FEBRUARY 2014

EMERGENCY RISKS IN VICTORIA

REPORT OF THE 2012-13 STATE EMERGENCY RISK ASSESSMENT

GET READY

State Government Victoria

The financial assistance of the Commonwealth Government towards this risk assessment project, through the Natural Disaster Resilience Program, is gratefully acknowledged.

Authorised by the Victorian Government Melbourne.

This document is also available in PDF and Word format on the internet at: **justice.vic.gov.au** search under Publications.

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1. INTRODUCTION

What is this report about?

This document reports the results of a recent state-level emergency risk assessment conducted in Victoria. It contains information about a range of important emergency-related risks, and a comparison of their severity relative to each other.

This is the first such risk assessment published for Victoria. It will be updated every few years to reflect the changing status of risks, and some risks other than those covered here.

The style and information in this report follows that of the UK Cabinet Office's *National Risk Register of Civil Emergencies,* which is currently in its fourth edition.[1]

> *'Risk assessment is a process to prioritise activity, it is not a method for forecasting or prediction.[2]'*

> *'All disasters are slow onset when realistically and locally related to conditions of susceptibility.[3]'*

Who is this report for?

This report provides information to support and assist users, whether state or local government officials, NGOs, researchers, or businesses, to better understand the emergency risks that exist in Victoria. It also sets out what is being done about those risks, and sources of further information, in order to better support strategic priority-setting.

For members of the public, while this report may be of interest and use to you, it does not detail the emergency risks for any specific location. Some localised risk information is published by emergency services as part of their community awareness activities, particularly for bushfire and flood.[4]

In addition, municipal emergency management plans[5] provide some information where publicly available, as do municipal planning schemes.

Helpful information and advice about household preparedness for emergencies is provided through the following websites:

Australian Red Cross Emergency Preparedness:
www.redcross.org.au/prepare.aspx

SES Preparing for emergencies:
www.ses.vic.gov.au/prepare

Safety Victoria: authorised information about safety and emergencies
www.safety.vic.gov.au

Harden Up: 'Empowering a resilient Australia'
hardenup.org

1 www.gov.uk/government/publications/national-risk-register-for-civil-emergencies-2013-edition

2 Hogan, Matthew, *London Community Risk Register* www.london.gov.uk/mayor-assembly/mayor/london-resilience/risks

3 Lewis, J. 1988. "On the line: An open letter in response to 'Confronting Natural Disasters, An International Decade for Natural Hazard Reduction'". Natural Hazards Observer, vol. XII, No. 4 March, p. 4. cited in Kelman, I (ed.), *Disaster Lexicon*, Version 7, 2008 Downloaded from www.ilankelman.org/miscellany/DisasterLexicon.rtf

4 Refer to websites listed in this report in the various risk chapters, e.g. bushfire on page 10 and flood on page 21.

5 Municipal emergency management plans may be available via council websites.

Purpose and contents

The Government of Victoria is publishing this risk assessment report under a national initiative known as the National Strategy for Disaster Resilience[6] (NSDR), which has been adopted by all Australian states, territories and the Commonwealth.

Under the NSDR, all states and territories are publishing their emergency risk assessment to demonstrate that they have an appreciation of the major emergency-related risks facing their jurisdiction, and to explain what is being done about those risks.

The NSDR expresses a national commitment to providing risk assessments in order to empower stakeholders and decision-makers to exercise choice for the emergency risks they live with and/or for which they share responsibility.

The geographic context of this assessment is the State of Victoria. A state-level risk assessment assesses risk for the whole state (or territory) rather than some part of the state such as a municipal district or a region. State level is sometimes termed as state wide, emphasising that the assessment covers the whole area. This assessment assumes the whole area to be equally at risk, even though in reality this is not the case. To differentiate between parts of the state requires smaller-area risk assessments to be undertaken on a consistent basis. The benefit of a state-level assessment is that it provides an overall picture to enable strategic decision-making.

Scope of risks

The risks that are included in this report are a broad selection of the risks that exist, but they do not necessarily represent all of Victoria's emergency risks, nor all the ways that emergency-related risk could manifest in Victoria.

Note that security-related risks, such as malicious attacks, are not included in this document, as they are assessed under other national arrangements. Information about them can be found on the following Commonwealth Government websites:

Terrorism:

www.nationalsecurity.gov.au

Cyber attacks:

www.cert.gov.au

www.dsd.gov.au

www.staysmartonline.gov.au

www.cybersmart.gov.au

6 www.em.gov.au/Publications/Program%20publications/Pages/NationalStrategyforDisasterResilience.aspx and www.dpc.vic.gov.au/index.php/featured/reforming-victorias-crisis-and-emergency-management-framework/disaster-resilience/22-html/106-national-strategy-for-disaster-resilience-html

What does the report tell us about emergency risks?[7]

The analysis tells us that our highest priority emergency risks are bushfire, flood and pandemic influenza. Following these are a group of risks that are more technological in origin, such as transport infrastructure emergency, mine failure (specifically coal mines supporting electricity generation), marine pollution and electricity supply disruption. Then come several risks that arise from natural processes, such as heatwave, insect pest incursions and emergency animal disease.

The lowest group of these significant risks include plant disease epidemic, major hazardous materials incidents, liquid fuel shortage, severe storms and earthquake.

Who is responsible for treating risks?

As the report of the 2009 Victorian Bushfires Royal Commission made very clear,

> *The policy approach also needs to recognise the important underlying principle of shared responsibility. A fundamental aspect of the Commission's recommendations is that everyone—the State, municipal councils, individuals, household members and the broader community—must accept greater responsibility for bushfire safety in the future and that many of these responsibilities are shared.*[8]

The same perspective is reflected in the 2011 *Final Report of the Review of the 2010-11 Flood Warnings and Response*, by Neil Comrie AO APM, and current government strategies including the *National Strategy for Disaster Resilience*, endorsed by all Australian Governments, and the Victorian Government's 2012 White Paper, *Victorian Emergency Management Reform.*[9]

As part of risk management, risk treatment includes those actions and decisions that effectively avoid, reduce, share or accept a risk. In the emergency management context, these actions, avoid or reduce in particular, also come under the general heading of mitigation, being actions taken in advance of emergencies that decrease or eliminate the consequences.

Risk treatments are implemented as appropriate by different elements of society. For households, insurance is a way of sharing a risk; those who do not insure are effectively accepting the financial element of risk. Household planning for what each person will do in a flood, bushfire or other emergency is a means to reduce risk. Relocating to a safer neighbourhood can avoid a particular risk.

Governments have key responsibilities in relation to the treatment of emergency risks. In Australia, this responsibility is borne largely by the states and territories, as they implement frameworks that support risk reduction along with other objectives, such as land-use planning, building control, and health and safety requirements across various sectors. However, the costs of risk reduction are borne not only by governments but also by all sectors of society. While governments can and do invest directly through specific expenditure and grants schemes, much of the total cost is dispersed through the private and household sectors through the operations of the safety elements of various regulatory frameworks,[10] as well as through self-directed activity.

While resilience is a shared responsibility between governments, communities, businesses and individuals, there is an expectation that government will take appropriate measures to assure the management of risks to the delivery of essential services, and coordinate the consequences and flow-on effects of a disruption. At the same time, government recognises that owners and/or operators of critical infrastructure are best placed to manage their own risks.

This demonstrates the reality that responsibility for risk reduction is shared across all sectors of society.

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7 Refer to Chart 1 on page 9

8 2009 Victorian Bushfires Royal Commission, July 2010, *Final Report – Summary*, p. 6

9 Available at: www.dpc.vic.gov.au/index.php/featured/victorian-emergency-management-reform-white-paper

10 For example, see Ashe, Brian, McAneney, K. J. and Pitman, A. J.(2009) 'Total cost of fire in Australia', Journal of Risk Research, 12:2, 121 — 136 www.riskfrontiers.com/publications/Total%20Cost%20of%20fire%20in%20Australia.pdf

This report

The next two parts of this document explain Victoria's emergency response, relief and recovery arrangements and an overview of the main emergency risks within Victoria.

The fourth part provides more detail about a number of high-priority risks for Victoria, and sets out how governments and communities are addressing those risks as well as information about which emergency management organisations within the State handle actual emergencies when they occur. Links to other sources of information are included.

In the Appendix is a glossary that explains the technical terms in this report, such as *risk* and *emergency risk*, and an explanation of the risk assessment process employed.

'All disasters are slow onset' – the risk of emergencies is often an attribute of specific places

The second quotation at the head of this part expresses an important perspective shared by the NSDR. That is that disasters (or emergencies) usually arise from conditions and attributes of the place and environment that create the vulnerability to and risk of an emergency when a triggering event arises. These attributes can be known and analysed, and the emergency risk assessed, such as in this report.

While an emergency might be a totally unexpected event for some residents of an area, it is quite likely that experts knew the possibility already existed, but that knowledge may not have been widespread in the community. The NSDR states that a 'disaster resilient community is one where people understand the risks that may affect them and others in their community. They understand the risks assessed around Australia, particularly those in their local area.[11]

In the emergency context, risk can be described as existing in locations where there is a hazard combined with an exposed and vulnerable population and its assets. This is particularly the case for geophysical hazards such as bushfire, flood, landslip, storm, earthquake, tsunami and others.

Attributes that create or amplify risk are often able to be modified to make an area safer. For example, new houses must be built a certain distance from forest/trees, and with fire-resistant materials and design, in order to reduce the risk of damage or destruction by bushfire. New housing estates are designed to channel rainwater along roads, should drainage pipes be fully loaded in heavy rain, rather than through buildings. In addition, people can plan and prepare for what they will do in an emergency, using appropriate information and guidance.

How are risks identified?

Victoria's State Emergency Mitigation Committee identified a range of high-priority risks for assessment, based on recent experience of emergencies in Victoria and Australia, and on members' technical knowledge. Some emergency risks that have been included may not have been evident recently, but are known to be both credible and potentially damaging.

The charts in Part 3 give a visual indication of the relative significance of the main types of emergency risk within Victoria.

11 Commonwealth of Australia, 2011 *National Strategy for Disaster Resilience* p. 5

2. EMERGENCY RESPONSE, RELIEF AND RECOVERY ARRANGEMENTS IN VICTORIA AND NATIONALLY

For many emergencies, it is not the emergency phenomena themselves that people have to deal with, but their consequences. Many of these consequences are common to a number of quite different kinds of emergencies. For example, a large flood or a major earthquake could result in a significant number of buildings being damaged and people being displaced from their homes.

Victoria has many public, voluntary and private organisations with roles to play in the response to or recovery from emergencies. Ensuring that they all work together efficiently and effectively is the role of plans and management structures supported by legislation and staffed by trained and expert personnel.

In Australia, each state and territory has these front-line responsibilities with support provided by the Commonwealth Government in a number of ways, including legislative, financial and operational, using the military forces.

Victoria's State Emergency Response Plan[12] and related documents set out the operational arrangements for response, that primarily involve the emergency services.

The vast majority of emergencies are small and handled by locally-placed emergency responders such as the fire services and the Victoria State Emergency Service. Affected people are also supported by agencies of the not-for-profit sector and municipal councils, all of which fulfil essential roles.

For larger emergencies, resources are brought from further away, and management of those resources escalates to higher levels, up to the state level.

The management of the response to emergencies relies heavily on the control agency, whose task it is not only to use its own resources but also to lead the deployment of other agencies' resources in the response. The control agency appoints an incident controller to take management control.

The Department of Human Services is the coordinating agency for emergency relief and recovery at the state and regional levels, working in collaboration with municipal councils which have the responsibility at the local level. These arrangements are set out in the State Emergency Relief and Recovery Plan.[13]

That plan identifies four key environments of emergency recovery, being

> people, social health and community

> economic

> built

> natural.

12 Published as Part 3 of the *Emergency Management Manual Victoria*

13 Published as Part 4 of the *Emergency Management Manual Victoria*

These environments represent the categories of loss and damage caused by emergencies that are addressed by recovery planning and management activities.

The same categorisation of loss and damage is used as the basis for the emergency risk assessment reported in this document, noting that the recovery environment 'People, social health and community' is subdivided into the two consequence categories 'People' and 'Social Setting'. The additional consequence category of 'Public Administration' is also included in the risk assessment. More detail is provided in Appendix 2.

Part 4 of this report contains some information about the specific response arrangements for each type of emergency risk included. Relief and recovery activities for the community are similar for many types of emergency. However, some types of emergency have unique clean-up and rehabilitation requirements.

Victoria's emergency management arrangements are set out in detail in the Emergency Management Manual Victoria.[14] Note that some elements of the arrangements will be changing as the Government implements the agenda set out in the December 2012 White Paper *Victorian Emergency Management Reform.*

14 Available at: www.oesc.vic.gov.au/emergencymanual

3. OVERVIEW OF EMERGENCY RISKS IN VICTORIA

The results of the risk assessment are displayed in the chart below. Risks are displayed in relationship to each other in a risk matrix. The information in the chart is derived from emergency risk assessments undertaken in 2012-13, and one from 2008. All of the risks shown here have potentially very severe consequences if realised.

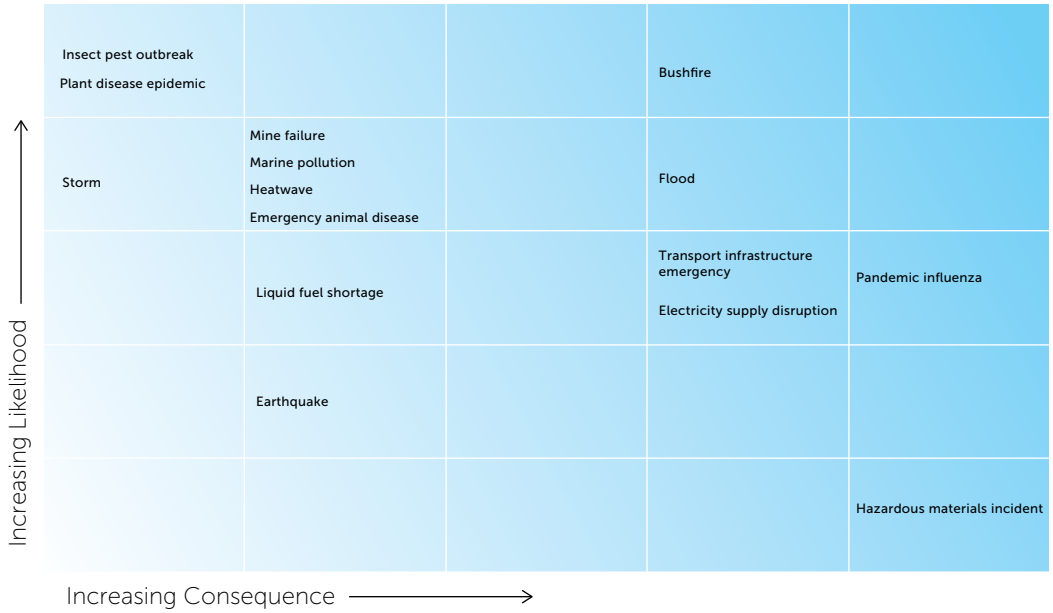
The relative risk charts

The relative risk chart is a table with two axes–likelihood and consequence. On such a risk table, risk is greatest near the top right corner, and least at the bottom left corner. Each cell represents a combination of a range of likelihoods and consequences. The scales on the matrix axes are linear, but do not have numeric values. Appendix 2 contains detail about the risk assessment process used.

The chart locates each risk in a cell to indicate the severity of that risk in relation to the other risks. The risk shown here is residual risk, that is the risk as it exists with all current mitigation controls in place and working as intended.

The relative positions of the risks is considered to be realistic, as the same methodology has been systematically applied to all assessments. Future cycles of the risk assessment should embody higher confidence through using better information and a more rigorous process. The position of each risk assessed is derived from combining the likelihood of the consequences of four emergency scenarios – low, medium, high and worst case. This result is more robust than risk assessments based on a single scenario, for example the 'reasonable worst case' (as per the UK Risk Register) or a single 'representative' case.

CHART 1: RESIDUAL RISKS ARISING FROM NATURAL HAZARDS AND MAJOR INCIDENTS[15]



15 The axes of this risk chart adhere to the National Emergency Risk Assessment Guidelines. Caution is advised if comparing this chart with those published by other jurisdictions, as the axes may be reversed, e.g. Tasmania and the United Kingdom. Note that scenarios with an economic consequence of less than $10 million are unlikely to be included

As explained in more detail in Appendix 2, this analysis considers six types of consequence for every scenario.

