

# Emergency risks in Victoria

July 2020

Issued by the State Crisis and Resilience Council (SCRC)



# Publication information

## Emergency Risk Assessment Review 2016-17.

This version of Emergency Risks in Victoria has been revised to include the Results of the State Emergency Risk Assessment Review 2016-17.

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

This document contains Standards Australia Ltd and ISO copyrighted material from the National Emergency Risk Assessment Guidelines that is distributed by SAI Global on Standards Australia Ltd and ISO's behalf. It is reproduced in accordance with the terms of SAI Global Ltd's Licence 1411-c083 to the Commonwealth of Australia ('the Licensee').

© State of Victoria through the Department of Justice and Community Safety 2020



Creative Commons Attribution 4.0 Australia licence

## Disclaimer

The Victorian Government Department of Justice and Community Safety, in consultation with emergency management professionals and subject matter experts, exercises care in the compilation and drafting of this publication; however, the document and related graphics could include technical inaccuracies or typographical errors, and the information may not be appropriate to all situations.

In no event shall the Victorian Government (acting through the Department of Justice and Community Safety) be liable for any damages whatsoever, whether in an action of contract, negligence or other tortious action, arising out of or in connection with the use of or reliance on any of the information in this publication.

# Contents

<b>Introduction</b>	<b>4</b>
What is this report about?	4
What is this report for?	6
<b>Background</b>	<b>8</b>
Scope of risks	8
Who is responsible for managing emergency risks?	9
This report	10
How are risks identified?	10
<b>Emergency management arrangements in Victoria</b>	<b>12</b>
<b>Overview of Victoria's emergency risks</b>	<b>14</b>
Risk characterisation (evaluation) matrices	14
What does the assessment tell us about emergency risks in Victoria?	17
Comparison of assessment results with the 2012-13 study	18
<b>Emergency risk descriptions</b>	<b>20</b>
Bushfire	20
Earthquake	24
Electricity supply disruption	30
Emergency animal disease	34
Emergency plant pest	38
Flood	44
Gas supply disruption	50
Hazardous materials incident	54
Heatwave	58
Maritime emergency	62
Mine emergency	68
Pandemic influenza	72
Storm	76
Water supply disruption	80
<b>Appendix 1 – Descriptive definitions</b>	<b>86</b>
<b>Appendix 2 – More detail about the emergency risk assessment process</b>	<b>90</b>

# Introduction

## What is this report about?

This publication reports the results of Victoria's state-level emergency risk assessment. It contains information about Victoria's significant emergency-related risks, including a comparison of their severity, and the institutional arrangements in place to manage these risks.

This is the second edition of Victoria's emergency risk register, which includes updated information from the State emergency risk assessment review completed in November 2017. The method used for this risk assessment followed the National Emergency Risk Assessment Guidelines (NERAG) Second Edition<sup>1</sup>.

The responsibility for managing emergency risks is shared across a range of 'risk owners', including institutions, groups and individuals<sup>2</sup>. The risk management controls (precautions) detailed in this publication focus on institutional arrangements,

particularly the strategies and actions of government and non-government organisations with key roles in emergency risk reduction.

This work is consistent with the priorities for action in the Sendai Framework for Disaster Risk Reduction 2015-2030.<sup>3</sup> In particular, Priority 1: Understanding disaster risk – to make non-sensitive hazard-exposure, vulnerability risk, disaster and loss-disaggregated information freely available and accessible, as appropriate.

---

1 NERAG (Second Edition) is published by the Australian Institute of Disaster Resilience (AIDR) – Handbook 10

2 Risk Ownership Framework for Emergency Management Policy and Practice, Bushfire & Natural Hazards CRC / Victoria University (2017)

