of suburbs with complete loss of water supply and sewage facilities. Power was also cut to the Emergency Services Bureau (as well as to the rest of Curtin), and the absence of adequate backup generation caused significant problems.

Another problem with recovery was that many of the houses burned in the bushfires were not insured or were underinsured. This is a common problem in the community. The Australian Government considers that there is a problem with availability and affordability of natural disaster insurance for households and small businesses, and established a High Level Group to report — after consultation with the Australian insurance industry — on remedial measures.[2]

Among centres engaged in work to assess risks in relation to natural disasters is Risk Frontiers at Macquarie University, Sydney. This centre is working on hazard risk ratings, and is funded largely by the Australian insurance and reinsurance industries. Risk Frontiers has developed software called PerilAUS,[56] which provides information on the relative risk posed by natural perils in Australia across a range of spatial levels. PerilAUS is a searchable database containing data on nine types of natural hazard (collected by Risk Frontiers and supplemented with data from the Bureau of Meteorology and the Australian Geological Science Organisation), and allows the user to search for information on natural hazards by peril type, date, event magnitude, damage and location.

The software has been particularly successful in providing risk ratings for bushfires and floods at fine spatial resolutions, aided by the recent availability of high-resolution spatial data.[57] The analysis by Risk Frontiers showed that the single most important factor in determining the probability of bushfire destruction was the distance of buildings from bushland and forest fringe. The highest rating (5) was given to buildings less than 100m from extensive bushland, and the next rating (of 4) to buildings 100–200m from bushland.

This is interesting in the context of Canberra, which, three years after a bushfire that destroyed nearly 500 homes that were significantly more than 200m from the nearest bushland, still has some suburbs (eg, Aranda and O'Connor) in which many homes are less than 200m from bushland. Houses are very close to tall eucalypt trees or right among them. Such bushland settings are popular among homeowners, who tend to underestimate the risk, and relatively little action has been taken by authorities to alleviate these particular threats, probably because it would be politically unpopular to do so. However, if another bushfire comes and does affect these suburbs, the Government will almost certainly be blamed for not having taken preventive action.

One positive in relation to Australian bushfires is the large amount of good work done on modelling fire behaviour. The CSIRO has done excellent work in the past, and work is continuing through the Bushfire Cooperative Research Centre.[58]

Other technical issues that are more contentious are whether or not to undertake controlled burning in national parks, and whether or not grazing in the 'high country' reduces the bushfire hazard.

In relation to controlled burning to reduce the fuel load in national parks, as noted above, the McLeod report[35] stated that the fuel load in Namadgi National Park was as high as any recorded. The fires were so intense that huge damage was done to wildlife and vegetation, and it will take the ecosystems many years to recover fully. It could be argued that much less damage is caused to flora and fauna by regular, controlled, low-intensity fires than by occasional very intense fires such as those of 2003. However, the matter remains controversial and should be debated further.

Whether or not to graze alpine grassland is also contentious because graziers who had grazing access that was recently removed would like to again graze the high country. Alpine grazing also plays a role in Australia's cultural history, as for example in 'The Man from Snowy River'. In a submission to the Alpine Grazing Taskforce, Victoria, by the Australian Academy of Science,[59] it has been argued that the vegetation eaten by stock is not a major fire hazard — it burns with relatively low intensity and fairly predictably. The high-intensity fires occur in heathland vegetation that is avoided by cattle, and among trees and fallen timber. This will be one element investigated further by the Australian Government-funded HighFire Project[60] currently being conducted by the Bushfire Cooperative Research Centre.

# Five case studies of risks that affected Australia


## **Case study 3:** Asbestos-induced mesothelioma

Exposure to asbestos fibres produces slow-developing and usually lethal lung disease — most seriously mesothelioma. Most of those affected die a slow and painful death, and Australia has the highest incidence in the world. More than 9,000 cases developed between 1945 and the present day, and there are expected to be about 18,000 cases by 2020 — a significant public health problem.

The actions of the company most involved, James Hardie Australia, have raised public and official criticism, and useful lessons can be learned from this event.

# **Case study 3:** Asbestos-induced mesothelioma

### The event

Asbestos was known in ancient times for its resistance to fire, and began to be exploited commercially in the 19th century. Its modern uses have been particularly for thermal insulation, brake linings and building materials. Among the last is asbestos cement, generally known as 'fibro', which was made into boards used extensively in the construction industry from about the 1950s. One of the leading manufacturers in Australia was James Hardie Australia, which in the early days of fibro was an Australian icon. One in three Australian homes built before 1982 is believed to contain asbestos in some component or other, and Australian per capita use of asbestos materials was the highest in the world.[61]

It had been known for some time that exposure to fine asbestos fibres or dust could cause lung and respiratory problems, but it was not until the 1960s that the problem came clearly into the public arena. The history of asbestos-related disease has been chronicled comprehensively by Bartrip.[62] That work also provides a comprehensive bibliography on the subject. The WA Government's SafetyLine Institute[63] has provided a chronology of events relating in particular to asbestos mining at Wittenoom in Western Australia, and Berry et al.[64] have provided a study of mesotheliomas among miners and millers of asbestos at Wittenoom (considered to be the site of worst asbestos exposure).[61]

The diseases associated with asbestos, including mesothelioma, take a long time to develop. Australian workers exposed to asbestos in mining or manufacturing industries have been gradually but increasingly developing these conditions. Leigh and Driscoll[61] stated that Australia had 7,027 cases of mesothelioma from 1945 to 2001, with another 488 cases developing in the subsequent year. The rates per unit of population are the highest in the world. They estimated that the number of cases by 2020 would be about 18,000.