They are:

> people

> infrastructure

> public administration

> environment

> economy

> social setting.

Medium and severe impact emergency scenarios

Chart 1 on the previous page is a representation of each risk drawn from combining four emergency scenarios. In the following charts, the medium impact and extreme/worst case impact scenarios are shown separately in order to show a more nuanced picture of risk relativities at different levels of impact.

Chart 2 below shows the medium impact emergency scenarios that were developed by working groups as part of the risk assessment project, and are the second lowest level of the four impact scenarios. The confidence level in this assessment is very good, as many or most of these scenarios are comparable to emergencies that have occurred in the state already.

Note that the scales on charts 2 and 3 are linear for the consequence scale and logarithmic for the likelihood scale. This allows detail to be displayed for very low likelihoods.

CHART 2: THE RISKS OF MEDIUM IMPACT EMERGENCY SCENARIOS

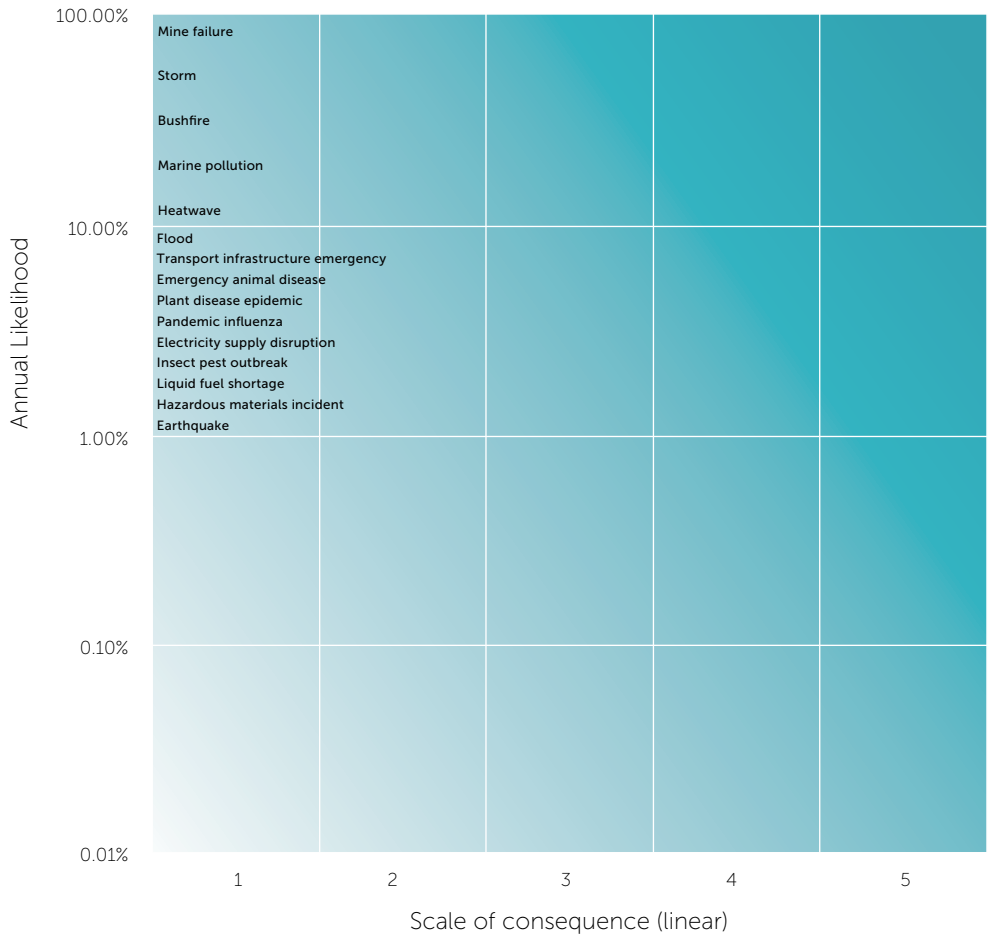
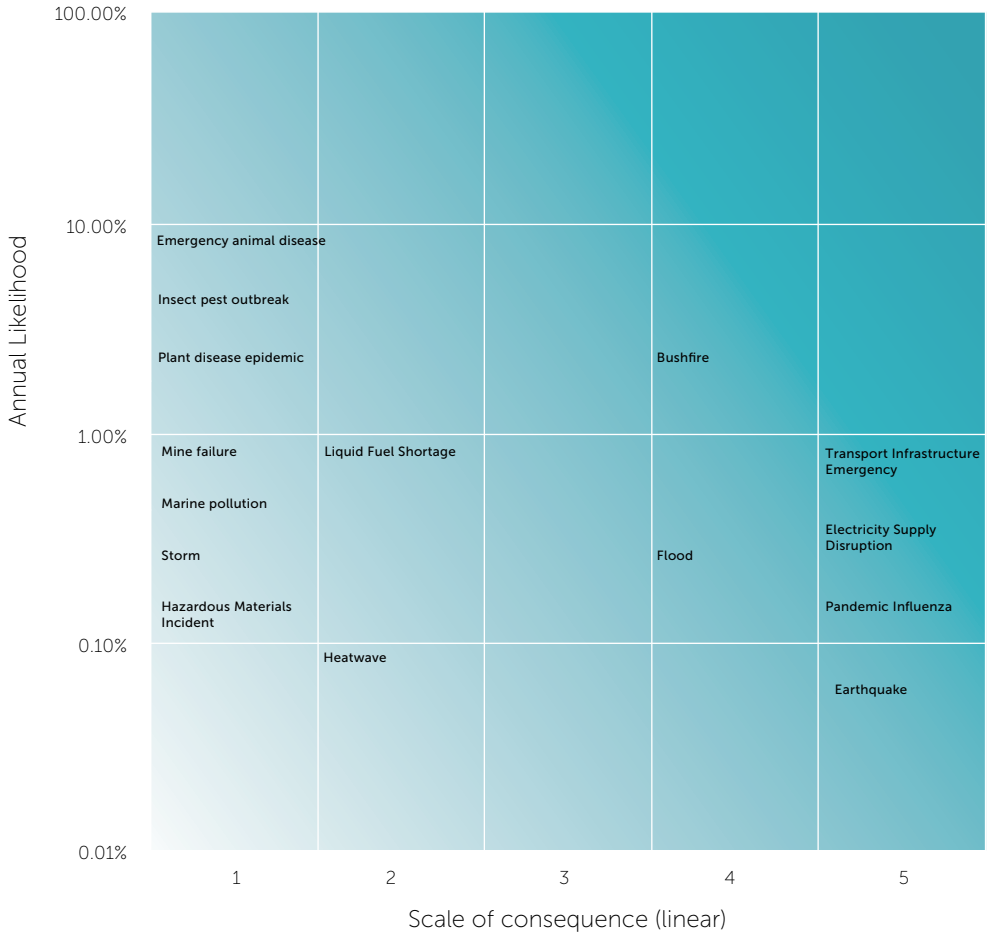


Chart 3 below shows the extreme/worst case scenarios developed in the assessment process. It is clear that most of the risks demonstrate higher consequence and lower likelihood than shown in Chart 2.

Note that all the events shown here are beyond anything experienced in Victoria since European settlement, so the confidence in this result is the lowest of the four scenarios. Nonetheless it is presented in order to give a richer picture of risk relativities for the State.

CHART 3: THE RISKS OF EXTREME IMPACT EMERGENCY SCENARIOS



4. RISK DESCRIPTIONS

Bushfire

Introduction

The high bushfire risk in Victoria is the consequence of a combination of factors including:

- large areas of highly flammable eucalypt forest
- expanses of highly flammable grassland
- a climatic pattern of mild, moist winters followed by hot dry summers
- protracted droughts
- agricultural practices that include the use of fire
- increasing population density in bushfire-prone areas, such as in the rural-urban fringe.[16]

The reason that the potential consequences of the rarest bushfires are so severe is the high possibility that major bushfires will lead to loss of life and injury, damage key State infrastructure such as electricity transmission lines, water supply assets including mature forests in water catchments, transport links such as roads, bridges and railways and cause permanent environmental damage.

Specific example(s) with brief descriptive information about risk events in Victoria or elsewhere

In the past 30 years, there have been two extremely damaging bushfire events in Victoria, the 'Ash Wednesday' fires of February 1983 and the 2009 'Black Saturday' fires. Both resulted in significant loss of life, destruction of many houses and other buildings, loss of fencing and livestock with severe impact on regional economies, as well as a call on major financial assistance from governments and insurers with charitable donations received from around the world.

Other major bushfires in recent years have included the 2003 Eastern Victorian Alpine fires that burned through 1.3 million hectares, and the 2006-07 forest fires in the Great Divide that burned over 1.2 million hectares.

Major recent reviews or significant government policies/strategies

Severe bushfire events in Victoria have been the triggers for major changes to government policies and strategies.

The 1983 Ash Wednesday fires were followed by a series of inquiries that resulted in Victoria's legislation being enacted in 1986 to formalise the emergency management arrangements for the first time.

Following the 2002-3 Alpine fires, the recommendations of the 'Victorian Bushfires Inquiry'[17] led to the Integrated Fire Management Planning project that brought all the fire-relevant agencies together into a cohesive planning and operational structure, as well as a significant increase in fuel reduction burning targets.

In July 2010, the 2009 Victorian Bushfires Royal Commission issued its Final Report, containing many far-reaching recommendations. The Victorian Government committed over $900 million to implement the recommendations which are changing the face of fire management and emergency management in Victoria through such initiatives as:

- revising the bushfire safety policy and public messaging
- enhancing bushfire safety information for householders and communities, including community information guides (formerly township protection plans)
- creating neighbourhood safer places as places of last resort
- revising fire danger ratings scale nationally
- enhanced community information and warning methods and practices including the national introduction of Emergency Alert telephone warnings
- new planning and building controls and revised definition of bushfire risk areas as well as the first building code for private bushfire shelters
- developing policy and standards for community fire refuges
- creating registers of vulnerable persons.

16 Fire Services Commissioner, *State Bushfire Plan 2012* p. 2

17 Esplin, B., Gill, M., Enright, N., *Report of the Inquiry into the 2002-2003 Victorian Bushfires*, Melbourne 2003

In 2013, the Emergency Services Commissioner reported to the Minister for Police and Emergency Services on how the initial response to a fire near Harrietville was managed by the then Department of Sustainability and Environment and the Country Fire Authority.[18] The report was on the facts, and made no recommendations. However, it identified lessons about the management of the initial response in relation specifically to record keeping and relationships between the fire services and the community that will assist in the continuous improvement of Victoria's emergency management arrangements.

Also in 2013, the Fire Services Commissioner issued a *Review of the community response in recent* bushfires,[19] based in areas affected by three of the 2012-13 fire season's more significant fires: Chepstowe, Aberfeldy and Donnybrook Road. The key outcome of this review is the identification of seven 'archetypes' i.e. typical patterns in the attitudes and behaviours of people in responding to the fire threat.

These archetypes helped to explain the range of experiences of people in responding to the threat of fire, and provide a new lens through which to better understand the effectiveness of the bushfire safety activities. The assessment suggests there is significant scope for improving community fire safety outcomes by better implementation of bushfire safety activities.

Mitigation controls in place by three levels of government

The most effective controls to reduce bushfire fall into the category of fire ignition controls, i.e. periods of fire restriction including total fire ban days. In addition, there are stringent requirements imposed on electricity distributors whose assets have ignited bushfires in the past. The next most effective controls are associated with a quick response to fires that do break out, requiring an effective chain linking detection, communication and rapid response by trained and equipped fire crews.

Other important and effective controls include:

- Community Information Guides to inform people in high risk locations about the local risk and safety strategies
- Land use planning that controls the location of buildings in relation to fire hazards and building regulations that prescribe performance standards for buildings in high-risk locations
- Protection strategies for essential services and infrastructure so they are less affected by bushfire
- Fire refuges and other shelter options
- The control of bushfire fuel – including the use of burning and slashing
- Ensuring access and egress routes can be kept open, by such activities as roadside grass slashing and burning
- Bushfire information and warnings delivered to the community
- Community education for fire safety knowledge and awareness.

Response planning/preparedness in place or planned

Victoria's three fire services, the Metropolitan Fire Brigade, the Country Fire Authority and the Department of Environment and Primary Industries (and its partners) have highly-developed plans to respond to fires of all types including bushfires with a broad range of resources both ground-based and aerial. They can work together seamlessly. Each fire service has a primary area for which it is responsible, and takes the role of control agency for a fire that starts in their area.

Should a bushfire escalate to, or have the potential to become, a major fire, the Fire Services Commissioner can assume control of the fire, thereby ensuring that all available resources are directed in an integrated and effective manner.

The Fire Services Commissioner has overall control of the response to major fires and issues warnings and information about fires to the Victorian community.

18 www.oesc.vic.gov.au/home/reviews+and+inquiries/2013+harrietville+fire

19 www.firecommissioner.vic.gov.au/our-work/review/community-response-to-bushfires-during-201213-fire-season/

The Fire Services Commissioner has published the State Bushfire Plan that provides a consolidated overview of the current arrangements for the management of bushfire and its consequences. The Plan contains an overview of bushfire prevention, preparedness and response arrangements, reflecting an integrated approach and shared responsibility for bushfire management between government, agencies, communities and individuals.

Other seasonal preparedness measures and responsibilities include:

> Householder clearance of vegetation on their properties

> Clearance of fuel on roadsides by VicRoads and municipal councils

> Ensuring safety options in holiday locations are known to visitors.

The future of the risk

The risk of bushfire is increasing in Victoria due to two primary drivers. One is the increase in population in the highest risk areas of the rural-urban interface. These areas are often on the outskirts of cities and towns with densely vegetated blocks near forests or farmland. The other is the trend to increased summer heat and dryness in south-eastern Australia associated with climate change.

Websites for further hazard-specific information such as hazard maps, business or household preparedness, specific emergency plans

Country Fire Authority:
This website contains extensive information covering fire safety, household preparedness, community information guides and more:

www.cfa.vic.gov.au

www.cfa.vic.gov.au/plan-prepare/community-information-guides/

Maps: The Bushfire Management Overlay prepared for planning scheme purposes, provides a guide to those parts of Victoria that are at high risk from bushfire. Maps can be viewed on the following website, at various scales:

http://services.land.vic.gov.au/maps/bushfire.jsp

Planning Schemes Online:

http://planningschemes.dpcd.vic.gov.au

On this page you can select a municipal district to view its planning scheme that invokes planning restrictions. Select the 'Maps' tab, and you will see a map of the municipal district divided into numbered grid areas.

From the table below the main map you can select and view maps for each grid area where there is a BMO (Bushfire Management Overlay) or WMO (Wildfire Management Overlay).

Current Bushfires and Warnings:
Current warnings and locations of fires are available on the VicEmergency website at:

www.emergency.vic.gov.au

The FireReady app is available for download from:

> Apple appstore

> Google Play store

Earthquake

Introduction

The State of Victoria is not located near any geologically-active plate boundaries. Despite this, Victoria does experience earthquakes due to the build-up of stress along fault planes in the region.

There are many faults that have been identified in Victoria, including those in the Strzelecki Ranges, Latrobe Valley, Otway Ranges and on the Mornington Peninsula. In addition to the known fault planes, new ones can be created over time.

For Australia as a whole, a magnitude 6.0[20] earthquake can be expected on average every five years and a magnitude 5.0 earthquake once per year. The probable maximum earthquake magnitude for Australia is approximately 7.5. By comparison, the largest earthquake affecting Christchurch (NZ) in 2010/2011 was of magnitude 7.1.

Earthquakes have the potential to cause catastrophic losses. Victoria is considered to have a comparatively low earthquake risk compared to more seismically active areas of the world. However, it is still possible to have a major earthquake located under a heavily developed and populated area that causes widespread damage. While there is a low likelihood such an event will occur in the foreseeable future, it is important to recognise the potential for catastrophic consequences.

In Australia, most consequences of earthquakes arise from the damage they do to structures. Buildings or parts of them – including external walls, chimneys, windows, facades or parapets – can collapse on people causing death and injury. Older unreinforced masonry (stone or clay brick) buildings are most likely to suffer damage, especially when built on soft soil. Much of the critical infrastructure providing essential services is vulnerable to earthquake. Dams and bridges are also vulnerable structures.