---

3 Adopted at the Third UN World Conference in Sendai, Japan on 18 March 2015

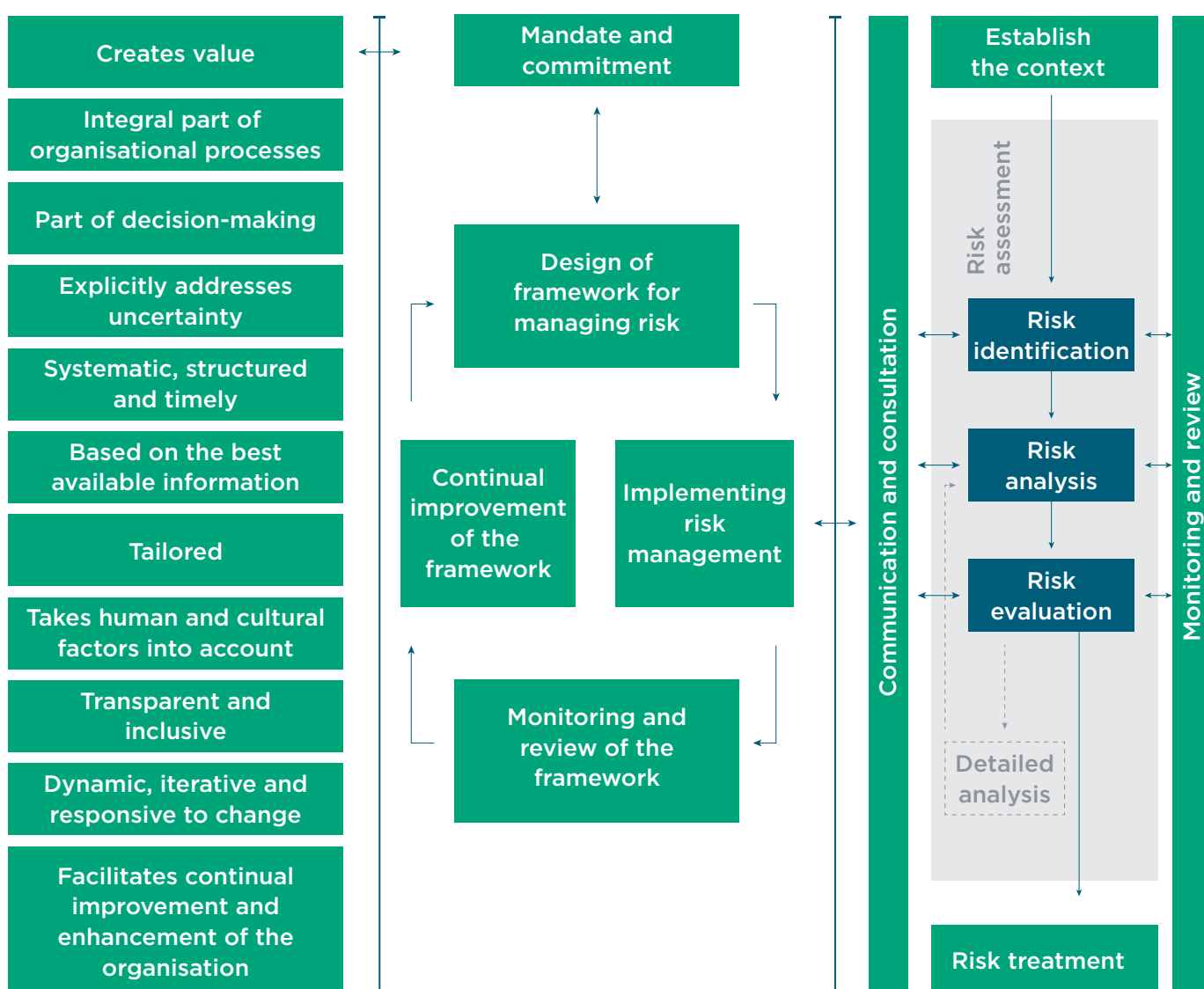


Figure 1: NERAG principles, framework and process

In an emergency management context, risk management is a process that involves dealing with risks to the community arising from emergency events

(NERAG, p. 16)

## What is this report for?

This report supports a range of users, including state and local government officials, non-government organisations, businesses, researchers and communities to better understand Victoria's emergency risk profile. It sets out what is being done to manage those risks, and sources of further information to better support strategic decision-making. It is an important risk communication strategy forming the basis for priority setting at state level.

The report does not detail the emergency risks for any particular location within Victoria. Localised emergency risk information is published by emergency services as part of their community awareness activities, particularly for bushfire and flood. In addition, regional and municipal emergency management plans provide some information where publicly available, as do agency plans relating to specific hazards.

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

Victorian Government, We work as one for emergencies:

[www.vic.gov.au/we-work-one-emergencies](http://www.vic.gov.au/we-work-one-emergencies)

Emergency Management Victoria, Vic Emergency:

<https://emergency.vic.gov.au/prepare>

Victoria State Emergency Service, Preparing

for emergencies: [www.ses.vic.gov.au/get-ready](http://www.ses.vic.gov.au/get-ready)

Australian Red Cross, Emergency Preparedness:

[www.redcross.org.au/prepare](http://www.redcross.org.au/prepare)

Australian Institute for Disaster Resilience,

Knowledge Hub: <https://knowledge.aidr.org.au>

Australian Government, Department of Home

Affairs: [www.homeaffairs.gov.au/emergency/files/australian-disaster-preparedness-framework.pdf](http://www.homeaffairs.gov.au/emergency/files/australian-disaster-preparedness-framework.pdf)

Australian Government business support website:

[www.business.gov.au/Risk-management/Emergency-management/How-to-prepare-an-emergency-management-plan](http://www.business.gov.au/Risk-management/Emergency-management/How-to-prepare-an-emergency-management-plan)



# Background

The Victorian Government is publishing this risk assessment report under a national initiative known as the National Strategy for Disaster Resilience (NSDR), which has been adopted by all Australian states, territories and the Commonwealth. Under the NSDR, all states and territories published their emergency risk assessment to demonstrate that they have an appreciation of the major emergency-related risks facing their state or territory, and to detail what is being done to manage those risks.

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 risk profile to support strategic decision-making.

The cost of managing emergencies in Victoria, and nationally, is expected to increase significantly in the future. The total economic cost of natural disasters<sup>4</sup> in Victoria over the past decade averaged \$2.7 billion per year, or 15 percent of the national cost. Hail accounted for 36 percent of this cost, 27 percent due to storm and

26 percent as a result of bushfire. The total economic cost of natural disasters in Victoria will reach \$3.2 billion a year by 2050, a growth rate of 3.6 percent per year <sup>5</sup>.

## Scope of risks

Emergency events and disasters stem from a range of natural, biological, technological, industrial and other human phenomena. These events impose significant social, environmental and economic costs on Australia including:

- fatalities, injuries and illness
- direct damage to property, infrastructure and facilities
- financial costs and economic losses
- ecosystem impairment and biodiversity loss
- social and cultural losses (NERAG, p.1)

The emergency risks included in this report have been assessed as significant for Victoria, from a broader selection of the risks that exist. They do not represent all of Victoria's emergency risks, nor all the ways that emergency-related risk could manifest in Victoria.

---

4 Natural disasters do not encompass the full scope of emergency types considered in the assessment

---

5 Building resilience to natural disasters in our state and territories – Deloitte Access Economics, November 2017 (this report excludes heatwave)



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 websites:

### Terrorism

Victoria Police, State security and counter-terrorism: [www.police.vic.gov.au/state-security-and-counter-terrorism](http://www.police.vic.gov.au/state-security-and-counter-terrorism)

Australian National Security: [www.nationalsecurity.gov.au](http://www.nationalsecurity.gov.au)

### Cyber security

Victorian Government Cyber Security Strategy: [www.vic.gov.au/victorian-government-cyber-security-strategy](http://www.vic.gov.au/victorian-government-cyber-security-strategy)

Australian Cyber Security Centre: [www.cyber.gov.au](http://www.cyber.gov.au)

Australian Signals Directorate: [www.asd.gov.au](http://www.asd.gov.au)

## Who is responsible for managing emergency risks?

Governments have key responsibilities for the institutional arrangements in place to manage emergency risks. In Australia, this responsibility is borne largely by state and territory governments (supported by local governments) through the implementation of frameworks that support emergency risk reduction, and other objectives. Responsibilities include emergency management arrangements, community awareness programs, land-use planning, building controls, and health and safety requirements across various sectors.

Other community sectors (groups) and individuals also have emergency risk reduction responsibilities, which can be identified through the ownership (or management responsibility) of the asset at risk from an emergency<sup>6</sup>. Examples of these responsibilities include insurance, household planning and business continuity planning. While governments invest directly through their budget allocations and grants schemes, much of the total cost is dispersed through the private sector and households through the operation of various regulatory frameworks<sup>7</sup>.