### Analysis

The first medical papers on the problems appeared in the 1920s in the *British Medical Journal*.[62] They indicated that asbestos inhalation could cause asbestosis, a form of pneumoconiosis. Asbestosis is a pulmonary fibrosis and develops after years of exposure to asbestos fibres. After the fibrosis becomes well established, the worker develops increasing breathlessness, often with a cough, excessive sputum and weight loss. The British Government formulated regulations to control dangerous dust emissions in asbestos factories, and that largely controlled the problem.

A first suspicion that asbestosis might also be linked to lung cancer emerged in the 1930s and, in 1955, a published study convincingly confirmed this.[62] Then in the 1960s, a third asbestos-related disease was discovered. This was mesothelioma of the pleura (or lining of the lungs), a rare but serious malignant disease. In contrast to asbestosis, which depends on the dosage of exposure to asbestos fibres, mesothelioma is not necessarily related to heavy exposure to asbestos fibres.

Evidence of the greatly increasing scale of health problems related to asbestos accumulated during the 1980s and companies (particularly in the United States) began to be sued by workers. However, it was not until 1987, 21 years after the dangers were drawn to its attention, that James Hardie stopped using asbestos in its products.[65]

Some aspects of the linkage between asbestos and the three diseases are still disputed, but the fact that there are such linkages is now fully accepted by medical authorities. The diseases have a slow and painful progression, and in a high proportion of cases result in death. Current estimates of mortality are approximately 100,000 deaths per year worldwide, with some predictions that the rate will rise in the future as those exposed previously to asbestos develop the disease (symptoms do not develop for at least 15 years after exposure, and often longer).[61]

### Prevention

Companies processing asbestos, including James Hardie, had ample warning that there might have been health problems resulting from exposure to asbestos fibres and dust. The first workers' compensation case (for asbestosis) was brought against James Hardie in 1939, and a trickle of other cases followed. Concern by public health authorities rose during the 1950s. According to material presented during court actions for compensation, the likely linkage between asbestos and mesothelioma was drawn to James Hardie's attention in 1966 (including by its own company medical officer), but the company did not take remedial action at that stage.[65]

Two other major, iconic Australian companies, CSR and BHP, also processed and used asbestos for many years, and claims for compensation were also made against them. The evidence indicates[64] that these companies accepted their responsibilities sooner than James Hardie and took remedial steps, and as a result avoided the negative public reaction that affected James Hardie.

The use of asbestos was eventually abandoned on safety grounds, but so long after the dangers had become apparent that this cannot really be classified as prevention. And the ultimate cost to the James Hardie Company was greater than if actions had been taken at the time — not only in terms of compensation to sufferers but also for the lost good name and reputation of the company.

The question might also be asked as to why the Government did not take more action sooner. The onset of asbestos-related diseases as a public health problem was evident for some time, yet little official action seems to have been taken overall.

### Preparedness

The indications are that James Hardie Australia was not prepared for the disaster that struck it and, as it did become aware, it did not take much action to become better prepared for it.[65] Denial is not, in the end, a useful strategy: as noted above, CSR and BHP, which accepted their liability and took remedial action, avoided the public opprobrium that has been directed at James Hardie.

Prince, Davidson and Dudley[66] have given an analysis of the implications of these events — legal and otherwise.

**Response**

Court actions have determined that James Hardie did not take appropriate action to care for the health of its workers, and it was found liable for damages. Questions could also be asked as to whether public health authorities did enough — or acted strongly enough — to force the company to accept its responsibilities. Twenty-one years is a long lag time and one lesson from this experience is that responsible authorities need to act quickly and firmly when such possibilities of industrial poisoning arise, whether or not there is resistance from the companies involved.

The cessation of asbestos use in 1987 was not, however, the end of the story. The subsequent actions of James Hardie in the face of mounting claims for compensation led to the company becoming the first Australian company to be dropped from a register of ethical investments,[67] and this again raises questions about the effectiveness of government responses.

In the late 1990s to 2000, James Hardie Industries Ltd began to separate the Hardie Group's assets from its asbestos-related liabilities. It stripped much of the assets from two subsidiary companies, then, in 2001, transferred ownership of these subsidiaries to the Medical Research and Compensation Foundation (MRCF), which it had established to deal with compensation claims. This was seen at the time to be a positive move for those suffering from asbestos-related health problems. It gave the MRCF $293 million to settle claims — though an estimated $1.9 billion of assets had been stripped from the subsidiaries.[67]

Those assets were then moved to the Netherlands, where a new parent company, James Hardie Industries NV, was set up. At the time, the company said this was an offshore restructure to reduce the company's tax burden. The NSW Supreme Court cleared the move after it was given an assurance that asbestos claims would not be affected — the two subsidiaries left in Australia would still be able to call on the $1.9 billion in the future.In March 2003, however, the offshore parent company cancelled the partly paid shares. The Supreme Court, the NSW Government and the Australian Stock Exchange were not informed that the $1.9 billion would no longer be available.[67]

In December 2003, the MRCF warned that it was facing a significant shortfall in funds and would soon be unable to pay asbestos compensation claims. A special commission of inquiry was set up by the NSW Government, chaired by David Jackson QC. The inquiry concluded that the corporate move offshore was legal, but that the company had misled the public with its claims that enough funding had been provided to the MRCF to cover compensation claims. It also raised questions about the company's failure to notify the relevant authorities about the unavailability of the $1.9 billion.[67]