Although earthquakes might seem a low priority to many Australians, they do pose a significant risk.

Specific example(s) with brief descriptive information about risk events in Victoria or elsewhere

- 1903, Mg 5.3 earthquake, Warrnambool: Minor yet extensive damage.
- 1932, Mg 4.5 earthquake, Mornington Peninsula: considerable damage on the Peninsula.
- 1941, Mg 7.2 earthquake, Meeberrie, WA: Australia's largest recorded earthquake.
- 1954, Mg 5.4 earthquake, Adelaide: Most earthquake damage to an Australian capital city[21]
- 1968, Mg 6.8 earthquake, Meckering, WA: Extensive damage.
- 1989, Mg 5.6 earthquake, Newcastle, NSW: 13 people killed and 120 hospitalised. Over 35,000 homes, 147 schools, and 3,000 commercial and/or other buildings damaged.
- 1996, Mg 5.2 earthquake, near Mt Baw Baw: Shock felt up to 100 km away with minor damage reported in Melbourne.
- 2010, Mg 5.0 earthquake, Kalgoorlie-Boulder, WA: Damage to hundreds of unreinforced masonry buildings.
- 2012, Mg 5.4 earthquake, Moe – Gippsland: Minor damage.

For a more comprehensive list of major earthquakes in Victoria refer:

www.ses.vic.gov.au/prepare/quakesafe

and for Australia as a whole:

www.ga.gov.au/hazards/earthquakes/earthquake-basics/historic.html

20 'Magnitude' is the term used to describe the size of the earthquake. Magnitude is determined by measuring the amplitude of the seismic waves recorded on a seismograph. A formula is applied to these which converts them to a magnitude scale, a measure of the energy released by the earthquake. For every unit increase in magnitude, there is roughly a thirty-fold increase in the energy released. For more information, see www.ses.vic.gov.au/prepare/quakesafe/earthquake-notifications

21 Of all Australian capital cities, Adelaide has the highest earthquake risk

Mitigation controls in place by three levels of government

The primary mitigation for earthquake lies in the area of building controls. Minimum building standards for earthquakes were first applied in Victoria in 1994. The current standard (Australian Earthquake Loading Standard, AS1170.4), dates from 2007. It applies to all new buildings, except residential houses. The underlying philosophy of the earthquake loading standard is to protect life by preventing building collapse whilst accepting that significant damage could occur (i.e. the philosophy is based on life protection rather than property protection)[22].

Seismic monitoring is the responsibility of Geoscience Australia, a Commonwealth Government agency.

Warnings to the community in advance of earthquakes are not possible as there is no scientifically-validated means of earthquake prediction.

Response planning/preparedness in place or planned

The Victoria State Emergency Service (VICSES) is the control agency for response to earthquakes. Its *Victoria State Earthquake Plan* can be viewed at:

www.ses.vic.gov.au/prepare/em-planning/em-partners-resources/state-earthquake-emergency-plan.

VICSES regions in Victoria also have earthquake emergency plans.

The future of the risk.

Due to the unpredictable nature of earthquakes and the long return periods (>500 years) between moderate to large earthquakes, it is difficult to estimate the change of this risk over time.

Websites for further hazard-specific information such as hazard maps, business or household preparedness, specific emergency plans

2012 Australian Earthquake Hazard Map – Geoscience Australia

www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=74811

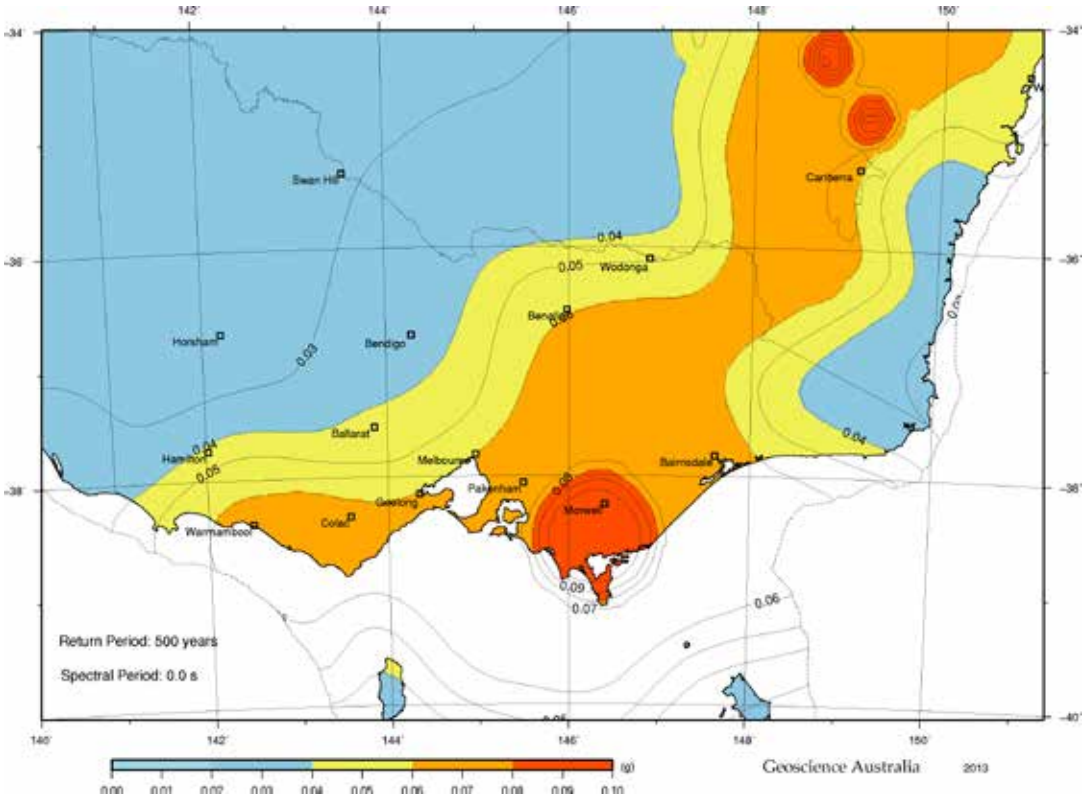
VICSES QuakeSafe Program:

www.ses.vic.gov.au/prepare/quakesafe

22 J.L. Wilson, N.T.K. Lam, L. Pham, 'Development of the New Australian Earthquake Loading Standard', Electronic Journal of Structural Engineering, Special Issue, 2008

Distribution of the earthquake hazard across Victoria

2012 AUSTRALIAN EARTHQUAKE HAZARD MAP FOR VICTORIA



The various areas of earthquake hazard on this map are shown as zones coloured to represent: moderate to high hazard (red); moderate hazard (orange and yellow), and low (blue).

The hazard map depicts the amount of bedrock ground shaking that has a specified probability of being exceeded in a given time period. The contours on this earthquake hazard map are of acceleration in units of gravity with around a 10 per cent chance of being exceeded in a 50 year period, corresponding to a 500 year average recurrence interval (or return period), for this intensity of ground shaking.[23]

23 www.ga.gov.au/about-us/news-media/news-2012/new-earthquake-hazard-map-for-australia.html

Electricity supply disruption

Introduction

The reliable supply of electricity is critical to many social and economic activities.

Victoria participates in the National Electricity Market (NEM) which serves eastern Australia, South Australia and Tasmania. Transmission links between NEM regions provide Victoria with the option of importing electricity at times of high demand. In aggregate, Victoria is a net exporter of electricity.

Most of the network of transmission and distribution lines is located above ground and is vulnerable to physical damage from a number of causes.

The physics of electricity supply require that the supply and demand for electricity be kept in balance at all times. As electricity cannot be stored in large quantities, the supply system must be responsive to meet peak demands.

Major electricity supply disruptions can occur either as:

- a result of events that cause the supply system to operate outside of its technical operating parameters, typically due to supply/demand imbalances; or
- as a result of extensive physical damage to transmission or distribution networks.

Transmission-level events are extremely rare. The NEM is managed through mirrored control rooms within tight technical parameters in real time. The controls that are built into the system have greatly improved reliability over time, which means major risk events on the transmission network are rare.

Distribution-level events occur virtually every day. These are often caused by external events such as overhead cables being contacted by vegetation, wildlife or road vehicles colliding with power poles. Most are resolved in a relatively short time, depending on what else may be happening on the network at the time. Victoria has experienced both types of disruption.

Examples of major disruptions in Victoria

On 16 January 2007, bushfire in the State's north caused an outage in the transmission line connecting Victoria to New South Wales. This led to a transmission outage to South Australia. The imbalances this caused required the disconnection of more than 480,000 customers. All these events happened within four seconds. Problems during supply restoration resulted in the loss of supply to a further 205,000 customers. Supply was restored in approximately 4½ hours. The economic consequence of this incident was estimated to be $500 million.

A State Government review of the supply disruption in January 2007[24] provided comprehensive analysis of the events, and led to changes to the National Electricity Rules, which form part of the NEM arrangements.

A windstorm that crossed Melbourne in April 2008 caused significant local damage to local networks in the metropolitan area (mostly the result of drought-stressed trees falling across powerlines). 93 per cent of the approximately 660,000 customers affected had power restored within 24 hours. However other customers in more isolated areas or those who also had damage to their homes, were off supply for longer.

Mitigation controls

The regulatory framework that governs Victoria's electricity supply system is predominantly the national framework applicable to the National Electricity Market. This has been developed under the auspices of COAG and is consistent with the development of the National Competition Policy.

The framework is developed in accordance with the National Electricity Objective which is:

to promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to –

1. *price, quality, safety, reliability, and security of supply of electricity; and*
2. *the reliability, safety and security of the national electricity system.*

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24 www.dpi.vic.gov.au/energy/safety-and-emergencies/energy-supply-emergencies/january-supply-interruptions-executive-summary

Electricity transmission and distribution businesses are responsible for the reliability of their networks and are subject to financial incentives to maintain and improve supply reliability under this framework.

Consistent with this objective, the regulatory framework incorporates incentives to achieve a level of supply reliability consistent with the preferences of consumers, given the costs associated with delivering a given level of reliability.

At a physical level, electricity supply systems must be managed in real time in order to operate within their technical operating limits. The Australian Energy Market Operator (AEMO) is responsible for system security consistent with its obligations under the National Electricity Law and the National Electricity Rules. Most of these controls exist in some legislative form at state level in Victoria.

Response planning/preparedness in place or planned

Under the National Electricity Law and Rules, AEMO has extensive powers of direction in relation to registered NEM participants in order to manage/resolve a major event involving a threat to system security. The arrangements that would be implemented to manage such an event are documented and exercised regularly.

As AEMO and all NEM jurisdictions have emergency powers, there is a Ministerial Memorandum of Understanding setting out how the use of emergency powers by AEMO and jurisdictions will be coordinated.

The National Electricity Law and National Electricity Rules address planning and preparedness arrangements. The administration of these occur through the Australian Energy Market Operator, Australian Energy Regulator and, in Victoria, through the Essential Services Commission and Energy Safe Victoria.

In addition, the Victorian Government has extensive emergency powers. These complement the above arrangements and seek to address social equity concerns, such as preserving supplies to critical customers where possible.

The Department of State Development, Business and Innovation is the control agency for electricity supply disruptions in Victoria.

The future of the risk

Climate change projections have been factored in for planning purposes. Growth in demand is captured in the Electricity Statement of Opportunities (published by AEMO) taking into account economic growth, government policies and margins of error relating to variability in weather patterns.

Investment in generation and the transportation of electricity (and therefore the mitigation of risk) occurs in response to NEM pool price movements and the system planning role AEMO has for the transmission network.

Websites for further hazard-specific information

The primary sources of information relating to preparedness and response activities are:

www.aer.gov.au (for information on how preparedness is intertwined into the design of the NEM)

www.aemo.com.au (for information on system security)

Advice for householders and other users:

www.betterhealth.vic.gov.au/bhcv2/bhcarticles.nsf/pages/Emergencies_coping_without_gas_or_electricity

www.energyandresources.vic.gov.au//energy/safety-and-emergencies/power-outages/guide

www.health.vic.gov.au/environment/floods-power-blackouts.htm

www.health.vic.gov.au/hacc/downloads/pdf/heatwave_power_outage.pdf

www.health.vic.gov.au/foodsafety/bus/emergency_situations.htm

www.redcross.org.au/files/20091113Coping_with_hot_weather_fact_sheet.pdf

www.redcross.org.au/files/SENIORS_Heatwave_Factsheet_Dec2010.pdf

Emergency animal disease

Introduction

Emergency animal diseases are diseases of animals (including bees and fish) that pose a serious risk to the economy, public health or the environment.

An emergency animal disease outbreak could result in:

- serious socioeconomic effects on farming and associated industries and communities (through international trade losses, production losses and market disruptions)
- risks to public health in the case of zoonosis[25]
- environmental impacts where wildlife are also affected.

An emergency animal disease outbreak can occur when:

- border controls or quarantine fail to keep out an infected animal, infected insect vector or contaminated materials
- migratory wild birds or wind borne insects arrive in Australia carrying a disease agent (e.g. avian influenza, bluetongue virus)
- environmental and population dynamics result in susceptible populations of animals being exposed to the disease agent (e.g. anthrax, hendra virus).

Commonwealth Government research into potential direct and indirect economic effects of a major multi-state outbreak of foot-and-mouth disease (FMD) estimates revenue losses of between $49.3 billion and $51.8 billion (in present value terms) over 10 years. Adding in the indirect effects, the total national impact over 10 years is estimated as $23.6 billion, some 0.16% of Australia's Gross Domestic Product. About half of this would be in Victoria.[26] This consequence would primarily be due to the national requirement to close beef and lamb export markets, and the flow on effects through the economies of all states and territories.

Specific example of disease outbreaks in Victoria

The importance of Foot and Mouth Disease (FMD) as a production-inhibiting, trade-stopping disease is well known. Victoria has not had an outbreak of FMD since 1872, but in recent years a number of FMD-free countries with livestock health and quarantine systems comparable to Australia have experienced devastating outbreaks. As the disease is present in parts of South East Asia and many other parts of the world, the risk of introduction to Australia through illegally imported animal products is very real.

Australia is the only country in the world that is free of Varroa mite, which causes disease in honey bees. If Varroa mite spreads to Australia, there will be a significant impact on bee health and the effectiveness of pollination of food crops.

Outbreaks of highly pathogenic avian influenza have a occurred in Victoria from time to time, the most recent being 1992. Outbreaks of avian influenza typically occur when biosecurity systems on poultry farms fail and domestic poultry are in contact with wild birds or their faeces. Wild birds may not show symptoms, but may spread the virus.

In 2007 there was an outbreak of Equine influenza in NSW and Queensland which had a significant impact on Victoria. Movement of horses was restricted and many racing and equestrian events had to be cancelled or postponed.

In August 2011, pigeon paramyxovirus was diagnosed in Victoria. The virus had obviously been smuggled into Australia through illegal bird imports, clearly demonstrating that Australia is not impervious to illegal animal/animal product imports and the diseases that accompany them.

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25 An animal disease that can also affect humans

26 Buetre, B, Wicks, S, Kruger, H, Millist, N, Yainshet, A, Garner, G, Duncan, A, Abdalla, A, Trestrail, C, Hatt, M, Thompson, LJ & Symes, M 2013, Potential socioeconomic impacts of an outbreak of foot-and-mouth disease in Australia, ABARES research report, Canberra, September

Major recent reviews or significant government policies/strategies

In 2011 the Commonwealth Department of Agriculture, Fisheries and Forestry commissioned Mr Ken Matthews AO to provide a qualitative assessment of Australia's readiness to respond to the threat of FMD. The Matthews report, entitled *A Review Of Australia's Preparedness for the Threat of Foot-and-Mouth Disease* whilst acknowledging the strength in Australia's biosecurity system, highlights eleven areas where improvements would further strengthen Australia's preparedness.

Importantly, although focused on FMD, by addressing the identified issues, Australia will be better prepared to detect and respond to incursions of a range of other important animal diseases. The report is a proxy for biosecurity in general; it has particular implications for all jurisdictions including Victoria.