The report of the 2009 Victorian Bushfires Royal Commission recognised the importance of a shared responsibility for the management of bushfire risks:

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.<sup>8</sup>

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,

---

6 Risk Ownership Framework for Emergency Management Policy and Practice, Bushfire & Natural Hazards CRC / Victoria University (2017), 7 – 11

7 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

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

and the Victorian Government's 2012 White Paper, Victorian Emergency Management Reform.

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.

While resilience is a shared responsibility between governments, communities, businesses and individuals, there is an expectation that government will take appropriate measures to manage risks to assure 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 well-placed to manage their own risks.

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

## This report

While an emergency might be a totally unexpected event for some residents of an area, it is likely that experts knew the possibility already existed, but that knowledge may not have been widespread in the community. A disaster resilient community is one where people understand the risks that may affect them and others in their community.

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 bushland and 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.

NERAG provides a contextualised, emergency-related risk assessment method consistent with the Australian Standard AS/NZS ISO 31000:2009 Risk management – principles and guidelines. NERAG's purpose is to:

- enable consistent and rigorous emergency-related risk assessments
- increase the quality and comparability of risk assessments
- improve the national evidence base on emergency-related risks. (NERAG, p. 3)

The outputs from NERAG risk assessments are intended to improve decision making when allocating scarce resources for risk treatment and emergency prevention and preparedness measures.

The next two sections explain Victoria's emergency management arrangements and an overview of Victoria's significant emergency-related risks.

The fourth section provides more detail about a number of risks for Victoria, and sets out how governments and communities are managing those risks. It also includes information about which emergency management organisations within the State handle actual emergencies when they occur, and links to other sources of information.

In the Appendix to this Part is a glossary that explains the technical terms used, such as risk and emergency risk, and an explanation of the risk assessment process.

## How are risks identified?

Sources of risk – including hazards, potential impacts, current controls, the associated risks relating to the established context, and elements at risk and their associated consequences – are identified and described on the basis of available information and knowledge, and in consultation and engagement with all relevant stakeholders (NERAG, p.19).

Senior representatives from Victorian Government departments and agencies identified a range of

potential high-priority risks for assessment, based on recent experience of emergencies in Victoria and Australia, and on 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 identification of emergency risks included in each project has been refined over time, with four state-level emergency risk assessment projects undertaken since 2006<sup>9</sup>. The governance for each project included a steering committee, consisting of high-level officers from relevant state government departments and agencies.

The steering committee determined the emergency risks to be included in each project – some high priority risks have been included in all four.

---

9 The 2006 state-level emergency risk assessment was a pilot project to test the risk assessment methodology.

# Emergency management arrangements in Victoria



Victoria has a long history of emergencies, some of them highly destructive, and has developed a capability for dealing with such events. Many organisations in the community, including the emergency services, play a part. The activities of these organisations, involving both volunteers and permanent staff, need to be coordinated to ensure agencies and resources are brought together to effectively support affected communities.

Emergency management in Victoria is underpinned by legislation, structures and plans which are established to bring together the endeavours of government, voluntary and private organisations and communities. A comprehensive approach is used, which includes management arrangements for prevention (mitigation), response and recovery. These arrangements deal with emergencies of all sizes, from small to very large. In particular, they deal with emergencies where more than one organisation is involved.

The Emergency Management Manual Victoria, in particular Part 3, the State Emergency Response Plan and Part 4, the State Emergency Relief and Recovery Plan, set out these arrangements in detail.

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, and using the defence forces.



# Overview of Victoria's emergency risks

The results of the risk assessment are illustrated in the risk evaluation charts. Risks are displayed in relationship to each other in a risk matrix. The information in the charts is derived from emergency risk assessments undertaken in 2016-17, which was a review of the 2012-13 study. All of the risks shown in the charts have potentially very severe consequences if realised.

## Risk characterisation (evaluation) matrices

The risk evaluation matrices have two axes—likelihood and consequence. The risk level is greatest in the top right corner, and least in the bottom left corner. To display the wide-ranging risk levels derived from the analyses, the scales on the matrices are logarithmic (log10), that is each ascending scale point represents an order of magnitude increase. Appendix 2 on page 90 contains detail about the risk assessment process used.

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

The position of each risk assessed is a direct plot of the likelihood of the consequences of two emergency scenarios – credible worst case [Figure 2] and high impact [Figure 3]. The assessment of low and medium impact scenarios can provide a broader characterisation for each emergency risk; however they do not evaluate as significant risks at state level. As such, these scenarios were not included in this risk assessment review.

The risk characterisations are considered to be realistic as the same methodology has been systematically applied to all assessments. Further, this is the third State-level emergency risk assessment project undertaken since 2008, with reasonable consistency in assessment results for similar emergency scenarios.