The revelations at the inquiry led to an unprecedented — and highly negative — public response. As the public outrage increased, the company's Executive Director at the time of the offshore move, Peter Macdonald, left the company and received an $8.3 million payout. He was then re-engaged for a time as a consultant. Public sentiment became even more negative as the company was seen to be rewarding one individual — who

had overseen the reduction of compensation funding — so generously, while victims were not able to get compensation.[67]

The public pressure became so intense that in late 2004 James Hardie was forced to take further action. It worked with the NSW Government, the ACTU, the MRCF and asbestos support groups to provide short-term funding to the MRCF to cover existing compensation settlements, and to ensure longer-term compensation to meet expected future claims (estimated to reach possibly as much as $4.5 billion).[67]

As the MRCF was about to go into liquidation in December 2004, James Hardie made a payment of $88 million to stop compensation payouts being frozen. An interim agreement was also negotiated with the ACTU under which James Hardie would make an annual payment to a special fund, capped at 35 per cent of the company's free cash flow (about $70 million a year at the time), with an additional buffer fund of about $250 million in case claims exceeded available funds in any one year.[67]

That deal was finally signed in December 2005, but was subject to the Australian Government providing tax relief on the compensation payments. The Federal Treasurer has stated that this would mean that Australian taxpayers would be paying part of James Hardie's liabilities and the Government would not agree to this. At the end of June 2006, the Australian Taxation Office handed down two rulings, one refusing charity status to the compensation fund and another granting tax relief on compensation payments. The full implications of the two rulings to those eligible for compensation are still being determined as this report goes to press.

It has been noted that no amount of money can compensate for a life seriously shortened by an agonising disease, though compensation can help to ease the suffering of all those affected.

### Recovery

There is no chance of medical recovery for the patients affected by asbestos-induced medical conditions. All that can be hoped for is adequate financial compensation, though at the moment there still seems to be some uncertainty about whether this will eventuate.

The Australian Government has now taken action to support research into asbestos-related diseases. A National Research Centre for Asbestos Related Diseases is being established with Australian Government funding over three years to draw together leading researchers in this field in a comprehensive, strategic national effort to help those suffering from asbestos-related diseases. The Research Centre will support a series of complementary research projects to be conducted at various research institutions at potentially disparate geographic locations around Australia.[68]

James Hardie Australia would also wish to recover its good name. The community has cautiously welcomed the arrangements noted above to provide compensation to those suffering from asbestos-induced mesothelioma, while waiting to see that the funds really do flow to those who need them, and in sufficient quantity.

The crocidolite (blue asbestos) mine at Wittenoom has been closed and the Western Australian Government tried to persuade residents of the nearby town to leave.[69] Safety warnings have been posted, the airport has been closed and many services have been withdrawn, however, about 25 residents still live there, and there is a regular flow of tourists even though the Government tries to discourage this.

An additional major feature of recovery relates to the large amount of asbestos material remaining in Australian buildings. In colder climates, loose asbestos fibre was pumped into roof cavities as heat insulation. Most or all of this has now been removed with government assistance, but much remains in forms such as fibro sheeting in eaves, electrical junction boxes and many other uses. In solid forms such as fibro there is no health risk unless the material is cut or broken and fibres are released, such as during building renovations. Homeowners aware of asbestos materials in their houses are required to draw these to the attention of builders about to work on the building.[70] The matter of asbestos in buildings also became an issue during the ACT bushfires, when some destroyed buildings were thought to contain disturbed asbestos.

### Comment

Perhaps the lessons from this experience are that corporate bodies should behave more ethically, because in the long term it is not in their interests to receive the public backlash that affected James Hardie; and governments need to act sooner and more decisively to prevent companies avoiding their moral and legal responsibilities.

This scenario has many features that are relevant to the tobacco industry — another industry for which there is clear medical evidence that its products are harmful to consumers and others passively exposed to tobacco smoke.

# Five case studies of risks that affected Australia

## **Case study 4:** White powder incidents

After the events of 9/11 in the United States, many scares involving suspicious white powders sent to agencies and individuals occurred in the US. In some cases the powder was infective anthrax material.

Many similar incidents occurred shortly afterwards in Australia, in Canberra and elsewhere. In the first three weeks of October 2001, more than 3,000 such incidents were reported (none involving anthrax). Australia's initial response was hesitant, and the lower level of continuing incidents remains a problem for the authorities.

# **Case study 4:** White powder incidents

**The events**

After the attacks on the World Trade Center on 11 September 2001, a number of scares involving white powder being sent to public agencies and high-profile individuals occurred in the US. Some of these proved to be material containing the deadly disease anthrax. These were not the first such incidents — there had been others earlier relating to campaigns against abortion clinics — but they caused a higher level of public concern.

These incidents were followed rapidly in Australia by a spate of similar occurrences, starting in October 2001. The first was in Canberra, but the 'epidemic' of white powder incidents spread around the country — in the first three weeks of October 2001 there were more than 3,000 such incidents. In NSW alone, about 990 incidents involving white powder were reported to the emergency services between 11 October and 16 November 2001 (only 37 days); 535 of these incidents were followed up by forensic services and NSW Health.[71]

It has been stated officially that none of the powders in Australia proved to be anthrax. Materials found included talcum powder, cleaning agents, sugar, starch, cement, gyprock dust and laundry detergent.[71]

There has been a fairly steady stream of such incidents since then, though not at the high level of late 2001. Some, however, have had high profiles and have been diplomatically embarrassing for Australia.