Mitigation controls in place by governments

Commonwealth Government:

- International disease intelligence gathering and participation in international networks (World Organisation for Animal Health [OIE], Food and Agriculture Organization)
- Border control, customs, quarantine measures
- Provision of diagnostic services for exotic diseases (Australian Animal Health Laboratory)
- Participation in joint disease emergency planning and response cost-sharing arrangements

State Government:

- Surveillance for early detection
- Implementation of livestock traceability
- Feeding practices audits ('ruminant feed ban' and 'swill feed ban')
- Regular training for government and private veterinary staff in emergency response
- Participation in joint disease emergency planning and response cost-sharing arrangements
- Information to farmers on good biosecurity practices and disease awareness

Response planning/preparedness in place or planned

Ausvetplan is a joint national government-industry detailed disease response plan covering numerous diseases and disease response activities (e.g. farm decontamination, control centre management). The plan involves experts from Commonwealth and state/territory governments and industry peak bodies. It is maintained by Animal Health Australia, a joint company set up by the above mentioned stakeholders.

The signatories of Ausvetplan have also jointly signed a cost-sharing agreement (Emergency Animal Disease Response Agreement – EADRA) whereby the cost of interventions to control/eradicate a series of diseases are shared by these stakeholders according to a set of agreed formulae.

In Victoria, DEPI is the control agency for emergency animal disease. DEPI is involved in various training and simulation exercises (either at state or national level) aimed at preparing staff to cope with animal disease emergencies and has developed highly specialised software packages aimed at outbreak management.

The future of the risk

Increased international travel and trade poses the greatest risk for exotic disease spread. The most recent FMD outbreak in Japan, for example, originated in Hong Kong, but the means of spread to southern Japan is unknown. It is obvious that some form of international travel was responsible, but the precise means was never pinpointed. Such incidents may become more frequent in future.

The shift towards free range poultry farming will also expose more poultry flocks to viruses spread by wild birds such as Newcastle disease and avian influenza.

The increasing movement of human settlement into wildlife habitats may cause more diseases to emerge from wildlife and infect domestic animals or people. Hendra virus and Australian bat lyssa virus are recent examples; more may emerge in future.

Websites for further hazard-specific information

Ausvetplan:

www.animalhealthaustralia.com.au/programs/emergency-animal-disease-preparedness/ausvetplan/

Farm Biosecurity:

www.farmbiosecurity.com.au/

Outbreak:

www.outbreak.gov.au/

FAO Emergency Prevention System:

www.fao.org/empres

EMPRES Global Animal Disease Information System:

http://empres-i.fao.org/eipws3g/

World Organisation for Animal Health:

www.oie.int/

Householder advice:

General information:

www.dfat.gov.au/facts/quarantine.html

Bringing goods into Australia:

www.daff.gov.au/biosecurity/travel/cant-take

Moving commodities between states:

www.quarantinedomestic.gov.au/

Flood

Introduction

Victoria faces a very serious risk from flood. The severe and widespread floods in northern Victoria in 2010-11 and the flooding in 2012 reminded Victorians that the risk from flood is very real and exists in many parts of the State, including Melbourne. Flooding is mainly caused by heavy rainfall that exceeds the capacity of normal water courses and bodies of water.

Most floods are classified as riverine (where rivers, streams or lakes overflow) or stormwater flooding that occurs when the capacity of drainage systems is exceeded and water can flow in normally dry and often impervious urban areas. Flood waters can often rise rapidly and flow with high velocity, thus posing the greater threat to human life, particularly for stormwater flooding or riverine flooding in the upper catchments. Such flooding is often called flash flooding because warning times are very short.

Coastal flooding, when land adjacent to the coastline or coastal waterways is inundated by high tides and/or storm surges, is also experienced in Victoria. This can be exacerbated by wind-wave generation from storm events.

While flooding is a natural occurrence and has a positive impact on wetlands and replenishing soil moisture and nutrient, much human settlement has occurred in floodplains and close to rivers over many years, with little or no regard to the flood hazard. This creates much of the current flood risk.

The reason the rarest flood events can generate such high consequences in Victoria is mainly because of the severe damage they cause to key infrastructure such as roads and bridges, water, sewerage and electricity facilities such as substations, as well as possible loss of life and negative impact of flooding on the local or regional economy.

Social disruption also occurs especially when people are displaced from their homes and normal community facilities are damaged. The immediate impact can endure for weeks or months if flood waters move or dissipate slowly.

Examples of major floods in Victoria

Major floods have occurred across Victoria since European settlement, with major regional flooding occurring somewhere every 10 to 20 years. The long term average of flood damage in Victoria has been estimated at $350 million per annum.

The floods of 2010-11 covered about one-third of Victoria, affecting 70 of 79 municipal districts with flood or storm damage.

The total gross cost of the floods exceeded $1.3 billion, covering property such as houses and vehicles, commercial damage and business interruption, plus significant damage to public infrastructure such as roads, bridges and buildings.

Flooding affected Victoria again in March 2012 (Broken Creek, Melbourne, Shepparton) and June 2012 (Latrobe Valley and other parts of Gippsland).

Major recent reviews or significant government policies/strategies

Following the major Victorian floods of 2010-11, Mr Neil Comrie AO, APM was commissioned to undertake a major review. His *Review of the 2010-11 Flood Warnings and Response*[27] contained a detailed examination of the emergency management arrangements in Victoria as well as flood warning, management and response issues, and included 93 recommendations of which 31 address flood-specific issues.

The Victorian Government has responded to the recommendations in two ways. The recommendations about emergency management arrangements have been addressed through the White Paper *Victorian Emergency Management Reform.* In addition, Victoria's Minister for Water announced the Government's response to the flood-specific recommendations in December 2012 in the document *Improving Flood Warning Systems Implementation Plan.*[28]

27 Available at www.floodsreview.vic.gov.au/

28 www.water.vic.gov.au/environment/floodplains/response-to-victorian-floods-review

Building on initiatives already in place to reduce the impacts of floods on communities, the plan aims to integrate and align flood planning with other emergency management planning. This will improve coordination at state, regional and local levels. The plan commits to a continual review and improvement process through revising the Victorian Flood Management Strategy and the Regional Flood Management strategies and building capacity and skills in flood intelligence.

The impact of the 2010-11 floods on communities was also investigated by the Environment and Natural Resources Committee of Parliament in its Inquiry into Flood Mitigation Infrastructure.[29] The Government's response to 40 recommendations provides direction for managing levees and waterways for flood mitigation purposes.

Collectively the two investigations set the scene for extensive reforms to reduce the impacts of flooding on communities. They include a significant increase in the number of studies, to improve knowledge of flood behaviour, flood warning upgrades and greater collaboration in emergency response planning. They also set the scene for updating the Victorian Flood Management Strategy in 2013/14.

Mitigation controls in place by three levels of government

The most important controls for flood are those related to:

- land use zonings and overlays which imposes restrictions on building in the most flood-prone places, in accordance with the level of risk,
- flood detection and warning systems combined with community knowledge about and preparation for floods, including evacuation planning.

Structural works such as levees and enhanced drainage works can be useful for some key locations but can be very expensive. Currently, there is increased emphasis on gaining better flood knowledge, making that knowledge more accessible to the local communities and using it to consider a wide range of mitigation, flood detection and warning and response measures.

As current building stock in flood-prone areas is replaced over time, risk reduction requirements, such as elevated floor levels, are imposed.

The Department of Environment and Primary Industries (DEPI) is responsible for the development and holding of flood knowledge in Victoria, in conjunction with Melbourne Water and the regional catchment management authorities as floodplain management authorities. The responsibility for generating flood warnings lies with Melbourne Water for the Port Phillip Region and the Bureau of Meteorology for the rest of the State.

Councils are responsible for including flood information as zones and overlays into municipal planning schemes. This invokes a referral of the application to the appropriate authority when a planning permit is sought.

29 Available at www.parliament.vic.gov.au/enrc/article/1425

Response planning/preparedness in place or planned

The control agency for flood in Victoria is the Victoria State Emergency Service (VICSES), which has developed the State Flood Emergency Plan.

In addition, VICSES is actively promoting community and household flood awareness through the FloodSafe program.

The future of the risk

The risk profile for flooding in Victoria is expected to alter in response to changes in both demographic patterns and climate.

Population growth in floodplains, such as many rural towns, increases the flood risk as a result of intensification of the built environment.

Climate change is likely to change flood patterns in ways we are only beginning to understand. It is possible that some areas will experience less flooding, while others will experience more. Current predictions are for less frequent floods but more intense flooding when they do occur. Climate change is also likely to increase the sea level, exposing more communities to coastal flooding.

Websites for further hazard-specific information

Flood maps and general information

Flood Victoria website:

www.floodvictoria.vic.gov.au

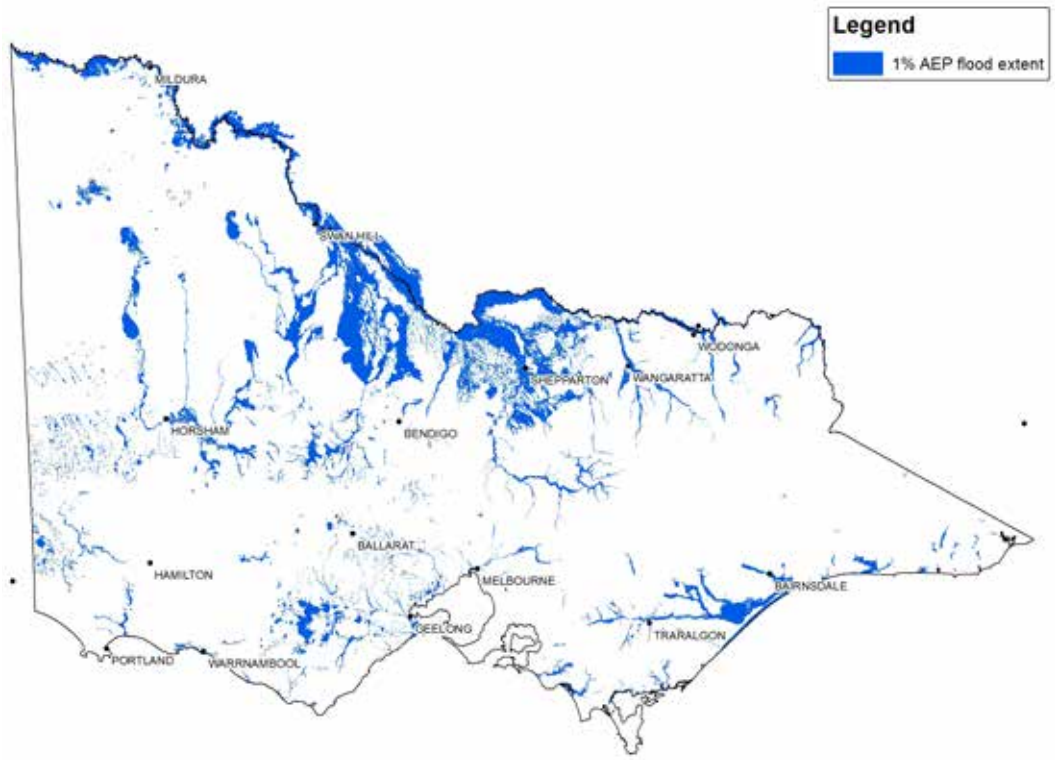
This website has a broad range of information about flood in Victoria, including links to Victoria's regional floodplain management authorities and Melbourne Water.

Planning Schemes Online:

http://planningschemes.dpcd.vic.gov.au

On this page you can select a municipal district to view its planning scheme that invokes planning restrictions. It is not necessarily a current map of the flood hazard. Once the page opens for the specific municipal planning scheme, you can click on the map or the text underneath it to bring up a page for planning scheme maps. Under zones, look for UFZ (urban floodway zone) and under overlays, look for FO (floodway overlay), LSIO (land subject to inundation overlay), or SBO (special building overlay). For a more detailed explanation of zones and overlays see: www.water.vic.gov.au/environment/floodplains/planning#zones

DISTRIBUTION OF THE FLOOD HAZARD ACROSS VICTORIA



Source: Department of Environment and Primary Industries

Water Mapper:

http://nremap-sc.nre.vic.gov.au/MapShare.v2/imf.jsp?site=water

On this website, you can see flood mapping for any area of Victoria you select, (including Melbourne as of late 2013). Once you have selected an area to zoom into, click on the folder icon for Surface Water, and then tick either or both '1 in 100yr flood' or 'floodways' then click 'refresh map'.

Coastal Inundation:

http://mapshare2.dse.vic.gov.au/MapShare2EXT/imf.jsp?site=future_coasts

National Flood Risk Information Portal:

www.ga.gov.au/hazards/flood/national-flood-risk-information-project/national-flood-risk-information-portal.html

Householder and Business Flood Planning:

http://ses.vic.gov.au/prepare/floodsafe

The map shows, for each catchment, the known outer extent of flooding for floods that have a 1% annual chance of occurring in any one year. All are included on one map to indicate the flood hazard across Victoria. The map is not perfect, and is derived from the best currently available information. Generally, if an area is coloured blue the likelihood of flooding every year will be 1% or more, and for the other areas the likelihood will be less than 1%.

The map is statistical in nature, representing the accumulation of a series of floods that vary in severity and areas affected. In reality each flood is different. A particularly large storm will lead to a range of probabilities of occurrence of flooding: 1% for one area, 2% for another area, 5% for yet another area, etc. The map is the output of analysing the probabilities for a large number of actual floods.

Hazardous materials (HAZMAT) emergency

Introduction

Because of its advanced industrialised economy, Victoria has many places where hazardous materials are manufactured, stored, transported, used and disposed of.

The term *hazardous materials* includes both

- dangerous goods that may be corrosive, flammable, explosive, spontaneously combustible, toxic, oxidising or water-reactive, and
- hazardous substances for which exposure or contact can cause cancer, skin disease, poisoning and respiratory illness.

Major risk events are usually associated with a loss of containment of materials. This can be due to such things as:

- plant or equipment failure – internal or external – due to e.g. collision
- deliberate or accidental misconduct resulting in a spill, fire or explosion
- an uncontrolled reaction e.g. excessive heat leading to vessel rupture due to overpressure.

The major consequences of hazardous materials incidents include:

- human injury, illness and death
- property damage
- environmental pollution
- economic loss

Examples of hazardous materials releases

This assessment has focused on emergencies with potential state-level consequence, rather than the daily/weekly low-level releases.

Examples of larger emergencies in Victoria include:

- 1991: Coode Island chemical explosion and fire over two days damaged or destroyed some 16 chemical tanks with approx. 8.6 ML of chemicals burned or leaked. Although the smoke plume landed some distance away, no deaths or injuries were reported.
- 1998: Longford gas plant explosion and fire killed two people, injured eight and interrupted gas production for two weeks.
- 2007: Westpoint Industries fire (Footscray/Tottenham) involving emissions of chlorine-based chemicals generated significant community concern about inadequate communication and engagement. Twelve people were treated by ambulance.
- 2012: Port of Portland 600T coal tar pitch spill took a week to clean up. A significant environmental threat was averted.

Recent events in other states include:

- 2008 WA: Varanus Island gas explosion cut the gas supply to WA by 30% for two months with a major effect on industry.

International events in 2013 include:

- Ammonium nitrate fertiliser plant fire and explosion, West Texas, USA, caused 15 deaths, injured 160 and damaged or destroyed 150 buildings including a school
- Rail-borne petroleum crude oil tankers explosion and fire, Lac-Mégantic, Ontario, Canada, caused up to 50 deaths and destruction of the town centre.

It is important to note that practices in place in Victoria relating to manufacture, storage and transport of hazardous materials significantly reduces the likelihood of emergencies of such consequence occurring in Victoria.

Major recent reviews or significant government policies/strategies

Victoria implemented the current regime for regulating major hazard facilities after the Longford Gas Plant explosion and subsequent Royal Commission that identified systemic flaws in the gas plant's design, operation and management culture.

The Dangerous Goods (Storage and Handling) Regulations 2012 effect requirements covering, amongst other things, classification and labelling, risk assessment and review, fire protection systems and notifications.

Mitigation controls in place

The storage, handling and transport of hazardous materials in Victoria is managed within a context of both international agreements and conventions and national systems, including:

> The National Industrial Chemicals Notification and Assessment Scheme (NICNAS) that, under Commonwealth legislation, assesses the risks of dangerous chemicals and regulates their packaging, labelling and use in Australia.