Key

 Bushfire

 Earthquake

 Electricity supply distribution

 Emergency animal disease

 Emergency plant pest

 Flood

 Gas supply disruption

 Hazardous materials

 Heatwave

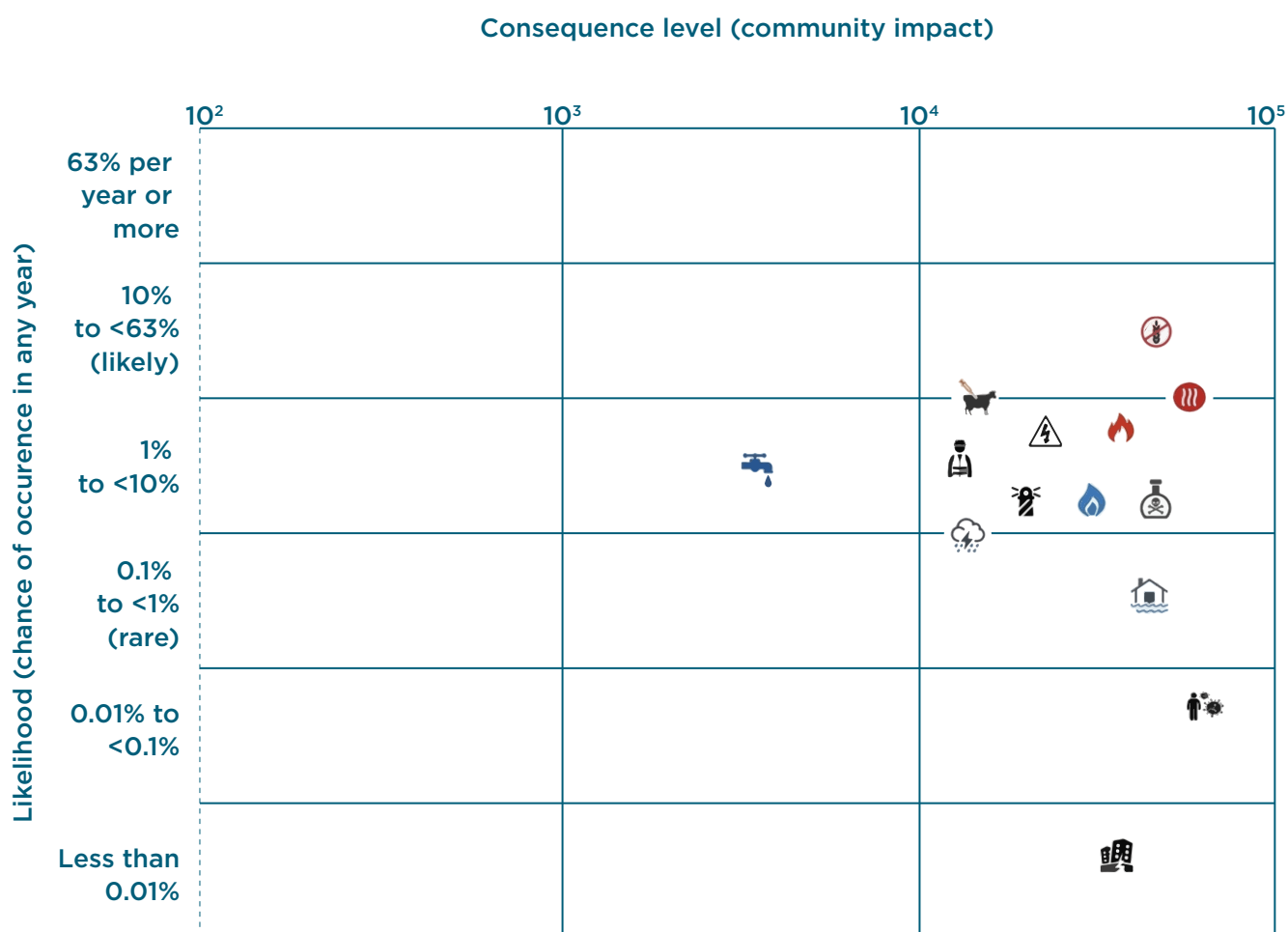
 Maritime emergency

 Mine emergency

 Pandemic influenza

 Storm

 Water supply disruption



**Figure 2: Risk evaluation matrix for worst case scenarios**

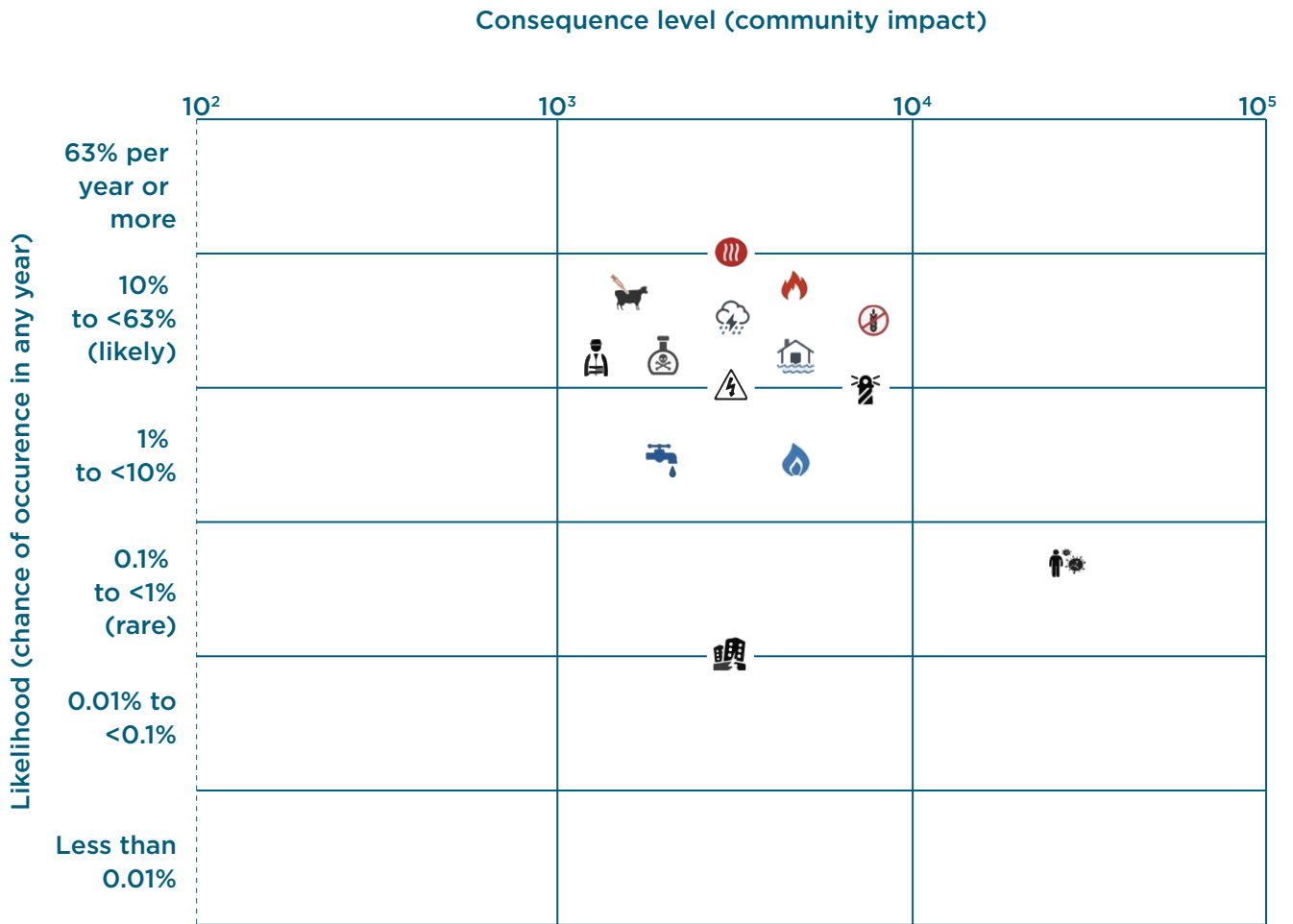


Figure 3: Risk evaluation matrix for high impact scenarios



## What does the assessment tell us about emergency risks in Victoria?

The assessment results for the worst-case scenarios show that there is a cluster of emergency risks with an estimated annual likelihood of 10 percent to 1 percent (indicative reoccurrence 10-100 years) with consequences in the catastrophic range ( $10^4$  –  $10^5$  column in Figure 2). Catastrophic consequences for Victoria include any one of the following criteria:

- Deaths and critical injuries or both directly from the emergency are greater than 600 people.
- Decline of economic activity loss of asset value greater than \$15 billion.
- Permanent destruction of an ecosystem or species recognised at the national level.
- The community of interest ceases to function effectively, breaks down and entirely disperses.
- Governing bodies are unable to deliver their core functions.

The high impact scenario assessment results show a cluster of emergency risks with an estimated likelihood of 10 percent to 63 percent (indicative reoccurrence 1-10 years) with major consequences (see  $10^3$  –  $10^4$  column in Figure 3). Major consequences for Victoria include any one of the following criteria:

- Deaths and critical injuries or both directly from the emergency greater than 60 people.
- Decline of economic activity loss of asset value greater than \$1.5 billion.
- Permanent destruction of an ecosystem or species recognised at the state level.

- The community of interest's social connectedness is significantly broken, with significant permanent dispersal.
- Governing bodies encounter severe reduction in the delivery of core functions<sup>10</sup>.

The consequence category and criteria that generate relative risk levels can differ between emergency types and scenarios. For example, the highest consequences for emergency plant pest and electricity supply disruption are based on economic and social consequence criteria, whereas for heatwave and pandemic influenza it is fatalities and illness.

The emergency risks assessed as being critical and credible scenarios for the state, they are known as 'state significant risks' and set Victoria's emergency risk profile. The highest priority emergency risks include those evaluated closest to the top right of the risk matrices; however the results do not support a precise ranking. All state significant risks require reasonable consideration and management.

Emergency plant pest, heatwave and bushfire are closest to the top right on both the worst case and high impact risk evaluation matrices (Figure 2 and Figure 3 above). Catastrophic or major consequences from earthquake and pandemic influenza are comparatively rare, and it is more likely for flood and storm to result in major consequences at state level. A scenario for water supply disruption that resulted in consequences greater than high impact was not considered plausible.

---

10 NERAG consequence criteria (truncated to demonstrate wide-ranging community impacts)

Secondary events such as electricity supply disruptions, telecommunications failures and transport infrastructure failures are often coincident with natural disasters – particularly for bushfire, earthquake, flood and heatwave – thus exacerbating their consequences. There are also interdependencies within the essential services sector, particularly the dependence on electricity supply for the rest of the energy market.