On 1 June 2005, white powder spilled from mail received at the Indonesian Embassy in Canberra. The mail also contained an abusive letter, and the incident was believed to be related to the jailing in Indonesia of Australian Schapelle Corby for drug offences.[72] A second incident of white powder in the mail occurred at the embassy a few days later. On 3 June 2005, security staff at Parliament House seized a package containing white powder addressed to the Australian Foreign Minister, Alexander Downer.

On 9 June 2005, the Canberra diplomatic missions of Britain, the US, Japan, Italy and South Korea all had to be closed after white powders were received in the mail, and materials were also found in the Department of Prime Minister and Cabinet and at Parliament House. On 14 June 2005, a loading bay was again closed at Parliament House when a package of white powder was found there.[73]

Not all incidents were aimed at embassies or politicians, though perhaps all have been politically motivated. For example, on 6 June 2005, the administration building at the Olympic Dam copper and uranium mine in South Australia had to be evacuated after white powder was delivered there.[74]

## Analysis

It is impossible to know in advance when powders might be exposed in public places or sent to public figures. The most important analytical facility is to have available rapid methods for identification of the powders, or at least methods for determining that they are not infective agents and are non-toxic.

The procedures used by NSW Health in 2001 were as follows.[71] The white powders were taken first to the NSW Police Forensic Services Group laboratory, where they were checked for the presence of irritant, toxic or explosive chemicals or radioactive materials. A sample was also extracted for microbiological assay, which was conducted at the Institute of Clinical Pathology and Medical Research at Westmead Hospital. Samples there were processed in a PC3 containment laboratory, initially with a quick presumptive test and then by plating out on various media.

Microbiological testing has focused particularly on anthrax because it has been used in such incidents in other countries, including the US, and is considered to be a possible weapon of biological warfare.

A Police Operations Centre at Surry Hills coordinated the operations and information collation. All incidents were classified according to whether people had come into physical contact with the white powder, whether they had been close to the powder, or whether they had been in the same room as the powder. Priority for analysis was graded according to these levels of exposure.

The temporal and spatial distributions of the incidents during the intense period of October–November 2001 were also analysed, though results were not reported publicly.

## Prevention

There is no obvious way to prevent either deliberate terrorist acts of this type or hoaxes.

## Preparedness

One valuable preventive measure that has been implemented increasingly since 2001 is the training of mailroom staff to watch for suspicious packages and be alert to the possibility of hazardous materials in packages while minimising exposure to them.

The Australian Academy of Science happened to send a large number of enveloped letters to scientists in the US shortly after the events of 9/11. As a precaution, a number of the scientists emailed the academy to check that the letters were legitimate before opening them — another advance precaution that is fairly easily taken when the purported origin of the letter is evident from printing on the envelope. In this case, the scientists were aware that there had been mailing of anthrax, and they were taking a sensible precaution.

Emergency services have procedures that are now well established for responding to such incidents, including detailed procedures for removal of powders and decontamination of exposed areas and if necessary exposed personnel.[71] Health services

have plans for treatment of victims should a genuine case of anthrax exposure be discovered.[75]

### Response

All state emergency services have HAZMAT teams trained and equipped to respond to any incidents where potentially hazardous materials have been exposed (not just white powders). These have been used in the white powder incidents and the system has generally worked well.

One response that was not managed ideally, however, occurred at Adelaide Airport on 26 June 2006, when yellow powder was found on the luggage of passengers arriving from overseas. About 500 passengers from several flights were quarantined for six hours, and media reports quoted the passengers as being locked in a room with no water or toilets for that time, with inadequate information provided on the situation.[76] Passengers were reported as having to urinate into plastic bottles. The delay was probably unavoidable given the number of people involved and current speeds of diagnosis of suspicious powders; but the reports suggest that the airport was not well enough prepared with facilities for quarantining such a large number of passengers.

### Recovery

There has been no particular problem with physical recovery at the sites involved, since none proved to have had any hazardous material released. Distinct problems have, however, arisen relating to the anxiety levels and even mental health of people exposed to white powders.

Authorities noted that people who had gone through precautionary decontamination procedures, rather than being reassured by the procedure, as had been expected, actually suffered higher anxiety levels. There were also unexpectedly high anxiety levels among people who were told that no infective substances were present in the powder they were exposed to but were not told what the powder was. Delay in reporting results to exposed people also raised anxiety.[71] These are areas that would merit further attention by mental health authorities.

### Comment

There is a major problem for public authorities with white powder incidents, because they are so easy for disaffected people to set up as hoaxes, but they cause great disruption. Any white powder will serve and the cost to the sender is little more than the cost of postage. The cost to the receivers, however, and to those who have to respond to the incident is vastly higher. An embassy, political office or company might have to be closed for a while, staff become frightened and worried about possible exposure to real hazards and highly trained and uncomfortably equipped teams have to respond to all the incidents, since all have to be treated seriously.

In the NSW incidents reported above,[71] as it became clear that none had involved a real threat, the NSW Health response was scaled down and became less intensive.I Initial responses must, however, always be undertaken to the fullest extent until the material

has been shown to be non-hazardous. Responding to such incidents ties up police, fire, emergency, forensic, health and pathology services, all of which could and should be undertaking more productive work for the community. The cost to all of such incidents is high.

# Five case studies of risks that affected Australia

## **Case study 5:** The Bali bombings

In October 2002, three bombs were detonated among tourists in Bali; 202 people were killed and 209 injured — the majority of the dead (89) were Australians. This was the most significant act of terror against Australia at that time and the national shock and outrage were very great.

In October 2005, more bombs exploded in Bali, killing four Australians. Significant anti-terrorist measures, including domestic legislation, have followed.