> The Australian Dangerous Goods Code sets out the requirements for transporting dangerous goods by road or rail.

In Victoria, the Major Hazard Facilities regulatory structure implements a safety management system that is underpinned by regulations, codes of practice, and subordinate guidance documents.

A strict oversight regime subjects major hazard facilities to five-year licencing, with annual risk-based inspections. Operators, both small and large, are required to have emergency management plans in place, the objective of which is effective containment of incidents to prevent escalation.

The transport of hazardous materials, mostly by road, presents a significant risk potential. All aspects of this activity are tightly regulated to minimise risk, from the packaging of substances through the construction of tankers, to the licencing of drivers and restrictions on routes.

In terms of local planning, the operators of major hazard facilities are required to engage councils and emergency services in the preparation of their emergency plans. They must provide local communities and councils with information about their facilities' safety, covering matters such as the risk of major incidents, and the means by which the local community would be notified.

Response planning/preparedness in place or planned

The control agencies for hazardous materials emergencies are the MFB and the CFA in their respective areas. Both agencies maintain specialist crews, vehicles and equipment to deal with the specific issues raised by emergencies involving spills and fires involving chemical, biological or radiological materials.

The principal support agencies are WorkSafe and the Environment Protection Authority who advise the fire services about the nature of the substance(s) involved, and how to minimise environmental consequences of spilt material and contaminated fire-fighting water.

The future of the risk

The future of this risk in Victoria is tied up with the future of manufacturing, and the mix of raw materials and finished products that are produced, transported, stored and used. The current trend to logistics specialists holding raw materials and finished goods for multiple clients means there is a need to ensure that the chemical industry's highly-developed safety culture extends to these more extended networks.

Websites for further information

Australian Government:

NICNAS

www.nicnas.gov.au/home

Transport of Dangerous Goods

www.infrastructure.gov.au/transport/australia/dangerous/index.aspx

National Transport Commission:

Australian Dangerous Goods Code

www.ntc.gov.au/viewpage.aspx?documentid=01147

Victorian Government:

WorkSafe

www.worksafe.vic.gov.au/safety-and-prevention/health-and-safety-topics/dangerous-goods

www.worksafe.vic.gov.au/safety-and-prevention/your-industry/major-hazard-facilities

Environment Protection Authority

www.epa.vic.gov.au/

Department of Health
Information about environmental hazards

www.health.vic.gov.au/environment/hazards.htm

Industry:

Plastics and Chemical Industry Association (PACIA):

www.pacia.org.au/programs/responsiblecare

Heatwave

Introduction

Heatwaves are considered to be the 'silent killer' of extreme weather events and are the leading cause of weather related deaths in Australia.[30]

The definition of extreme heat, or heatwave, varies from place to place and is influenced by humidity, demographics, urban and rural design. People's own adaptation to their climate also needs to be considered when defining a heatwave. For consistent community understanding in Victoria, a heatwave is generally defined as a period of abnormally and uncomfortably hot weather that could impact on human health, community infrastructure and services.

Victoria's Department of Health has identified heat health temperature thresholds, above which heat is likely to impact on the health of a community. When forecast average temperatures are predicted to reach or exceed the heat health temperature threshold for a specific weather forecast district, the Department will issue a heat health alert for that district. This process, known as the Heat Health Alert System (HHAS), uses the same districts as the Bureau of Meteorology's weather forecast districts and the CFA's total fire ban districts. An example calculation of the daily temperature is shown in the map on page 29.

Heatwaves can affect anybody, including the young and healthy, however there are certain population groups more at risk. These include people aged 65 years and over, people who have a pre-existing medical condition and people taking medicines that affect the way the body reacts to heat. Heat-related illness can range from mild conditions, such as a rash or cramps, to very serious conditions, such as heat stroke, which can be fatal. Heatwaves can also exacerbate existing medical conditions including heart and kidney disease.

Infrastructure failure or other natural emergencies can add another level of demand on a community and services. For example, power outages can impact on people's ability to run air-conditioners; bushfires can increase vulnerability by reducing air quality; and public transport disruptions hinder people's ability to reach a cooler location.

Heatwave in Victoria

An exceptional heatwave affected south-eastern Australia in late 2009. Melbourne endured three consecutive days of temperatures above 43°C in late January followed by a record 46.4°C on 7 February. This was a period during which Victoria experienced the most extreme temperatures with maximum temperatures 12-15°C above normal for much of Victoria. Many records were set for high day and night time temperatures, as well as the duration of extreme heat, and the period culminated in the 'Black Saturday' bushfires of 7 February.

There were widespread effects on the health system, with 374 excess deaths in comparison to the same time period in the previous 5 years; that represents a 62% increase in total all-cause mortality, unrelated to the bushfires.

Tram and train services were also badly affected by the heat as tracks buckled, overhead lines sagged and carriage air conditioning units failed, with over 1,000 individual train services cancelled in Melbourne in one week. Heat impacts on transport infrastructure have a systemic effect in that reduced capacity on one mode increases stress on others. In addition to various minor power outages, a major blackout occurred on the third day that affected part of Southbank and other areas west of Melbourne.

More recently, heat health alerts were issued in Victoria on eight occasions during the 2012-13 summer, with two in 2011-12.

30 The Senate, Environment and Communications References Committee, *Recent trends in and preparedness for extreme weather events*, August 2013, p.83

Major recent reviews and significant government policies/strategies

In Victoria, heatwave planning commenced in 2007 with the first Victorian Heatwave Strategy. This followed overseas events, e.g. Europe 2003, in which 35,000 people are thought to have died due to heat related causes.[31]

The *January 2009 Heatwave in Victoria: an Assessment of Health Impacts*[32] was released by the Office of the Chief Health Officer describing the health impacts of the period of extreme heat.

The 2013 *Victorian Climate Change Adaptation Plan* identifies a number of strategies for increasing public and private resilience to climate risks. In relation to heatwave, the plan identifies two policy frameworks promoting more liveable urban spaces in existing and new developments, including enhanced use of water.

Mitigation controls in place

In some ways, southern Victoria is not optimally adapted to extreme heat events in that rail and electricity infrastructure can fail in extreme heat and excessively high demand, and the use of air conditioning in homes while widespread, is not universal among certain age and socio-economic groups. Reducing these vulnerabilities needs to remain a key objective in ensuring ongoing provision of services to the community.

Most management activity in recent years has been in relation to forecasting, preparing for and responding to heat events. The Department of Health's heatwave framework comprises the *Heatwave Plan for Victoria*, the *Heatwave Planning Guide*, the HHAS and the Heat Health Information Surveillance System and communication resources.

The Department works with local government and the health and community sector to raise community awareness about the health impacts of heat. It also provides advice and communication resources to stakeholders to disseminate to their clients. It works closely with local government to support the development and implementation of heatwave plans. This has resulted in all councils implementing a heatwave plan to address the impacts of heat in their communities.

Response planning/preparedness in place or planned

Neither heat nor heatwave are specifically-named emergencies under Victoria's emergency response arrangements, and their effects are not confined to an easily-defined sector.

In relation to health, the main actions are:

- Public health messages – tips on staying healthy in the heat, monitoring weather forecasts, issuing heat health alerts, provision of other communication resources such as posters, brochures and fact sheets on heat health
- Councils and community organisations that support vulnerable populations activating their heatwave plans which may include preparing environments, ensuring appropriate staffing levels, and considering staff and client safety in hot weather. This might also include updating individual heatwave plans for clients and vulnerable client lists, as well as preparing a business continuity service plan.

The impacts of some intense and prolonged heatwaves will require actions through municipal and state emergency management plans. Circumstances that are likely to require such a response include:

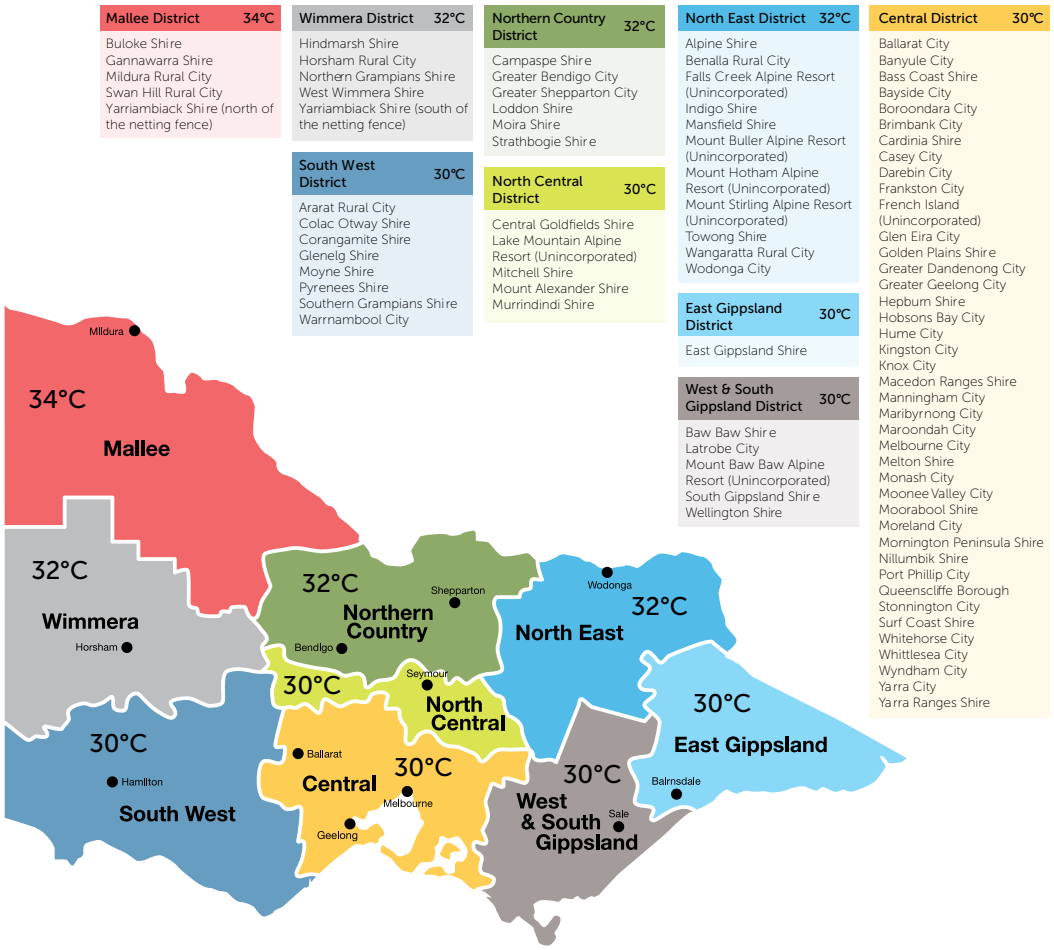
- record-breaking or extreme heat events
- Code Red fire danger days
- power and public transport failures
- extreme demand on health services such as ambulances, hospitals and GPs.

In 2011, Victoria Police issued the *Extreme Heat Event Guidelines* that support the *Heatwave Plan for Victoria* by ensuring a multi-agency approach to management of heat events. Should there be a need to exercise the control function, Victoria Police would assume that role, ensuring also that all actions and public messaging are coordinated.

31 www.newscientist.com/article/dn4259-european-heatwave-caused-35000-deaths.html

32 Available at: http://docs.health.vic.gov.au/docs/doc/January-2009-Heatwave-in-Victoria:-an-Assessment-of-Health-Impacts

HEAT HEALTH TEMPERATURE THRESHOLDS AND CORRESPONDING WEATHER FORECAST DISTRICTS



The heat health temperature thresholds are aligned with the Victorian Country Fire Authority's (CFA) total fire ban and fire danger ratings districts and the Bureau of Meteorology's weather forecast districts.

Source: Department of Health

The future of the risk

It is expected that climate change will increase the frequency and intensity of heatwave in Victoria.

The average annual number of days above 35°C is likely to increase from 9 days currently experienced in Melbourne to 11-13 days per year in 2030 and 15-26 days by 2070 on current trends.[33] In Mildura, average annual days above 35°C may increase from 32 days currently to 76 days under the same scenario.[34]

Websites for further hazard-specific information such as hazard maps, business or household preparedness, specific emergency plans

www.health.vic.gov.au/environment/heatwaves.htm

www.health.vic.gov.au/environment/heatwaves-planning.htm

www.health.vic.gov.au/environment/heatwaves-community-resources.htm

33 Department of Sustainability and Environment, 2012, *Report on Climate Change and Greenhouse Gas Emissions in Victoria*, Victorian Government, Melbourne, p. 23

34 www.climatechange.gov.au/climate-change/climate-science/climate-change-impacts/victoria

Insect Pest Incursion

Introduction

In common with most economies with significant agricultural sectors, Victoria is subject to outbreaks of native (endemic) pests and incursions of exotic invertebrate pests (predominantly insects but including snails, mites and nematodes) that can sometimes occur in plague proportions. The major exposed sector is agriculture, but insect pests can also attack people and timbers in buildings. Losses from pest outbreaks may include direct production losses to crops, costs associated with controls and restrictions on market access to other states or international markets.

Australia's economy and environment benefit significantly from a strong national biosecurity system. Australia has enjoyed a high degree of protection from biosecurity risks based on natural advantages of relative geographical isolation, the absence of shared land borders and a border-focused system of biosecurity. These advantages have meant that the environment has been free of many pests common elsewhere and has positioned Australia well to prevent their entry into our ecosystem. The continuation of high quality Australian exports depends on the sector's freedom from the most destructive pests.

Insect Pest Incursions in Victoria

Since European settlement, Victoria has experienced many significant insect / invertebrate incursions.

> In the nineteenth century, phylloxera affected vineyards in a number of areas which still result in restrictions on movement of vine material.

> Late in the twentieth century, potato cyst nematode was found in Victoria and Western Australia and has resulted in ongoing management programs to restrict further spread and losses to potato crops.

Endemic species

Examples of native (endemic) species which can cause outbreaks in areas they do not usually inhabit include the following:

Australian plague locust

In 2010/2011 Victoria experienced a major plague of locusts that also affected agricultural areas in other states. Australian plague locusts are a native pest which can build to very high numbers under suitable conditions and migrate from their home breeding areas in central NSW and the channel country of Queensland to southern agricultural areas. Under ideal conditions, it is possible for locusts to affect agriculture in up to a third of Victoria. Swarms of flying adults and bands of hoppers can cause substantial economic loss by destroying crops including pasture, as well as widespread community disruption by affecting major events, drinking water quality, air travel, and wellbeing generally.

The Australian Plague Locust Commission (APLC) commenced operations in 1976 and has continued a program of monitoring, forecasting, research and control since that time. The primary purpose of the APLC is to overcome past difficulties in organising the control of an insect which migrates over long distances and poses an interstate threat.

Queensland fruit fly

Queensland fruit fly is a native species to northern Australian areas. However, outbreaks in southern areas have occurred (including Victoria) and have caused losses to production and affected market access for produce from affected areas. Management of fruit fly in Victoria has required on-going government and industry collaboration.

Exotic species

Industry Biosecurity Plans have identified many exotic invertebrate pests that could severely affect Australian industries should they be introduced to Australia.

Major recent reviews and significant government policies/strategies

Australia's biosecurity system has been subject to review several times. Recommendations made for improvements to the way it operates started with the Nairn Review in 1995, and culminated in the 2008 independent review of Australia's quarantine and biosecurity arrangements *One Biosecurity: A Working Partnership* (the Beale review). Beale proposed significant reforms to strengthen the system by revising legislation, targeting resources to the areas of greatest risk, sharing responsibility between government, businesses and the community, and improving transparency, timeliness and operations across the continuum.

The National Plant Biosecurity Strategy (NPBS) outlines strategies to strengthen Australia's plant biosecurity system to 2020. The NPBS was finalised in December 2010 and the process of implementing the recommendations began in 2011. Through its implementation, the NPBS is continuing to provide the focus and strategic direction for national plant biosecurity activities and in doing so, strengthening the current plant biosecurity system.

Mitigation controls in place

Preventing outbreaks and incursions is a combined effort of governments and the private sector. The primary controls to prevent insect pest incursions are border controls at national and state levels. Australia's biosecurity system operates under Commonwealth, state and territory legislation administered and managed by the respective agricultural and environmental agencies. The Commonwealth Department of Agriculture, Fisheries and Forestry (DAFF) Biosecurity, including the Australian Quarantine and Inspection Service, has a major role to play in this process.