## Comparison of assessment results with the 2012-13 study

Three of the emergency risks included in the 2016-17 review have been redefined from the 2012-13 study. This includes maritime emergency, mine emergency and emergency plant pest. The changes are as follows:

- Maritime emergency replaced marine pollution – this broader term is preferred as it includes all (non-search and rescue) maritime casualty emergencies, including marine pollution
- Mine emergency replaced mine failure – also encompassing a broader range of scenarios as mine failure focuses on batter / embankment failures for opencut mines
- Emergency plant pest replaced (or merged) insect pest incursion and plant disease epidemic – this aligns with national policy and includes plague locusts and bee pests / diseases.

Liquid fuel shortage and transport infrastructure failure emergencies were included in the 2016-17 review; however, high impact scenarios – based on revised NERAG criteria – were not considered plausible. Gas supply disruption and telecommunications systems failure were assessed as new emergency risks, which had not been included in the 2012-13 study. Of these new emergency risks, credible scenarios that resulted in high impact (and greater) were only considered plausible for gas supply disruption.

The risk evaluation matrices included in the previous version of this report appear different because the consequence levels were modified to a linear scale. This approach separated the relative risk level characterisations, however it is inconsistent with the NERAG methodology. In addition, NERAG version 2 (released in 2015) was used for the 2016-17 review, which included revised assessment criteria.

Notwithstanding, the results of the 2016-17 emergency risk assessment review are largely consistent with raw results of the 2012-13 study. Variations include increased risk levels for heatwave, emergency plant pest and hazardous materials (worst-case scenarios). Consistency in the assessments results from emergency risk assessment studies over time provide greater confidence in the process and results.

Despite the considerable investment and effort applied to control Victoria's significant emergency risks, it is inherently difficult to demonstrate risk reduction. Measuring potential consequences that do not occur for a wide range of emergencies is a significant challenge for emergency managers. Several emergency risks are also affected by factors that potentially augment risk levels, For example, climate change and changes to demographic profiles.

Aligned to a precautionary approach, emergency risks are managed through the application of controls based on the significance of the risk (risk level) and effort required to reduce it. This includes consideration of new and improved control strategies through contemporary research and practice. Further work on assessing the effectiveness (cost-benefit) of various controls will be beneficial for supporting a quality assurance system.



# Emergency risk descriptions

## Bushfire

### Introduction

South eastern Australia, including Victoria is among the most bushfire-prone areas in the world. This high risk of bushfire is due to combination of factors including:

- large areas of highly flammable eucalypt forest and grassland
- climatic pattern of mild, moist winters followed by hot dry summers
- protracted droughts
- increasing population density in bushfire-prone areas, such as in the rural-urban fringe.

The potential consequences of a credible worst-case bushfire in Victoria will lead to loss of life and injury, damage 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.