# **Case study 5:** The Bali bombings

**The events**

Details of the 2002 bombings were gathered from various press reports at the time[77] and for the 2005 bombings from the Department of Foreign Affairs and Trade and other reports.[78]

On 12 October 2002, three bombs were detonated in the town of Kuta, a popular tourist resort in Bali. The first was a small backpack bomb in Paddy's Bar, apparently set off by a suicide bomber. The injured from that blast rushed into the street and, 10 to 15 seconds later, a huge car bomb (approximately 1 tonne) was detonated by remote control in front of the Sari Club. A third bomb was detonated in front of the American Consulate in Bali but did little damage.

The two main explosions killed 202 people and injured another 209. Of the deaths, 89 were Australian, 38 were Indonesian (mostly Balinese) and 26 were British; the rest were small numbers from European countries and elsewhere. The scene could be described as one of horror and carnage and the local hospital was unable to cope — particularly with the large number of burns victims, many very serious. The Royal Australian Air Force (RAAF) evacuated many of the wounded (not only Australian) to Darwin and other Australian cities.

The high number of Australian deaths and injuries, combined with the horror of the scenes (graphically reported in TV news bulletins), caused great shock to the Australian nation. Although there had been the horror of 9/11 in the US the year before, this was the first time that Australia had been so directly affected by a major act of terrorism. The Australian Government considered that the attack was aimed deliberately against Australians because of the country's involvement in peacekeeping, security and anti-terrorist actions in Asia.[79]

There were major repercussions on Bali's tourist industry, which suffered a big downturn, with a flow-on effect to Indonesia's economy.

A further set of bombings, aimed at Australian and other tourists in Bali, occurred on 1 October 2005. Two bombs went off near a food court in Jimbaran, and another soon after in Kuta Town Square. Another two bombs exploded at food stalls along Jimbaran Beach, and there were reports that another three unexploded bombs were found by the police. A total of 23 people were killed, including three bombers. On this occasion, most deaths and injuries were Indonesians, though Australia was the next most affected country, with four killed and 19 injured. The Balinese tourist economy, which had just been emerging again after the 2002 bombing, suffered another major blow.

It is worth noting that these have not been the only two attacks directed against Australians in Indonesia. On 9 September 2004, a car bomb was detonated by a suicide bomber outside the main gate of the Australian Embassy in Jakarta. Eleven people were killed, all Indonesians who were at the front of the embassy or in the street at the time. The embassy suffered considerable blast damage, but thanks to earlier blast-proofing no one was hurt inside and there were no significant Australian injuries. It was, however, a further attack on and shock to Australia.

On 5 August 2003, a suicide bomber detonated a car bomb outside the lobby of the JW Marriott hotel in Jakarta, killing 12 people and injuring 150. No Australians were killed or injured, but the hotel was frequented by Australian businesspeople as well as by Americans and Europeans, and this was seen as a direct attack against these nations.

### Analysis

Ever since the first Bali bombing there has been dispute about the extent to which the Australian Government had any advance warning, either of general risks of terrorist attacks in Indonesia or of specific attacks in Bali, and about the extent to which US travel advice to its citizens for Indonesia and Bali was a more accurate analysis than that of Australia.

Intelligence reports to the Government are naturally confidential and the Government has not been inclined to release details even after an event to justify its level of action. An inquiry into Australian intelligence after the Bali bombing found that there had been no advance intelligence warning,[80] but that report did not investigate either Australian or US travel advice current at the time.

The Australian Government reaction since the Bali bombings has been to increase the intensity of travel warnings in relation to Indonesia and other possible terrorist hotspots in Asia. This might have pacified the domestic audience to an extent, but it then caused negative reactions from various Asian governments, including Indonesia, Malaysia, Singapore and Thailand.[81] Those countries do not see themselves as the terrorist sites that the travel warnings might suggest and they are also worried about loss of important revenue from tourism. It is a delicate balancing act for the Australian Government.

### Prevention

Any preventive measures are harder when the potential threat is overseas rather than in one's own country. It is also extremely difficult to prevent the activities of suicide bombers. Even Israel, which is the nation that has tried hardest to achieve this, has not been able to prevent all such attacks. The main, but very long-term, effort towards prevention is political dialogue with the nations in which terrorists are located or from which they come, to try to negate the factors that motivate the terrorists and to try to secure the help of those nations to identify and arrest potential bombers and those who plan bombings. Australia is currently conducting such a dialogue with Indonesia and with some other states, to try to rein in terrorist activities and networks in those countries.

### Preparedness

Australia has existing plans for emergency evacuations from neighbouring territories. These are coordinated by Emergency Management Australia (EMA) and are implemented by the relevant states or territories (those geographically nearest to the emergency). The speed and efficiency with which the RAAF was able to evacuate casualties from Bali to Australia (see next section) indicates that there was good preparedness for emergency evacuation of Australians from overseas locations.

The Australian Embassy in Jakarta was blast-proofed as a precaution when threats of terrorist bombings increased and this prevented casualties within the building when a car bomb was detonated in the street outside on 9 September 2004.

Australian assistance has also been provided to upgrade the hospital in Bali, which was understandably unable to cope with the large number of casualties caused by the Bali bombings. This will enable the hospital to cope better should there be any future bombings or other terrorist incidents.