Victorian legislation (*Plant Biosecurity Act* 2010; Plant Biosecurity Regulations 2012) and international agreements that control the transportation of agricultural commodities cover a range of activities involving domestic and international movement of people and goods into and around the country, and the export of agricultural commodities.

The Biosecurity Victoria Division of Victoria's Department of Environment and Primary Industries (DEPI) delivers biosecurity and product integrity programs across the terrestrial and aquatic plant and animal sectors. Activities are guided by the state's Biosecurity Strategy. The aim is to minimise the impact of emergency pest incidents on the environment and production systems, maintain access to local and overseas markets, and ensure food safety and public health.

Response planning/preparedness in place or planned

State and territory governments are responsible for plant biosecurity services within their respective borders. In Victoria, the control agency for plant pest or disease is DEPI. A national approach to the management of plant biosecurity in Australia is maintained through the national committees framework. The sequential approach of prevention, eradication, containment and asset-based protection is utilised.

Australia's partnership approach to biosecurity is underpinned by the Intergovernmental Agreement on Biosecurity (IGAB), signed in January 2012. The IGAB strengthens the working partnership between the Australian Government and state and territory governments by defining the roles and responsibilities of governments and outlining priority areas for collaboration and to improve the national biosecurity system.

The National Environmental Biosecurity Response Agreement is the first deliverable of IGAB, and sets out emergency response arrangements, including cost sharing for biosecurity incidents that primarily impact the environment and social amenity. It is yet to be formally activated to respond to an exotic pest incursion.

The future of the risk

Increasing global trade and travel could potentially change the landscape for biosecurity threats. As Victoria's climate is projected to become warmer and drier, this will change the habitat for insects as well as their hosts such as orchard trees. It is very likely that warmer weather pests and diseases will start marching southwards.

Websites for further hazard-specific information

Plant Health Australia lists a number of industry biosecurity plans relevant to insect pests.

www.planthealthaustralia.com.au/

APLC website

www.daff.gov.au/animal-plant-health/locusts

DEPI website

www.depi.vic.gov.au/agriculture-and-food/pests-diseases-and-weeds

(Also other websites relevant to quarantine as per emergency animal disease)

www.daff.gov.au/biosecurity/travel

Liquid fuel shortage

Introduction

Victoria is part of the international supply chain for liquid fuels (notably petrol and diesel) which are essential for the proper functioning of our economy and community. The supply chain is flexible and professionally managed, however disruptions can occur.

The level of security and continuity of Australia's liquid fuel supplies is rated as high trending to moderate in the long term.[35] The main effects of a global fuel shock scenario would be on price and competitiveness rather than availability.

Fuel shortages in Victoria

In November 2012, simultaneous outages at two Victorian refineries, and off-specification diesel arriving in NSW, led to a shortfall in diesel supplies in Victoria and parts of South Australia. Some areas ran out of diesel but the impact was patchy and variable as local production resumed. Supplies were returned to normal by Christmas.

The National Oil Supplies Emergency Committee (NOSEC) was convened during the 2012 Victorian diesel shortage. While it did not recommend intervention given the local / intermittent nature of the event, the then Commonwealth Minister and Victorian ministers requested the event be reviewed. At the time of writing, that is not finalised, but it is clear that there are opportunities to reinforce the need for community and business self-reliance in case of such shortfalls.

Mitigation controls in place

The primary contributors to maintaining the continuity of liquid fuel supplies are the diversity of the supply chains and the open competitive markets for fuel.

The main management strategy for the risk of shortages is for large users, including government agencies, to have their own fuel management strategies to support business continuity. These include entering into fuel supply contracts or similar arrangements.

Governmental intervention in fuel markets in the management of fuel supply occurs only when there is an actual or threatened supply reduction. While Australia is a member of the International Energy Agency (IEA), and has an obligation to assist in releasing liquid fuel stocks to the market during a major international fuel disruption, the Commonwealth Government does not hold strategic reserves of fuel, relying instead on the commercial operators' stocks. Australia would contribute to a global shortage crisis through market-induced reductions in the Australian demand for liquid fuels.

The International Energy Agency conducts regular analysis of the supply chain and conducts exercises. It also coordinates collective responses to fuel supply disruptions.

NOSEC convenes twice a year, maintains the National Liquid Fuel Emergency Response Plan (NLFERP) and conducts exercises every year or two.

Victoria's Department of State Development and Business and Innovation (DSDBI) periodically briefs industry representatives on a range of risks to their businesses, as well as interdependencies particularly in relation to electricity supplies.

35 *National Energy Security Assessment December 2011* p. vi

Response planning in place

In a liquid fuel shortage, Victoria and other jurisdictions have legislation that can be used to manage fuel supplies if industry responses are inadequate. Commonwealth and state energy portfolio ministers have extensive direction powers available to them. These include restricting available supplies to essential users such as emergency and essential services.

In Victoria, the control agency for petroleum and liquid fuels disruption is DSDBI.

The future of the risk

Excess refinery capacity in the Asia region and the flexibility of the international supply chain have reduced supply chain risks. These risks are examined periodically as part of the National Energy Security Assessment and Liquid Fuels Vulnerability Assessment conducted by the Commonwealth Department of Resources, Energy and Tourism.

The likely ongoing trend to close down refineries in Australia is not expected to compromise fuel supplies, particularly where those refineries may be converted into import terminals.

Websites for further hazard-specific information

Information on NOSEC and relevant national legislation can be seen at:

www.ret.gov.au (search for NOSEC)

Home > Energy > Energy security > Emergency response > Liquid fuel emergency > The National Oil Supplies Emergency Committee

Marine Pollution

Introduction

Victoria's diverse coast and marine environments are among the State's most valued assets. One of the most serious risks our marine environment faces is pollution from oil or other hazardous or noxious substances. International conventions and Australian laws have been developed to reduce the number of marine accidents, improve safety and prevent pollution. As an island nation, Australia relies on shipping activity, therefore marine pollution incidents remain a possibility.

Marine pollution emergencies have the potential to cause significant, long term environmental damage in ports, embayments and along Victoria's coastline. Business disruption and negative impacts to tourism and communities can also be associated with large spills.

Low level marine pollution incidents occur frequently at the rate of several per month. These are usually responded to at the local level and the costs are relatively low. However, the challenge for the State is managing the low frequency, high consequence marine pollution emergencies which can cause significant damage and disruption and also have high political and reputational impacts.

Examples of risk events in Victoria or elsewhere

Significant oil spill incidents have occurred in Australia and New Zealand within the past five years. In the financial year 2010-11 there were 88 reported Tier 1 incidents (up to 10 tonnes) in Victoria. Tier 2 (10 to 1,000 tonnes) and Tier 3 events (over 1,000 tonnes) occur sporadically and are difficult to predict. There can be extended periods without a major spill, or incidents like the Pacific Adventurer (Queensland 2009) and the Montara (NT 2009) can occur within months of each other. These incidents and the grounding of the Rena (NZ 2011), highlight the magnitude of the environmental, social and economic damage that can occur. The Rena grounding in October 2011 is still ongoing with clean-up costs estimated to be in excess of $130 million. These incidents have heightened public and government awareness of the consequences of an oil spill and their expectations of how an oil spill incident should be managed.

Major recent reviews or significant government policies/strategies

The 2011 Marine Pollution Coastal Risk Assessment conducted by the (then) Department of Transport, identified a number of highly sensitive areas along the Victorian coastline where an oil spill would have catastrophic consequences for the environment. This includes high profile areas in and around Port Phillip and Westernport Bays. (Refer to the map on page 36.) These threats are compounded by the potentially significant economic impact that would be caused by disruptions to shipping activity to, from or within Port Phillip Bay. A capability and gap analysis was also completed in 2012 and is being used to inform equipment and capability planning, including human resource implications.

Mitigation controls in place

Mitigation of marine pollution is largely achieved through ship industry construction standards, safe navigation rules, port operations procedures, maritime training, legislation and regulation. These involve state-based, national and international rules, agreements and arrangements.

Response planning/ preparedness in place

Demand for marine oil spill response is driven principally by the risk of significant marine pollution from incidents involving large commercial shipping. Such movements in Victorian waters have increased year on year. Growth in shipping activity is forecast to continue, exposing the State's coastline and natural resources to an increasing risk of pollution. Victoria has been fortunate to date in that we have not suffered a significant marine oil spill incident.

The Department of Transport, Planning and Local Infrastructure (DTPLI) has the responsibility to ensure that, within State waters, an effective marine oil spill response capability is in place and able to be deployed quickly. This legislated responsibility is supported by an Inter-governmental Agreement (IGA) included in the National Marine Oil Spill Contingency Plan (NATPLAN).

National – The National Plan (NATPLAN) facilitates resource sharing and coordinates deployment support across jurisdictions for large spills.

State – The Victorian Marine Pollution Contingency Plan (VICPLAN) facilitates a multi-agency and whole of government approach to marine pollution response, under the direction of the State Marine Pollution Controller.

Regional – Selected ports in each region operate under a Direction as Regional Control Agencies. The Directions are issued by the State Marine Pollution Controller which mandates participation in VICPLAN and minimum operational response requirements.

As specified under the NATPLAN and VICPLAN, DTPLI has a responsibility to undertake cost recovery from the polluter if it can be identified. In the event that the polluter cannot be identified the State is liable for the clean-up costs.

To meet its statutory and control agency obligations, DTPLI must maintain stockpiles of highly specialised oil spill equipment and adequate numbers of trained response personnel. This is to ensure that the State can adequately respond to Tier 1 and Tier 2 spills within State waters – up to 3 nautical miles from the shoreline. For Tier 3 spills, national assistance will be provided to supplement state assets and personnel.

State-owned resources would also be supported by those of the Commonwealth and the shipping, oil and gas industries should a spill occur. This approach increases the level of interoperability between systems and equipment, to enhance their effectiveness and to achieve economies of scale resulting in a reduction in cost.

The Country Fire Authority and Metropolitan Fire and Emergency Services Board are control agencies for land-based incidents involving hazardous material spills (e.g. dangerous goods chemicals). This responsibility extends to preventing entry of spilt hazardous materials into inland waterways.

The future of the risk

Any increase in shipping volumes, new hazardous cargo types, new port developments or degradation in navigational aids could increase the risk of marine pollution. Degradation of mitigation measures or response capability would also increase the risk.

Websites for further hazard-specific information

www.transport.vic.gov.au/freight/marine-pollution

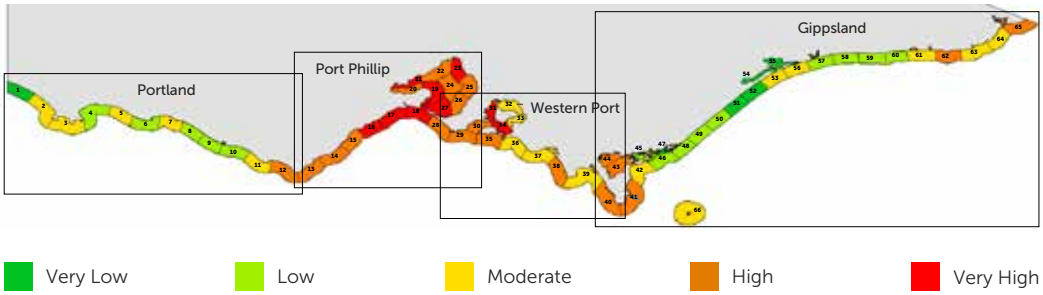
www.dse.vic.gov.au/plants-and-animals/native-plants-and-animals/wildlife-emergencies/wildlife-affected-by-marine-pollution

www.environment.gov.au/coasts/pollution/

National arrangements including legislation and the National Plan for Maritime Environmental Emergencies:

www.amsa.gov.au/environment/

DISTRIBUTION OF THE RISK ALONG VICTORIA'S COASTLINE



(Source DTPLI)

This map shows coastal waters broken into 20 km cells with a risk rating for each, indicated by the colour of each cell. The risk rating is based on the environmental factors, the shipping activity and the likelihood of a spill reaching the shoreline.

Mine Failure

Introduction

Mines currently operating in Victoria utilise both open cut and underground methods of mineral extraction, including some large open cut coal mines for which continuity of coal supply is associated with power generation. Mining activities involve earth moving operations with the use of a variety of mechanical equipment operated by a range of skilled people and can also include blasting operations.

Mining operations can:

- be in close proximity to town centres, major built infrastructure (road, rail, power, gas, etc.) and sensitive natural environments (rivers, lakes, etc)
- result in discharges to land, air, surface water, groundwater and also be the source of additional noise
- involve hazardous, toxic and/or radioactive substances
- introduce an additional fire risk (e.g. coal mines).

In Victoria, mine failure relates to the large open cut coal mines in the Latrobe Valley, which are privately owned and operated.

The stability of open cut mine walls (batters) can be affected by extreme weather and geological patterns, where water and seismic loading weakens the rock mass resulting in batter collapse. In addition, large parts of Victoria are overlayed with highly reactive soils, meaning soils that expand and contract with a variation of moisture content, exacerbating mine instability.

The consequences of a major mine batter failure can include:

- People: multiple fatalities, either directly (e.g. miners, other people in close proximity) or indirectly (e.g. due to shutdown of essential services)
- Infrastructure: disruption to essential services (e.g. electricity supply), loss of a major highway or complete loss of a mine
- Environment: local to regional impacts to water/air quality or permanent loss of local ecosystem.

Examples in Victoria

Yallourn Mine Northern Batters Failure (2007): In November, the North East batters of the Yallourn open cut coal mine failed on a slope that was approximately 500 m long and 80 m high, encompassing about six million cubic metres of material. The failure resulted in damage to mining infrastructure, cessation of coal production from the East Field and inflow of the entire Latrobe River into the mine. Remedial works were undertaken for a period of several months following the failure, including the construction of a channel to divert the flow of the Latrobe River away from the Mine.

Hazelwood Mine Northern Batters Movement (2011): On 5 February, heavy rain led to movement of the northern wall of the Hazelwood open cut coal mine. As a result of the movement, cracks appeared on the surface of the Princes Freeway and the adjoining area. A section of the Princes Freeway between the mine and the township of Morwell was temporarily closed. The area was stabilised after the completion of an extensive remedial works program and the Princes Freeway re-opened in September 2011, having being closed for over 7 months.

Yallourn Mine Morwell River Diversion Failure (2012): On 6 June an embankment constructed to divert the Morwell River across the Yallourn open cut coal mine failed during a flood. The failure of the embankment resulted in flooding of the mine on both sides of the diversion, which severely disrupted mining operations for several months.

Recent reviews

The Mining Warden's Yallourn Mine Batter Failure Inquiry (report 30 June 2008) identified a number of areas for improvements in the management of geotechnical and hydrogeological risks. These included setting up a Technical Review Board to provide advice on mine stability issues, building geotechnical expertise, and funding a Geotechnical and Hydrogeological Engineering Research Group at Monash University in Churchill.

Mitigation controls in place

The State Government provides resources to oversee mining operations with the backing of a regulatory framework. The mitigation controls for mine failure are predominantly regulatory, implemented through the Department of State Development, Business and Innovation (the Department), including approval of work plans that encompass comprehensive risk assessments, and inspections and audits of operations by the Department's technical officers.

Response planning

The major mines in Victoria including the Latrobe Valley Coal Mines have emergency response plans in place. The Department provides expert advice and support on mine stability for mine failure emergencies.

Websites for further hazard-specific information

Yallourn Coal Mine Inquiries:

www.dpi.vic.gov.au/earth-resources/exploration-and-mining/issues/yallourn-coal

Victorian Mining Bibliography – including mapping tool:

www.dpi.vic.gov.au/earth-resources/exploration-and-mining/tools-and-resources/geovic

Pandemic Influenza

Introduction

Influenza, commonly known as the flu, is caused by a highly contagious virus that is spread by coughs and sneezes. Every year it causes illness in the community (seasonal influenza) and when a high proportion of people in a group or geographic region are affected it is called an epidemic.

An influenza pandemic occurs when a highly infectious new strain emerges for which humans have little or no immunity. During a pandemic, the virus spreads rapidly around the world causing high rates of illness and death – resulting in severe social and economic disruption. History has shown that pandemics tend to occur every 10-50 years.