### Examples of significant bushfires in Victoria

In the past 35 years, there have been two extremely damaging bushfire events in Victoria, the Ash Wednesday fires of February 1983 and the 2009 Black Saturday fires. The Ash Wednesday bushfires burnt 150,000 hectares in Victoria, 47 people died, including three Country Fire Authority (CFA) volunteer firefighters, and 1,620 houses were destroyed.

The Black Saturday bushfires commenced on 7 February. Approximately 400 fires were recorded across Victoria, affecting 78 communities.

A total of 173 people died in the fires and 2,029 houses were destroyed.

Both bushfires also resulted in significant losses of other buildings, fencing and livestock, with severe impact on regional economies. Major financial assistance from governments and insurers was provided and charitable donations were 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 reviews or significant government policies and strategies

Significant 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 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 nationally
- enhanced community information and warning methods and practices including the national introduction of Emergency Alert telephone warnings
- electricity network upgrades aimed at reducing bushfire ignitions
- 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.

Since the implementation of recommendations from the Bushfires Royal Commission, contemporary policy and practice for bushfire management has been further enhanced.

In particular, a national research program has improved our understanding of bushfire behaviour and predictive services. Among other things,

this research is applied to improve the quality of data used by fire behaviour analysts and incident controllers for managing the response to major bushfires. Further funding has also been provided for additional aerial firefighting resources, and a national project is underway to review the fire danger ratings system.



Figure 4: Victoria's Fire Danger Ratings<sup>11</sup>

<sup>11</sup> The fire danger rating (FDR) predicts how a fire would behave if one started, including how difficult it would be to put out – refer to the Country Fire Authority website for information about FDR.

Prevention	Response	Recovery
<ul style="list-style-type: none"> <li>• land use planning</li> <li>• building regulations, standards and codes</li> <li>• landscape fuel management incl. legislative requirements</li> <li>• fire ignition controls including total fire ban days, arson programs</li> <li>• community education, awareness and engagement to prevent and respond to bushfire</li> <li>• seasonal arrangements to ensure capability</li> <li>• restricted access to public land.</li> </ul>	<ul style="list-style-type: none"> <li>• evacuation and relief (including establishing relief centres)</li> <li>• detection and notification</li> <li>• access and egress arrangements</li> <li>• private bunkers</li> <li>• refuges</li> <li>• neighbourhood safer places (places of last resort)</li> <li>• critical infrastructure protection</li> <li>• community information and warnings</li> <li>• community fire plans</li> <li>• vulnerable facilities controls</li> <li>• response agencies capacity and capability to respond to bushfire</li> <li>• restricted access to fire affected land</li> <li>• animal welfare response</li> <li>• national and international response arrangements.</li> </ul>	<ul style="list-style-type: none"> <li>• public information and messaging</li> <li>• emergency recovery of individuals, households, communities and industries / businesses (state resources exceeded - national support would be required)</li> <li>• implementation of business continuity and disaster recovery planning especially essential services and critical infrastructure</li> <li>• development and implementation of essential services including government health and wellbeing programs for the wider community.</li> <li>• restricted access to fire affected land</li> <li>• longer term animal welfare considerations</li> <li>• community rebuilding</li> <li>• reinstate public land access and use</li> <li>• ecosystem services restored.</li> </ul>
<b>Quality assurance:</b> emergency preparedness including training and desktop exercises		

The most effective controls to reduce bushfires fall into the category of fire ignition controls, that is, 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 response planning and preparedness. Victoria's fire services have highly developed plans to respond to fires of all types including bushfires with a broad range of resources both ground-based and aerial. 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 Emergency Management Commissioner is responsible for coordinating the response and appointing a State Response Controller. The Emergency Management Commissioner is also responsible to ensure warnings are issued and information is provided to communities in relation to fires (in Victoria) for the purposes of protecting life and property.

### Websites and publications for further hazard-specific information

#### VicEmergency:

Current warnings and locations for fires and other emergencies are available on the VicEmergency website.

[www.emergency.vic.gov.au](http://www.emergency.vic.gov.au)

The VicEmergency App is available for access to timely, relevant information about emergencies in Victoria, including tailored bushfire warnings and advice.

#### Emergency Management Victoria:

The Emergency Management Commissioner has published the State Bushfire Plan that provides a consolidated overview of the current arrangements for the management of bushfire and its consequences.

<https://files-em.em.vic.gov.au/public/EMV-web/State-Bush-Fire-Plan-2014.pdf>

#### Country Fire Authority, Fire Rescue Victoria & Forest Fire Management Victoria:

The Country Fire Authority, Fire Rescue Victoria and Forest Fire Management Victoria websites contain extensive information covering bushfire safety, household preparedness, community information guides and more.

[www.cfa.vic.gov.au](http://www.cfa.vic.gov.au)

[www.frv.vic.gov.au/bushfire-safety](http://www.frv.vic.gov.au/bushfire-safety)

[www.ffm.vic.gov.au/](http://www.ffm.vic.gov.au/)

#### Bushfire Management Overlay:

The Bushfire Management Overlay (BMO) is a land use planning control applied to land in Victoria that may be significantly affected by bushfire. The following website provides further information about the BMO, including links to Victoria's bushfire planning and building framework and Planning Schemes Online.

[www.planning.vic.gov.au/policy-and-strategy/bushfire-protection/bushfire-management-overlay](http://www.planning.vic.gov.au/policy-and-strategy/bushfire-protection/bushfire-management-overlay)

#### Australian Disaster Resilience Knowledge Hub – Land Use Planning for Disaster Resilient Communities:

<https://knowledge.aidr.org.au/resources/handbook-land-use-planning/>



# Earthquake

## Introduction

Earthquakes are the vibrations caused by rocks breaking under stress. The underground surface along which the rock breaks and moves is called a fault plane. No part of the Earth's surface is free from earthquakes, but some regions experience them more frequently. They are most common at tectonic plate boundaries where different plates meet. The largest events usually happen when two plates are colliding, or colliding and sliding past one another. The size or magnitude of an earthquake is determined by measuring the amplitude of the seismic waves recorded on a seismograph and the distance of the seismograph from the earthquake. These are put into a formula which converts them to a magnitude, which is 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 instance, a magnitude 6.0 earthquake releases approximately 30 times more energy than a magnitude 5.0 earthquake, while a magnitude 7.0 earthquake releases approximately 900 times (30x30) more energy than a magnitude 5.0.<sup>12</sup>

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 damage 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.