The Australian Government has continued to publish travel advice and warnings relating to travel to Indonesia and likely threats of terrorism. These are readily available from the Department of Foreign Affairs and Trade's web site.[82]

### Response

The Australian Department of Health and Ageing, in cooperation with EMA, undertook a major response to the Bali bombings.[83] This included evacuation of seriously injured patients to Darwin for triage, then transfer to other Australian hospitals with burns capabilities, shipment of medical supplies to Bali, provision of medivac teams, arrangement of evacuation flights and operation of an information hotline. The Australian aid agency AusAID also set up an office in Bali to coordinate the efforts of Australian health professionals who flew to Bali after the bombing. The medical evacuations to Darwin were not only of Australians but of seriously injured people of other nationalities (six from the UK, six from Germany, two from Sweden, two from New Zealand, one from Canada and one from South Africa).[83]

A team of Australian Federal Police investigative and forensic officers went to Bali within 24 hours of the bomb blasts to assist the Indonesian National Police.[84] The AFP and Indonesian National Police established a joint police investigation, which proved to be a very effective partnership. The AFP also assisted with victim identification, and at the height of the investigations more than 120 Australian law enforcement personnel were working alongside Indonesians and experts from other countries around the world. The Australian team included state police, ASIO officers and specialist advisers as well as AFP personnel.

Security was also tightened at public buildings and around infrastructure in Australia, and at all Australian diplomatic posts, after the bombings.

## Recovery

From an Australian community perspective, the greatest need in recovery has been for counselling of families who lost relatives, counselling of survivors and survivors' families, and in some cases counselling of Australian personnel and volunteers who saw the horrific scenes immediately after the bombings and who coped with the victims, dead and alive. Anniversary memorial services have been held in Australia each year since the bombings and these have provided comfort to some who were affected. Recovery will be a long and slow process, however, and for some will never be complete.

From an Australian Government perspective, these events have produced yet another area of fragility in Australia's relations with an important Asian neighbour, Indonesia. This too will take time to recover.

## Comment

Out of tragedy sometimes comes a positive development and the aftermath of the Bali bombings has provided an excellent learning experience for AFP officers, including forensic scientists. They have received direct exposure to and analysis of terrorist events and have also gained valuable experience in identification of a large number of victims, many of whom were not identifiable by usual means. This practical experience proved valuable when AFP personnel had to undertake similar identification operations in Asia after the Indian Ocean tsunami on 26 December 2004.

# Chapter 3

# Lessons learned and future research needs

Australia has an enviable record in responding to disasters and taking measures to ensure that they are prevented or their impacts lessened in the future. Some examples are given here.

# Lessons learned and future research needs

### Responses to threats

A broad survey of Australian emergencies or to perceived threats suggests that in recent years there has been a significant number of activities in response, which, overall, reflect credit on the nation and its governments. There are gaps and omissions, but many valuable initiatives have been undertaken. Some of these are listed below, classified according to the type of risk that they address.

Risks facing Australia fall into the following broad categories:

1. Natural disasters
2. Industrial/corporate disasters
3. Biological (including human, animal and plant health) risks
4. Security risks

### Natural disaster risks

Disastrous floods affected Brisbane in January 1974, caused by Cyclone Wanda dropping 300mm of rain on the city in 24 hours (and 580mm within a three-day period).[85] At least 6,700 homes were flooded, with some washed away altogether, and 14 people lost their lives. After this major catastrophe, the Queensland Government initiated extensive flood mitigation measures for the region.[86] Other flood mitigation structures have been installed in river towns in NSW and elsewhere and, while homes continue to be flooded in Australia at times, the situation is better now than 30 years ago.

Tsunamis were another type of natural disaster on which Australia and the world focused after December 2004, when a large tsunami struck a number of countries in Asia and elsewhere, and caused massive damage and loss of life.

Small tsunamis strike the shores of Australia quite regularly and the historical record shows that larger ones have affected Australia in the past. The 2004 tsunami travelled east and west after the earthquake that caused it; had it travelled southwards, Australia would have suffered significant damage. As a result of this realisation, in 2005 the Australian Government funded an Australian Tsunami Warning System,[87] which will contribute to an Indian Ocean Tsunami Warning System set up after the 2004 disaster, and will also integrate with the existing Pacific Tsunami Warning Centre in Hawai'i.

A more extensive analysis of the threat posed by tsunamis, with recommendations for future actions, was prepared by a Working Group for the Prime Minister's Science, Engineering and Innovation Council.[88]

One initiative recently set up to improve national emergency collaboration is Hazwatch,[89] a spatial information system that provides the first common platform to share live information. Hazwatch is driven by a powerful location and mapping engine that combines data from public and private sector sources, plus operational reports from the field, to build a detailed picture of an emergency as the crisis unfolds. This

information is then available to emergency personnel via the Internet, hand-held devices and mobile phones.

The system has been trialled extensively by agencies in Western Australia, NSW, Queensland and Victoria for counter-terrorism, bushfire fighting and search and rescue incidents. It would have been extremely valuable for the ACT bushfire response, where information flows overall were patchy, sometimes non-existent and often not up to date.

### Industrial/corporate risks

One field of science that offers great and exciting possibilities is nanotechnology,[90] however, safety fears have been expressed in relation to certain specific nanomaterials.[91] The Australian Government has provided funding to the National Academies Forum to undertake a survey of the materials, their physical and biological properties and their possible hazards. The report of this work[92] has been accepted by the Australian Government's Department of Industry, Tourism and Resources and is now being considered by the Prime Minister's Science, Engineering and Innovation Council.