Because of their high levels of illness and death, pandemic influenza events can have immense effects on society through the social distancing that may be required. Schools may be closed and public events cancelled.

In addition, it is estimated that up to 40% of the workforce may withdraw from work at any one time due to illness, the need to care for family members, or the fear of contracting the virus in the workplace or on public transport. Businesses need to be conscious of this possibility for their continuity planning, as well as exercising their duty of care to employees under occupational health and safety to take all reasonably practicable steps to protect their health and safety at work.

It is difficult to predict how quickly a pandemic will progress. Based on data and assumptions drawn from previous pandemics and seasonal influenza and their treatments, it is anticipated that a pandemic could last from seven to ten months in Australia. However, the social, economic and health system impacts could last longer depending on the severity of the health impacts of the virus.

One study estimated that in a worst-case pandemic influenza scenario, Australia's GDP could suffer a decline of greater than 10%.[36]

Specific example(s) with brief descriptive information about risk events in Victoria or elsewhere

In the twentieth century, the world experienced three pandemics, in 1918 ('Spanish flu'), 1957 ('Asian flu') and 1968 ('Hong Kong flu'). The latter two were relatively mild, but the 1918-19 pandemic killed an estimated 50 million people worldwide, more than in the war that preceded it.

More recently, a novel influenza A virus emerged in late April 2009. This particular H1N1 strain had not circulated previously in humans. The virus was contagious, spreading easily from person to person and from one country to another.

Globally, the 2009 influenza pandemic was considered to be of mild to moderate severity with the overwhelming majority of patients experiencing mild symptoms and making a rapid and full recovery. However, severe cases were reported predominantly in people with existing chronic conditions such as respiratory diseases, cardiovascular disease, diabetes, autoimmune disorders and obesity. Pregnant women and indigenous Australians were also identified as those with an increased risk of serious disease.

Mitigation controls in place by three levels of government

Control of pandemic influenza is an international activity, with worldwide surveillance for human outbreaks. Surveillance of birds is concentrated in the parts of East and South-East Asia where there is high potential for animal/bird to human transmission of new influenza strains. Occasionally, there are large culls of poultry in Asian countries, such as chickens in Shanghai in 2013.

Culls that occur in Australia tend to be for avian influenza subtypes that do not normally pose a threat to human health. This is commonly referred to as Low Pathogenic Avian Influenza.

There is some protection afforded by the level of immunity to various influenza strains already present in the community, such as in older people who may have experienced a particular strain earlier in their lives. This was the case for the 2009 H1N1 pandemic.

36 McKibbin WJ and Sidorenko AA, 'Global Macroeconomic Consequences of Pandemic Influenza' 2006, Lowy Institute for International Policy, Sydney

Vaccination against seasonal flu is an important annual control measure. In a pandemic, the production of a pandemic strain-specific vaccine would be an important potential control measure, noting that it can take a number of months to produce in sufficient quantity to meet sufficient demands. Should an outbreak commence in the Northern Hemisphere or emerge first as an avian strain with few human cases, Australians may derive a time advantage in this regard.

Response planning/preparedness in place or planned

There are well-developed international, national and state plans to respond to the detection of new influenza strains, including pandemic strains. In the event of human infection in Australia, the *Australian Health Management Plan for Pandemic Influenza 2009* and allied state and territory plans will mobilise health plans across both public and private sectors, at all levels.

The control agency for infectious disease in Victoria is the Department of Health. Under the Public Heath and Wellbeing Act 2008, in a declared state of emergency, the Chief Health Officer has several specific powers to assist in dealing with an outbreak, for example, restricting movement or the use of specific premises.

Victoria has two specific plans:

- Victorian Health Management Plan for Pandemic Influenza (2007 and 2013)
- Victorian Action Plan for Human Influenza Pandemic (2012)

The latter plan is a Government-wide plan for management across state and local government and all sectors of society.

The key response issues are caring for the seriously ill within the health system and at home, and assisting the rest of the community to contain the disease and continue functioning.

Outside the health system, the main response strategies for pandemic influenza include:

- Hygiene measures e.g. enhanced hand washing
- Communication to the community, including advice about travel and home isolation or quarantine
- Containment Activities
  - Restricting public access to premises
  - Social distancing
  - Workplace surveillance and infection control enhanced
  - Usage of personal protective equipment (masks, etc)
- Business continuity strategies
- Vaccination and use of antiviral medications

The future of the risk

In the foreseeable future, the risk of new pandemic strains emerging from the traditional areas from which new flu strains emerge, in East Asia, remains real. In general, the improving general health within our community will assist in reducing vulnerability although our ageing population increases this cohort which is sometimes significantly at risk of severe illness.

The development of a "universal" vaccine that protects against all types of influenza A (seasonal and pandemic) is a real possibility in the foreseeable future, through the application of new developments in molecular virology, immunology and vaccine delivery technologies.

Websites for further hazard-specific information

Commonwealth Government Websites:

- www.dpmc.gov.au/publications/pandemic/index.cfm
- www.flupandemic.gov.au
- www.health.gov.au/internet/panflu/publishing.nsf/Content/ahmppi-2009
- www.health.gov.au/internet/panflu/publishing.nsf/Content/individuals-households-lp-1

Victorian Government Websites

- Better Health Channel – for the general public: www.betterhealth.vic.gov.au/
- Department of Health Website – for health professionals

  www.health.vic.gov.au/pandemicinfluenza/

  http://humanswineflu.health.vic.gov.au/

Plant Disease Epidemic

Introduction

In common with most economies with significant agricultural sectors, Victoria is subject to plant disease incursions. Plant disease refers to any disease of plant or plant products caused by any bacterium, fungus, protozoa, phytoplasma, virus, viroid or other organism.[37]

The entry, establishment and spread of plant diseases can affect plant industries, market access, the environment and production systems.

A major outbreak of karnal bunt (a fungal infestation of wheat) in Victoria would have major economic and social consequences as trade restrictions would be imposed by many countries. It is not currently present in Australia.

Plant disease outbreaks in Victoria

Chestnut blight

Chestnut blight (a lethal disease of chestnuts caused by the fungus Chryphonectria parasitica) was first detected in Eurobin, North East Victoria in September 2010. A survey defined the extent of the incursion to 9 groves in the Ovens Valley. In total, 5,329 chestnut and 38 oak trees were destroyed to June 2013. Owners of commercial chestnut groves received owner reimbursement costs under the Emergency Plant Pest Response Deed, a cost sharing arrangement between Commonwealth and state governments and industry. It is expected that given no further detections, Victoria will be able to declare eradication of chestnut blight in the Ovens Valley by Spring 2013 .

Myrtle rust

The fungus Uredo rangelii (myrtle rust), was found in Victoria for the first time in December 2011. It poses a threat to Victoria's nursery, forestry and beekeeping industries, as well as to public parks and gardens and native forests. It can potentially attack all species of the Myrtaceae plant family. More than 60 sites in Victoria have been infected with myrtle rust across metropolitan Melbourne and in Shepparton, Lorne, Ballarat and near Bairnsdale. Because myrtle rust is no longer contained and has become widespread, it has been declared an endemic disease in Victoria. This means that myrtle rust is not eradicable and host materials will be able to enter Victoria from NSW and Queensland without certification.

Significant government policies/strategies

Australia's biosecurity system operates under Commonwealth, state and territory legislation administered and managed by the respective agricultural and environmental agencies. The Victorian legislation (*Plant Biosecurity Act* 2010; Plant Biosecurity Regulations 2012; and international agreements that control the transportation of agricultural commodities) cover a range of activities involving domestic and international movement of people and goods into and around the country, and the export of agricultural commodities.

State and territory governments are responsible for plant biosecurity services within their respective borders. A national approach to the management of plant biosecurity in Australia is maintained through the national committees framework. The sequential approach of prevention, eradication, containment and asset-based protection is utilised.

Within government, Australia's partnership approach to biosecurity is underpinned by the Intergovernmental Agreement on Biosecurity[38] (IGAB), signed in January 2012. The IGAB strengthens the working partnership between the Commonwealth and state and territory governments by defining the roles and responsibilities of governments and outlining priority areas for collaboration and to improve the national biosecurity system.

37 Information about plant pests can be found in the section Insect pest incursions

38 www.coag.gov.au/node/47

The 2010 National Plant Biosecurity Strategy[39] (NPBS) outlines strategies to strengthen Australia's plant biosecurity system to 2020. Through its implementation, the NPBS is continuing to provide the focus and strategic direction for national plant biosecurity activities and in doing so, strengthening the current plant biosecurity system.

The Biosecurity Victoria (BV) Division of Victoria's Department of Environment and Primary Industries (DEPI) delivers biosecurity and product integrity programs across the terrestrial and aquatic plant and animal sectors. Activities are guided by the Biosecurity Strategy for Victoria.[40]

Mitigation controls in place by three levels of government

Preventing outbreaks and incursions is a combined effort of governments and the private sector. The primary controls to prevent insect pest incursions are border controls at national and state levels. Commonwealth agencies have a major role to play in this process.

Minimising the negative impacts associated with incursion involve:

- prevention programs that minimise the risk and occurrence of exotic pests and disease incursion and spread
- a surveillance strategy that enables early detection or determination exotic pest and disease presence and distribution status
- training and industry engagement to enhance biosecurity awareness, response and compliance
- a preparedness and resourcing framework for responding to new or emerging pest and disease incursions

Response planning/preparedness in place or planned

The Emergency Plant Pest Response Deed[41] covers the management and funding of responses to emergency plant pest incidents; all states and territories are signatories to this agreement.

Underpinning the EPPRD is PLANTPLAN, (the Australian Emergency Plant Pest Response Plan) the agreed technical response plan for an emergency plant pest incident. It provides nationally consistent guidelines for response procedures, outlining the phases of an incursion, as well as the key roles and responsibilities of industry and government during each of the phases.

In Victoria, the control agency for plant disease is the Department of Environment and Primary Industries.

The future of the risk

Increasing global trade and travel could potentially change the landscape for biosecurity threats. As Victoria's climate is projected to become warmer and drier, this will change the habitat for insects as well as their hosts such as orchard trees. It is very likely that warmer weather pests and diseases will start marching southwards.

Websites for further hazard-specific information

Plant Health Australia lists a number of industry biosecurity plans relevant to plant diseases.

www.planthealthaustralia.com.au/

Cooperative Research Centre:

www.crcplantbiosecurity.com.au/

Victoria:

www.depi.vic.gov.au/agriculture/pests-diseases-and-weeds

www.depi.vic.gov.au/agriculture/about-agriculture/biosecurity

39 www.planthealthaustralia.com.au/national-programs/national-plant-biosecurity-strategy/

40 www.dpi.vic.gov.au/agriculture/about-agriculture/biosecurity/strategy/full-document

41 www.planthealthaustralia.com.au/biosecurity/emergency-plant-pest-response-deed/

Storm

Introduction

Storm risk in this context includes wind storms, dust storms, blizzards, storm tides, and severe thunderstorms including hail storms, tornadoes, and heavy rain. Storm events affecting land based communities are generally divided into two broad categories: severe thunderstorms and severe weather.

Typical weather patterns that can cause severe thunderstorms and severe weather in Victoria include:

- vigorous, squally cold fronts
- strong pressure gradients, often ahead of cold fronts, causing land gales – particularly in exposed alpine regions
- recently decayed tropical cyclones bringing increased moisture levels to southern regions and sometimes interacting with cold fronts
- East coast lows: deep low pressure systems that can form in the Tasman Sea and affect the Gippsland coast
- deep, southern low pressure systems that can produce ocean swells that reach the Victorian coastline causing dangerous surf, coastal inundation and erosion.

Thunderstorms are most likely to occur during the period October to April, primarily due to the warm temperatures and increased moisture levels in the atmosphere. Only about 10% of thunderstorms are severe, but these account for approximately 90% of the damage produced by all thunderstorms. However they all produce lightning which can cause death, injury and damage.

Wind storms can occur at any time of year although are more common in the winter and spring months when intense low pressure systems and cold fronts are stronger and more common.

Heavy rainfall is mostly a winter-spring phenomenon in Victoria, also associated with the frequent passage of fronts and low pressure systems. However some major events have occurred in the summer half-year as systems of tropical origin extend or move south.

Blizzards are violent and very cold winds loaded with snow. Blizzards are confined to Alpine areas in Victoria and mainly during the winter and early spring months but can also occur in autumn.

Consequences of Storms in Victoria may include:

- loss of life or serious injury
- damage to or loss of:
  - key infrastructure – road, rail, public buildings
  - utilities – power, water, gas, telecommunications
  - private property
  - industry/ business
  - agriculture – crop and livestock
- damage to the environment.

Because of their intensity and sudden impact, severe storms can cause significant spikes in the number of calls to 000 and requests for emergency service attendance. In addition, storms can generate extremely large insurance payouts for damage to insured buildings, cars and crops.

Recent damaging storms in Victoria

13 November 1976 – Tornado near Sandon in central Victoria

Two people killed, winds estimated at 300 km/h, trail of destruction 400 m wide and 6 km long.

2 April 2008: Wind Storm

Strong northerly winds developed across central and western Victoria. Maximum wind gusts at Dunns Hill of 115 km/h. Areas of raised dust from the western half of the State, with visibility down to 200 m in some places. Flying vegetation and debris caused major disruption to Melbourne traffic and public transport systems and extensive damage to the electricity distribution network. Lanes were closed on the Westgate bridge with wind gusts close to 120 km/h.

6 March 2010: Labour Day Long Weekend Hailstorms

Severe thunderstorms developed to the north-west of the Melbourne bringing isolated severe wind gusts. Flash flooding was widespread; hailstones measuring 2-10 cm caused damage to homes and buildings mainly in the Knox area. SES received 7,500 requests for assistance. Insurance claims exceeded $1 billion.

4 February 2011: Severe Thunderstorm

Severe thunderstorms developed over Victoria as a result of the tropical moisture associated with Tropical Cyclone Anthony and ex Tropical Cyclone Yasi, extending from Central Australia, through Mildura, Melbourne, to north-eastern Tasmania. The extremely high humidity levels resulted in record daily and multi-day rainfall totals to areas of north-east and south-east Victoria. A damaging microburst caused damage west of Melbourne at Laverton with wind speed strengthened from calm to 131 km per hour in six minutes causing damage to vegetation and structures within an area of approximately one square kilometre. VICSES received more than 6000 requests for assistance.

28 September 2011: Severe Thunderstorm

Thunderstorms and heavy rain occurred across Victoria. Melbourne recorded its wettest September day with more than 48 mm of rain falling in the city in the 24 hours. Electrical storms disrupted flights and public transport and left tens of thousands of homes without power. Hail caused significant crop damage in the Mildura area. In the north-east of Victoria, Tolmie weather station recorded the highest record of 101 mm in a day.

25 December 2011: Christmas Day Severe Thunderstorm

Thousands of homes were damaged when thunderstorms swept across Melbourne, bringing flash flooding and hail. Over a seven hour period up to five long-lived supercells (very severe long lasting thunderstorm cells) moved eastwards across Melbourne. The northern suburbs of Eltham, Broadmeadows and Keilor were among the worst hit. There were reports of two tornadoes in Fiskville and Melton. In some places cars were upended. VICSES received more than 4200 requests. Insurance payments exceeded $700 million.

21 March 2013: Tornado

At least 20 people were injured and taken to hospital, with two in a critical condition, after two tornadoes with wind gusts between 180 and 250 km/h cut a path of destruction across Victoria's north-east. The SES received 150 calls for assistance when the tornadoes hit the towns of Yarrawonga, Mulwala, Bundalong, Rutherglen and Euroa causing damage to properties, businesses and infrastructure.

25 September – 1 October 2013 Severe Windstorms

A series of strong windstorms affected most parts of Victoria for several days. Gusts of up to 142 km/h were recorded, putting the strength of the storms into the range of Category 1 tropical cyclones. The SES received over 3,600 calls for assistance. Apart from fallen trees damaging cars and houses, power outages affected many thousands of premises.

Mitigation controls in place

- Engineering standards for key infrastructure
- Drainage systems – e.g. retention basins to control flash flooding
- Vegetation management
- Bureau of Meteorology forecast and warning services
- Community warnings
- Community education – StormSafe
- Building standards/regulations

Response planning/ preparedness in place

The control agency for storm is the Victoria State Emergency Service (VICSES). It has published its 2011 State Emergency Storm Plan.[42] Severe thunderstorm warnings are issued by the Bureau of Meteorology, and augmented on TV and radio by VICSES preparedness messages.