---

12 Geoscience Australia website: [www.ga.gov.au/scientific-topics/community-safety/earthquake](http://www.ga.gov.au/scientific-topics/community-safety/earthquake)



## Examples of significant earthquakes in Australia

Magnitude	Date, Location and damage
5.3	1903, Warrnambool: Minor yet extensive damage.
4.5	1932, Mornington Peninsula: considerable damage on the Peninsula.
7.2	1941, Meeberrie, WA: Australia's largest recorded earthquake.
5.4	1954, Adelaide: Most earthquake damage to an Australian capital city. <sup>13</sup>
6.8	1968, Meckering, WA: Extensive damage.
5.6	1989, Newcastle, NSW: 13 people killed and 120 hospitalised. Over 35,000 homes, 147 schools, and 3,000 commercial and/or other buildings damaged.
5.2	1996, near Mt Baw: Shock felt up to 100 km away with minor damage reported in Melbourne.
6.2	1997, across the Kimberley region of Western Australia with reports received from Halls Creek, Fitzroy Crossing, Derby, Broome and as far away as Darwin and Kununurra - 600km
5.0	2010, Kalgoorlie-Boulder, WA: Damage to hundreds of unreinforced masonry buildings.
5.4	2012, Moe - Gippsland: Minor damage.
5.4	2015, east of Fraser Island followed by magnitude 5.3 and 5.2 earthquakes causing minor damage to some households and building evacuations in the Brisbane central business district
6.1	2016, Petermann Ranges region approximately 125 km west of Uluru, NT - the largest earthquake in Australia since the 1997 earthquake across the Kimberley region in WA

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

## Distribution of the earthquake hazard across Victoria

There are a number of fault planes that have been identified in Victoria, including the Strzelecki Ranges, Mornington Peninsula and in the Otway Ranges. In addition, fault planes can be created over time or may have not been identified.<sup>14</sup>