### Biological risks

In the area of human health Australia has a strong record in developing strategies to minimise problems and threats, often ahead of other developed countries. When HIV/AIDS began to receive global attention, Australia was quick to develop containment strategies and education campaigns, and is one of relatively few countries to have reduced the incidence of the problem in recent years.[93]

Another area in which Australia has developed a strategy for treatment and containment is with smallpox. This virulent disease was declared eradicated from the world in 1979, and Australian scientist Professor Frank Fenner played a leading role in this. Reference material of the pathogen was, however, subsequently kept in secure storage in the US and the former USSR. With the break-up of the USSR, there have been rumours that the smallpox pathogen might have been removed from storage and made available to international terrorists.

Australia considers that the risk to this country from smallpox introduced by terrorists is low,[94] but to be prepared, the Australian Department of Health and Ageing has produced detailed guidelines[95] — preparedness, response and management — to be used in the event of a smallpox outbreak in Australia.

Another subject about which health concerns have been expressed by some sectors of the community is in relation to genetically modified organisms (GMOs) — principally food crops. The risk has been addressed in detail[96] by the Office of the Gene Technology Regulator, which is responsible for regulation of all GMOs.

One disease of concern worldwide at the moment is the H5N1 strain of avian influenza. Humans can become infected from contact with birds suffering from the disease, but the greater concern is that the virus will mutate into a form that can be transmitted from human to human, resulting in a pandemic. Australia has produced a detailed management plan[97] for action should the mutated disease enter Australia. Dr Peter

Sandman, a leading consultant on risk and crisis communication and Professor at Rutgers University, has praised[98] Australia's efforts in risk communication in relation to this disease.

In relation to a broader suite of diseases, the Australian Academy of Science held a High Flyers Think Tank on *Emerging diseases — ready and waiting?* in Brisbane in 2004. The report of this meeting[99] surveyed human, animal, plant and aquatic diseases of current concern to Australia, factors affecting their likelihood of becoming problems and an assessment of Australia's preparedness for these diseases.

Australia has a strong and creditable record on quarantine and bio-security preparedness for animal and plant diseases (which can affect agriculture and the environment). The Department of Agriculture, Fisheries and Forestry and state departments of primary industries have spent much effort on analysis and preparedness and have been able to isolate and manage potentially disastrous incursions on a number of occasions.[100]

### Security-related risks

Australia's security can be affected by overt aggression (including war) or covert aggression (particularly terrorism).

The nation has a well-trained defence force that has demonstrated its skills in various situations in recent years. Increasingly, the defence forces of nations such as Australia are having not only to fight in conventional warfare situations but to undertake policing (as recently in Solomon Islands), peacekeeping (as recently in East Timor) and civilian relief operations (as in Indonesia after the 2004 tsunami). The forces have shown themselves well able to undertake all of these functions.

Terrorism is not entirely new to Australia, but the size, scope and nature of the threat has changed in recent years. The Australian Government is investing a large amount of funding and effort in the fight against terrorism, but much of the detail is confidential and not available for this report. Two important initiatives that are in the public domain, however, are Critical Infrastructure Protection and the Trusted Information Sharing Network.

Critical Infrastructure is defined as those physical facilities, supply chains, information technologies and communication networks which, if destroyed, degraded or rendered unavailable for an extended period, would significantly impact on the social or economic wellbeing of the nation, or would affect Australia's ability to conduct national defence and ensure national security.[101]

Terrorism is of course not the only threat to Critical Infrastructure as defined above. Natural disasters such as earthquakes could disrupt physical facilities and communication networks, as could certain industrial disasters. Critical Infrastructure Protection is thus an important activity for Australia in many ways.

Critical Infrastructure Protection encompasses a variety of activities, described in the Critical Infrastructure Protection National Strategy.[101] It includes linkages between federal and state governments and with and between elements of the private sector. One

further element of the strategy is the establishment of a Trusted Information Sharing Network.[102]

As part of the national effort to protect infrastructure, a Quantitative Risk Management group has been set up within CSIRO Mathematical and Information Sciences.[103] Geoscience Australia has also established a Risk Research Group[104] that is developing a National Risk Assessment Framework, particularly in relation to natural hazards but applicable more broadly.

### Australia's interactions with other countries

As described in the Introduction, the modern global interconnection of many human activities has given rise to risks of greater complexity than ever before — the so-called 'systemic' risk. One major area of response by Australia to this has been for the nation to interact with the rest of the world in a diversity of ways. Australia might have a degree of geographical isolation, but Australians are certainly not isolated from the rest of the world.

Through AusAID, the Australian overseas aid program has been working to strengthen developing-country neighbours and increase their capacity to solve their own problems and address their own risks in the future. Programs have included education, health, welfare and good governance projects. At the request of countries such as the Solomon Islands and East Timor, Australia has also intervened to restore security during times of political upheaval.

In parallel, the Australian Centre for International Agricultural Research (ACIAR) has supported hundreds of projects with the same developing countries, aimed at increasing those countries' capacities to provide their own food safely and efficiently into the future. In the area of human health, an Australian, Professor Aileen Plant, recently headed the World Health Organisation task force that brought SARS under control in Vietnam.[105]

This assistance also reduces risks to Australia, because stable and prosperous neighbours pose less threat than unstable countries or 'failed states', open to crime, corruption and negative outside influences that can impact unfavourably on Australia. ACIAR projects to reduce animal diseases and crop pests in neighbouring countries have also helped Australia by reducing the quantity of the disease or pest close by, which could threaten Australia. It also gives Australian scientists exposure to problems with which they would otherwise be unfamiliar, making them better able to address the problems should they ever reach Australia, and provide early warnings to Australia of threats that are emerging overseas.

Cooperation has also included assistance against piracy, towards air safety, improvement of customs procedures, monitoring of financial transactions to speed up the legitimate transfer of funds and identify money-laundering or other criminal financial transactions, and regional pacts for help when natural disasters strike one country.