The future of the risk

La Niña is the positive phase of the El Niño Southern Oscillation. Historically, La Niña years deliver more moisture to Australia, because warm waters gather closer to the east coast. Combined with increasing trade winds, this provides more moisture in the atmosphere and directs it towards eastern Australia. The 2010–12 La Niña event was one of the strongest on record, with 2010 and 2011 the second and third wettest calendar years on record. La Niña events normally last for around a year, however they can be shorter, or much longer and with climate change, more frequent and severe La Niñas could lead to severe storms.

Websites for further hazard-specific information

SES StormSafe Program

www.ses.vic.gov.au/prepare/stormsafe

www.ses.vic.gov.au/prepare/stormsafe emergency-plans-and-kits

42 www.ses.vic.gov.au/prepare/em-planning/state-plans

Transport Infrastructure Emergency

Introduction

Victoria has a highly-developed complex network of transport infrastructure that underpins much of the State's economic and social functioning. Specifically, the road network and the tram and train networks rely on a range of physical, electromechanical and electronic infrastructure elements to maintain safe, effective and punctual operations.

There is a risk that damage caused by failure of or within the transport system infrastructure would impair the operations of those networks, as well as causing death and injury. Economic consequences through repair costs and disruptions to normal flows of people and goods could be high.

The risk assessment did not cover high-frequency road crashes, as individually they do not cause a significant systemic impact, nor did it cover marine or aviation infrastructure.

Specific examples

The first example involves a convergence of transport modes where a lack of mitigating controls realised the risk. The second is a technical system failure within one transport mode which had a systemic effect across other modes.

Kerang Train Crash

In June 2007, a southbound V/Line passenger train service consisting of a locomotive and a set of carriages, was run into by a northbound semi-trailer truck at a level crossing where the Swan Hill railway line crosses the Murray Valley Highway. Eleven people died and the lines were shut for several days causing disruption to freight and passenger movement.

Burnley / Domain Tunnel Closure

On 3 October 2012, the CityLink Burnley and Domain Tunnels were closed due to a technical failure. The system error was first detected about 4.10 am and was not resolved until late in the day significantly affecting Melbourne's traffic for the entire day. The problem affected the tunnels' incident detection and safety systems that are activated in the case of a crash, making the tunnels unsafe for traffic. The closure was an example of how significant a computer or SCADA failure can be to the transport system.

Mitigation controls in place

Much of the transport system is run by commercial organisations, which have developed their mitigation strategies to address operational and business risk. Whilst this provides some comfort for the community, the Government's core mitigation strategies are:

- Legislation and regulation including regulatory oversight by state and federal authorities including:
  - National Transport Commission initiatives for Heavy Vehicle Regulation and the National Rail Safety Regulator
  - Transport Safety Victoria (discussed below)
  - VicRoads (discussed below)
  - Construction Standards for bridges, tunnels and roads.
- Engagement with industry to influence preparedness and share risk information: Trusted Information Sharing Networks (TISN) and Security Continuity Networks (SCN), Transport Security Precincts (intermodal interface for public transport).

Transport Safety Victoria (TSV) is Victoria's integrated safety regulator for bus, maritime and rail transport. It is headed by the Director, Transport Safety (Safety Director) whose statutory object is to independently seek the highest transport safety standards that are reasonably practicable, consistent with the transport system's vision and objectives under the *Transport Integration Act 2010* (Vic).

As Victoria's transport safety regulator, TSV:

- licences, registers and accredits operators and other industry participants
- monitors the transport industry's and participants' systems for managing safety risks
- monitors compliance with transport safety legislation
- takes enforcement action as appropriate to promote safety outcomes in Victoria.

Response planning/preparedness

The control agencies in Victoria are:

- Victoria Police for road, rail and tram emergencies
- Public Transport Victoria (PTV) for public transport disruption
- VicRoads for emergencies related to roads/bridges/tunnels

Response and preparedness planning rests predominantly with the operators of transport infrastructure. Public Transport Victoria (PTV) is responsible for coordinating systemic responses to a significant transport disruptive event affecting the movement of people.

Transport operators have security and emergency plans across the transport system, including the Melbourne underground rail loop, stations, key bridges, control centres, depots and stabling areas etc. The West Gate Bridge has extensive security and emergency management measures in place and emergency response plans are exercised every year as are the plans of all the key transport operators.

Police and emergency services have response plans in place should an emergency occur as a result of one or more hazards. Some of these response plans need to be quite specialised due to the complex physical environment around transport infrastructure. An example is access to tunnels during an emergency where trains are disabled and there is no power or lighting to support the response.

The City of Melbourne has prepared a CBD Safety Plan, of which public transport coordination is a key feature.

In all cases, there is a range of support agencies including rescue services (fire services and VICSES) and the transport operators. Specialised equipment is maintained by emergency service agencies and transport operators to protect and support responders when operating in dangerous transport infrastructure environments.

The future of the risk

As future transport networks become more complex it is likely that the associated risks would also increase. The demand for transport services, aging infrastructure, emerging technologies and severe weather events all contribute to the risks. Some system components can demonstrate unpredictable behaviour due to conditions at the time of the emergency. As systems develop and become more complex they may generate new risks which increases the difficulty of effective risk and problem definition. Clear risk definition and description is the basis for effective assessment and management so understanding emerging risks is a key future challenge.

New technology, such as driverless trains and automated road vehicle safety systems are still being assessed. However, based on the experience of the aviation sector, the effect of human factors as an input to the system is likely to remain a key hazard contributor to transport systems and intermodal interface.

Climate change leading to increased severe weather is likely to impact on aging infrastructure. This indicates a need to assess and possibly modify construction standards to ensure more resilient infrastructure in the future.

Distribution of the hazard/risk across Victoria

The transport system is a geographically spread network and as with any network there are key nodes where criticality of systems failure is emphasised. These may include key bridges or intermodal hubs. Loss of these nodes could significantly impact on the movement of people and freight.

Websites

www.dtpli.vic.gov.au/

http://ptv.vic.gov.au/

www.transportsafety.vic.gov.au/

www.tisn.gov.au/Pages/default.aspx

5. APPENDIXES

Appendix 1
Descriptive definitions

The following sets out the meaning of the key terms used in this risk report, and some associated terms.

Consequence

In risk management, consequences are the outcomes of the impact of the hazard event. Several categories of consequence are often assessed, such as on people, economy, environment.

Estimating potential consequences involves an understanding of both:

> the **exposure** of assets and people to the impacts of hazard agents e.g. flood, fire, hazardous materials escapes.

> their **vulnerability** i.e. propensity to be damaged by the impact, for example buildings collapsing in earthquakes.

Emergency

An emergency is an event which is immediately threatening to life, health, property and/or the environment. Emergencies vary in size and impact from very small to extremely large, when they may be referred to as a *disaster*. While it is common to differentiate between 'natural' and 'man-made' or 'technological' disasters, similar risk management and emergency management tools and techniques are applied to both.

Emergency management

Emergency management means the organisation and management of resources for dealing with all aspects of emergencies, which are often categorised as prevention/mitigation, preparedness, response and recovery.

Emergency risk

This risk report is concerned with *emergency risks*, that is risks that, if realised, would result in emergencies.

It is not primarily concerned with other types of societal risks, such as financial/economic, military/strategic or lifestyle/health.

Hazard

A hazard is a source of potential harm. In this report, bushfire, flood and storm etc are referred to as hazards. A risk assessment differs from a hazard assessment in that risk assessment emphasises the possibility of damage or loss to something from a hazard event, and rates it in such terms as moderate, high or extreme. A hazard assessment is more likely to refer to exposure, i.e. the places where the hazard is present or may manifest, and which can be more easily displayed on maps.

Hazard Event

Another term for emergency.

Likelihood

A general description of probability – the chance of something occurring.

Mitigation

Measures aimed at decreasing or eliminating the consequences of emergency impacts. Mitigation mostly refers to actions implemented prior to the onset of an emergency, however it can include actions that are implemented at or just prior to the outbreak of an emergency.

Mitigation controls

A term that covers a wide range of strategies and actions that reduce risk i.e. reducing the likelihood of the specific level of consequence occurring.

Controls can operate to reduce the **exposure** of assets to hazards – the most obvious is to separate them by physical distance, which is why land use planning that restricts building development in high-hazard locations is such a powerful mitigation measure. Prior evacuation reduces the exposure of people to flood or bushfire. Levees prevent flood water reaching buildings.

Other controls can also reduce the **vulnerability** of assets. This can be achieved via government regulation, such as building codes, that require structures and materials to have damage-resisting properties. People can reduce their own vulnerability to loss through emergencies by being aware of local hazards, having adequate insurance, ensuring their own preparedness and attending to sources of information and warnings.

Many mitigation controls are most effective on lower-impact emergencies and may become less effective or ineffective in extreme-case emergencies. As an example, levees are only effective when flood waters remain below their maximum height.

Prevention

1. Actions that operate to prevent a specific emergency from occurring
2. Alternative term for mitigation

Recovery

Recovery is the assisting of persons and communities affected by emergencies to achieve a proper and effective level of functioning.

Residual Risk

Recognising that many emergency risks have not been reduced to insignificance through mitigation controls, residual risk remains. It is residual risk that is revealed in this risk assessment, in other words, with all current controls in place and working to their normal level of effectiveness. Residual risk gives rise to the need for preparedness, response and recovery.

Response

Actions taken during an emergency to ensure that its consequences are minimised. Response activities include firefighting, rescue and managing evacuations.

Risk

Risk is formally defined as the effect of uncertainty on objectives.[43] Societal objectives such as those relating to the economy, employment, health, education, personal wellbeing, the environment and community life in general are threatened by emergencies whose location, likelihood and consequences are uncertain. To the extent that they can be understood, risks can be reduced by a range of active and passive measures.

Risk is often defined, for risk assessment purposes, as the likelihood that a particular level of impact (consequence) will occur. This approach is used in Victoria and for this report.

For example, a flood of a certain size (depth and extent of water spread) at a particular location might be assessed as having a 1% likelihood of occurrence[44] in any given year. Such a flood may inaccurately be described as the '1 in 100 year' flood, noting that such floods will probably occur more often than once per century.

The highest risk emergencies are those that are most likely to happen with the highest impacts/consequences if they do.

Risk assessment and risk management

Risk management comprises a series of coordinated activities or steps in the management of risk. The steps are:

- Establish the context – including the risk criteria

- Risk identification – what are the risks to be assessed and managed?
- Risk analysis – what are the characteristics and severity of the selected risks?
- Risk evaluation – comparing results of risk analysis with risk criteria

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- Risk treatment – actions that avoid, reduce, share or accept the risk

Of the steps in risk management shown above, the three highlighted steps together comprise risk assessment.

These steps are embedded in a key activities essential to effective risk management that include communication and consultation as well as monitoring and review.

State level

A state-level risk assessment assesses risk for the whole state (or territory) rather than some part of the state such as a municipal district or a region. State level is sometimes termed as state wide, emphasising that the assessment covers the whole area. This assessment assumes the whole area to be equally at risk, even though in reality this is not the case. To differentiate between parts of the state requires smaller-area risk assessments to be undertaken on a consistent basis. The benefit of a state-level assessment is that it provides an overall picture to enable strategic decision-making.

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43 AS/NZS ISO 31000:2009 *Risk Management-Principles and Guidelines* p. 1

44 Typically, the calculated likelihood is of exceedance, i.e. the probability that a flood of that size or greater will occur.

Appendix 2
More detail about the risk assessment process and the risk charts

How is each risk analysed for likelihood and consequence?

The process used for the risk assessment involved workshops for each risk with experts drawn from government, emergency services, universities and the private sector, who identified four likely and plausible impact scenarios for Victoria – low scale, medium, high and extreme/worst case when considered at state level. Where historical events were used, their consequences were adjusted to current equivalents, e.g. for the dollar value of losses. Where no such event had occurred, plausible emergency scenarios were identified.

Following that, the possible consequences of each emergency scenario were described in some detail using the six consequence categories of the National Emergency Risk Assessment Guidelines (NERAG) 2011.[45]

The potential **consequences** for each scenario are described using the following six categories:

- **People**: covering not only fatalities but also the level of pressure on the health system and the arrangements for assisting affected people with emergency food, clothing, finance and temporary housing.
- The functionality and continued supply of essential services delivered by **infrastructure**, including transport, fuel, water, telecommunications, food and money supply.
- **Public administration**: The ability of state and local governments to continue to govern, have the community's confidence and maintain existing programs and activities.
- **Environment**: The ability of significant ecosystems to continue functioning.
- The **economy** of the State, considering the value of costs and losses, industry disruption and loss of production. Note that Victoria's assessment uses higher thresholds for economic impact than shown in the NERAG.
- The **social setting** which reflects the level of the community's ability to maintain functioning, resilience, social fabric, cultural values and heritage.

The consequence scale aligns closely to that found in the NERAG, noting that the *Insignificant* level has been omitted. Each consequence category has four levels of severity: minor, moderate, major and catastrophic. For each scenario assessed, the highest consequence level is taken as the overall consequence level.

When the consequence level for each scenario is agreed, each scenario is assessed by the expert group for **likelihood**, and plotted as a point on a log-log scaled risk matrix.

Chart 1: The risk chart

The risk points for the four scenarios are mathematically consolidated into a cell location on Chart 1 on page 7. This process has two steps. The first is the generation of a line of best fit through the points of the four scenarios on the scaled risk matrix. The second step is the derivation of a single point to represent the length and position of the risk curve. This single point is determined by calculating the centre of the trapezoidal shape (the centroid) beneath the line of best fit.

All centroids are then shown together on a single risk chart to highlight their relativities. Chart 1 on page 7 places the risks in the cells where their centroids fall. It is not possible to show specific likelihood and consequence numeric values or descriptors for a centroid, as it represents four individual scenarios that have been consolidated. It would not be valid to impute scales to the chart's axes, i.e. the maximum value of the likelihood scale does not represent 100%, and the lowest value does not approach zero.

The risk chart is a new representation of the relative significance of emergency risks.

45 www.em.gov.au/Publications/Program%20publications/Pages/NationalEmergencyRiskAssessmentGuidelines.aspx

Charts 2 and 3: The medium and extreme impact scenarios

The placement of the risks in the charts on pages 8 and 9 reflects the likelihood of the consequence for the medium and extreme impact scenarios as estimated by the risk assessment workshops. While the scale of the charts is linear for consequence, it is logarithmic on the likelihood scale, to provide greater separation of low likelihood scenarios. The results shown are not able to be strictly compared with Chart 1 which is a mathematical derivation from four scenarios. However, Charts 2 and 3 are scaled identically and can be compared. In Chart 3, most of the hazard impact scenarios display much higher consequence at lower likelihood.

How accurate and reliable are the risk assessments?

Risk assessment involves thinking about uncertain events, including those that may never have happened in Victoria or of a magnitude not yet experienced. Although the assessments are done by experts in each field, the methods used have not, for the most part, involved detailed statistical analyses, but relied on expert estimates, a more qualitative process.

Therefore, the risk assessments shown in this report cannot be taken as *highly* reliable, in particular for the higher levels of consequence, where uncertainty is greatest. The methodology applied is intended to provide a comparative picture of emergency risks from a variety of hazards. The level of precision is sufficient to allow comparisons between the different risks.

The report represents expert opinion using a standard, nationally-approved process of emergency risk assessment.

All the risks shown in this risk report have the potential to manifest as extremely high consequence emergencies in Victoria, with varying degrees of likelihood.

PHOTO CREDITS

Photo Credit	Page
East Gippsland Flooding 2012, Department of Environment and Primary Industries. Photographer: David Young.	6
Kilmore Public Hall meeting regarding upcoming fire season. 23rd September 2009. CFA Strategic Communications. Photographer: Keith Pakenham.	23
Yallourn Northern Batter Environment and Failure. Yallourn Coalmine, La Trobe Valley. Source – Department of Environment and Primary Industries.	38

Accessibility

If you would like to receive this publication in an accessible format please telephone Victorian Government Contact Centre on **1300 366 356**

ISBN 978 1 92 5140 04 0 (print)

ISBN 978 1 92 5140 05 7 (pdf)

State Government Victoria

DTPLI-8186/14