This large body of cooperation has not only produced direct practical results from the projects, but perhaps even more importantly it has led to the building of many networks

— formal and informal — and friendships between Australians and their counterparts in other countries. When political problems arise between Australia and another nation, it is often possible for the experts who are also colleagues to work together in harmony and trust to resolve the problem.

A further benefit of this cooperation is that Australians gain better understanding of socioeconomic and cultural issues in our neighbours, and it probably also helps them to gain a better understanding of Australia and Australians. This two-way exchange reduces the risk of misunderstandings producing unnecessary crises between countries.

Australia's learned academies have been active in maintaining networks within the Asia Pacific Region. The Australian Academy of Science is an active member of the Federation of Asian Scientific Academies and Societies and hosted the council meeting of the federation in Canberra in 2005. The Australian Academy of Technological Sciences and Engineering is likewise a member of the International Council of Academies of Engineering and Technological Sciences and hosted the council's 2005 convocation in Australia. The Academy of the Social Sciences in Australia is an active member of the Association of Asian Social Science Research Councils and has held the secretariat of that council since November 2005. It also hosted the council's 2003 conference in Australia. Such involvement and memberships provide valuable non-government linkages to other countries in the region and the world.

### Lessons learned

The drought, bushfire and mesothelioma case studies all suggest that political considerations might make governments slow to act when they are aware that action should be taken (except in the acute phase of a crisis, when actions are taken as quickly and as effectively as possible). Corporate bodies cannot always be relied on to do the right thing when conditions become extreme, and firm government intervention might be required, as was the case with asbestos-induced mesothelioma. Profit incentives do not always favour acting in the public interest and good corporate governance and corporate social responsibility should be encouraged.

The need for well-equipped, well-trained and well-coordinated emergency management personnel, including specialists for all types of disaster, criminal and forensic situations, is abundantly clear from all the case studies except that of the drought. Australia does have such emergency services and they have generally performed very well. The lesson learned from these studies is the need to continue supporting the services and to continue improving them and the techniques available to them wherever possible.

### Research and other needs for the future

One of the most important and broadest needs is increased capacity to anticipate crises and identify threats, especially novel threats and complex systemic risks. This will require imaginative thinking about Australia's vulnerabilities, modelling of systems to understand them better and how to intervene to reduce risk and better understanding of how systems fall apart and how this can be prevented.

Probably the greatest single technical need is for better field diagnostic systems and field access to related databases. The need is for rapid, real-time field diagnostics with continuous back-to-base linkage. This need was identified by (among others) Dr James Robertson, National Manager — Forensic and Technical, Australian Federal Police. The six-hour quarantining of passengers at Adelaide Airport in June 2006 noted earlier[76] highlights the need for speedier diagnostics than are currently available.

One action that might assist could be an upgrading of scientific laboratories at all Australian ports of entry. Airports and seaports currently have laboratories for the examination of plant and animal quarantine material. These could be upgraded to provide the capacity for rapid health and forensic diagnosis as well as satisfying quarantine requirements, and they could have fast and secure communication links to databases, headquarters, etc.

Another area in which fast and accurate sensing is required is the detection of explosives, as well as moving members of the public in busy concourses without disruption to the flow of travellers. Work is currently proceeding on this and it should be given priority.

A comprehensive list of needs in science and technology relating to diagnosis and management of emerging diseases (human, animal and plant) was given in the report of the High Flyers Think Tank, *Emerging diseases — ready and waiting?*.[99]

# Glossary

| | |
|---|---|
| ABARE | Australian Bureau of Agricultural and Resource Economics |
| ABC | Australian Broadcasting Corporation |
| ACIAR | Australian Centre for International Agricultural Research |
| ACT | Australian Capital Territory |
| ACTU | Australian Council of Trade Unions |
| AFP | Australian Federal Police |
| ASIO | Australian Security Intelligence Organisation |
| AusAID | Australian Agency for International Development |
| BAS | Business Activity Statement |
| BSE | Bovine spongiform encephalopathy |
| CJD | Creutzfeldt-Jakob Disease |
| COAG | Council of Australian Governments |
| CSIRO | Commonwealth Scientific and Industrial Research Organisation |
| EMA | Emergency Management Australia |
| ES | Emergency services |
| GDP | Gross domestic product |
| GMO | Genetically modified organism |
| HAZMAT | Hazardous materials (emergency response units) |
| HECS | Higher Education Contribution Scheme |
| HQ | Headquarters |
| ID | Identification or identity |
| MRCF | Medical Research and Compensation Foundation (for asbestos-related health problems) |
| NCA | National Capital Authority |

| | |
|---|---|
| NSW | New South Wales |
| OECD | Organisation for Economic Cooperation and Development[†] |
| PC3 | Physical Containment, Level 3 (for hazardous materials) |
| PMSEIC | Prime Minister's Science, Engineering and Innovation Council |
| QC | Queen's Counsel |
| RAAF | Royal Australian Air Force |
| RSPCA | Royal Society for the Prevention of Cruelty to Animals |
| SARS | Sudden acute respiratory syndrome |
| SOI | Southern Oscillation Index |
| TISN | Trusted Information Sharing Network |
| WA | Western Australia |

[†] The Organisation for Economic Cooperation and Development is a forum where the governments of 30 market democracies work together to address the economic, social and governance challenges of globalisation as well as to exploit its opportunities. The organisation provides a setting in which governments can compare policy experiences, seek answers to common problems, identify good practice and coordinate domestic and international policies. Member countries are Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States of America.

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