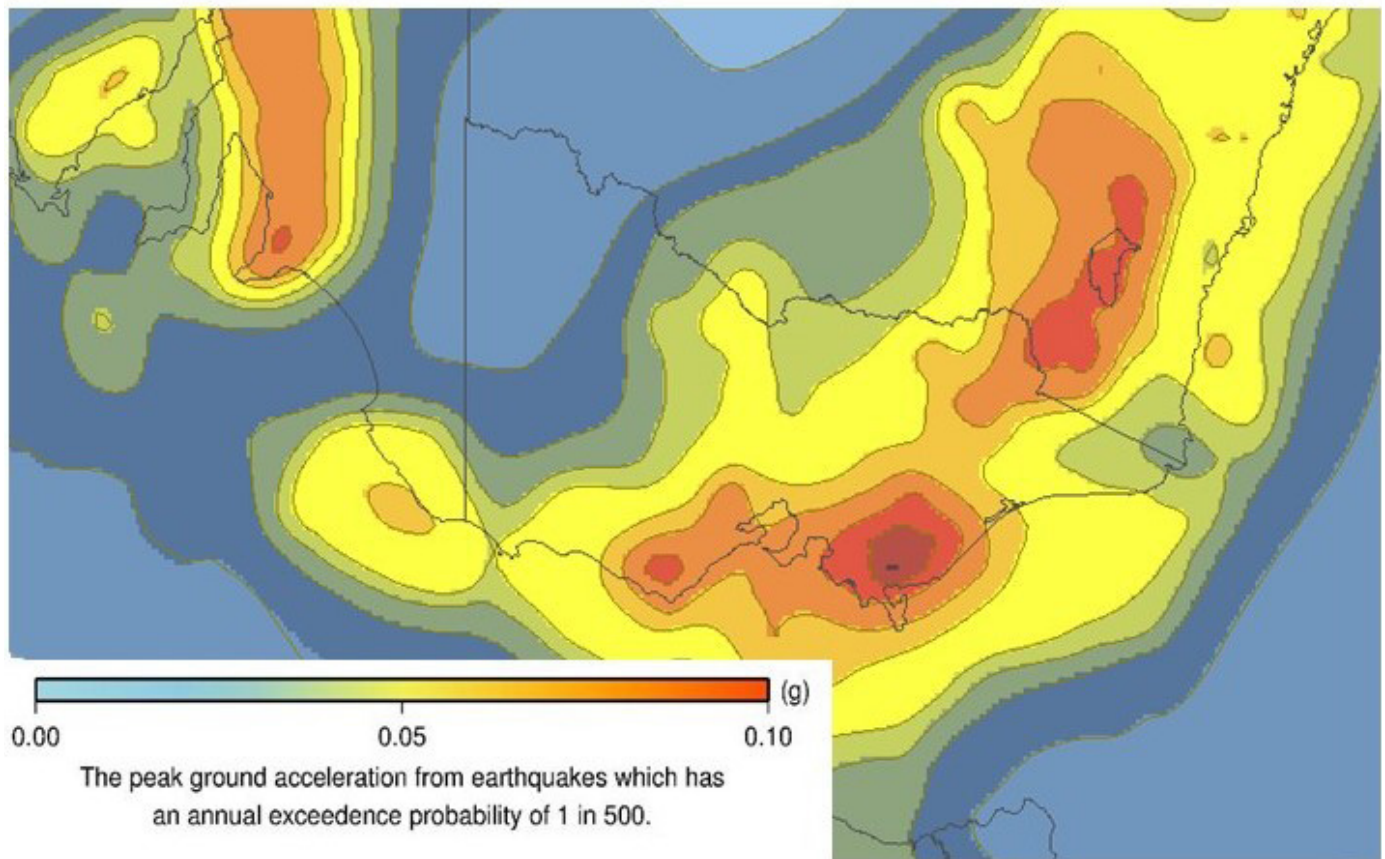


Figure 5: Map of Victoria showing earthquake hazard<sup>15</sup>

14 VICSES QuakeSafe publication: *Earthquakes in Victoria*

15 National Seismic Hazard Assessment 2018, Geoscience Australia

Mitigation	Response	Recovery
<ul style="list-style-type: none"> <li>• building standards / regulations and enforcement (post 1989, 1993, 2007 standards) *</li> <li>• critical infrastructure (engineering) vulnerability assessments and maintenance regimes (essential services, dams / levees, buildings, roads, bridges, tunnels) **</li> <li>• planning provisions</li> <li>• list of vulnerable (i.e. pre-1989) buildings in cbd to inform response planning</li> <li>• community education</li> </ul> <p>* relates to prevention of consequences, rather than prevention of earthquake itself</p> <p>** control is somewhat effective for 'high' scenario but not for 'worst-case' scenario - building and design standards (the basis for maintenance regimes) do not address worst-case magnitude event.</p>	<ul style="list-style-type: none"> <li>• evacuation and relief (including establishing relief centres)</li> <li>• information and warnings</li> <li>• urban search and rescue (USAR) including formal interstate and/or international resource arrangements</li> <li>• local, interstate and international engineering resources to undertake assessments etc. (informal arrangements) *</li> <li>• seismic monitoring</li> <li>• incident preparedness</li> <li>• triage and where necessary cordoning off assessed substandard buildings</li> <li>• critical infrastructure outside immediate affected areas allowing some service provision</li> </ul> <p>* proposed to be formalised.</p>	<ul style="list-style-type: none"> <li>• emergency recovery of individuals, households, communities and industry / business incl. tourism (note state resources would be exceeded - national and international support would be required)</li> <li>• implementation of business continuity and disaster recovery planning, especially for essential services and critical infrastructure</li> <li>• development and implementation of government health and wellbeing programs for the wider community.</li> </ul>

**Quality assurance:** Emergency preparedness training and desktop exercises

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 premise of the earthquake loading standard is to protect life by preventing building collapse whilst accepting that significant damage could occur.<sup>16</sup>

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.

### Websites and publications for further hazard-specific information

#### Emergency Management Victoria:

The Emergency Management Commissioner has published the State Earthquake Sub-plan that provides a consolidated overview of the current arrangements for the management of earthquake and its consequences.

[www.emv.vic.gov.au/responsibilities/state-emergency-plans/state-earthquake-sub-plan](http://www.emv.vic.gov.au/responsibilities/state-emergency-plans/state-earthquake-sub-plan)

#### Victoria State Emergency Service:

The Victoria State Emergency Service (VICSES) is the control agency for responding to earthquakes. The VICSES website contains important information that can help you learn more about earthquakes, including how to prepare and what to do if an earthquake happens.

[www.ses.vic.gov.au/get-ready/quakesafe](http://www.ses.vic.gov.au/get-ready/quakesafe)

#### Geoscience Australia:

Geoscience Australia (GA) undertakes research for a range of geoscientific topics including earthquake. The GA website includes detailed information about earthquakes in Australia, including interactive mapping products and links to contemporary research.

<https://www.ga.gov.au/scientific-topics/community-safety/earthquake>

---

16 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



# Electricity supply disruption

## Introduction

Victoria's electricity is predominantly supplied by the National Electricity Market (NEM). 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 in Victoria.

Electricity transmission and distribution businesses are privately owned in Victoria and responsible for the reliability of their networks and are subject to financial incentives to maintain and improve supply reliability under the national framework.

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.

The reliable supply of electricity is critical to many social and economic activities. Major electricity supply disruptions can occur either as:

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

Victoria has experienced both types of disruption.

## Examples of major electricity supply 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. 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 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. Approximately 660,000 customers were affected and 93 per cent had power restored within 24 hours. It is unusual for such a wide-spread disruption to occur without any major infrastructure damage, with most outages caused by drought-stressed trees falling across powerlines. Following the windstorm the Emergency Services Commissioner conducted a review of the event, to identify potential improvements in emergency management arrangements.

A series of extreme weather events, wide-spread flooding and thunderstorms impacted Victoria from September to December 2016 causing extensive damage to electricity distribution networks (pole and wires). During this period 155,000 properties lost electricity supply. Electricity distribution companies repaired transmission lines. On 28 September, a wide-spread electricity black out occurred in South Australia due to storm damage to transmission infrastructure.

On 28 and 29 January 2018, pressure on low-voltage fuses, due to high demand from sustained high temperatures and humidity, overloaded localised electricity network assets causing power outages for 94,700 customers.

On 31 January 2020, severe winds caused damage to eight transmission towers in southwest Victoria, resulting in a separation between Victoria and South Australia at the Heywood interconnector, as well as interrupting power supply to the Alcoa aluminium smelter in Portland.

## Major reviews or significant government policies and strategies

The Office of the Emergency Services Commissioner prepared a report into the April 2008 windstorm. The Victorian Government broadly supported the 35 recommendations of the report, predominantly in light of any findings of the subsequent Victorian Bushfires Royal Commission. Some of the April 2008 Windstorm Report's recommendations led to improvements in managing energy related emergencies, including:

- establishing the State Control Centre (SCC) as Victoria's primary control centre for managing emergencies - an energy team is embedded as part of the SCC Intelligence Unit
- establishing a dedicated division in a government department (currently DELWP) primarily responsible for managing energy related emergencies
- embedding electricity emergency management liaison officers from the five electricity distribution businesses at the SCC during electricity related emergencies (where thresholds are met)
- development of the Victorian Energy Emergency Communications Protocol (VEECP) which brings together representatives from the electricity sector, government departments and agencies - the VEECP can be activated in response to a range of triggers (including severe weather).

In 2017, the Victorian Government commissioned an Independent Review of Victoria's Electricity and Gas Network Safety Framework. Dr Paul Grimes was appointed as independent chair for the review, which examined the design and adequacy of the safety regulatory obligations, incentives and other

arrangements governing Victoria's safety of the electricity and gas networks.

Implementation of the significant reform agenda is well underway, including the establishment of Energy Safe Victoria as a three-person commission (from a single member agency) supported by a Technical Advisory Committee and Chief Executive Officer by 1 January 2021.

More information on the Grimes Review, including a copy of the final report and the government response, can be found on the Engage Victoria - Electricity and Gas Network Safety Review webpage.

Following the power outages on the 2018 Australia Day long weekend, a Post Event Review Report was conducted to identify potential improvements and prevention measures. The Report included 15 recommendations to address outage prevention, improved communications and consumer protection. More information about the Post Event Review, including a copy of the final report can be found on the DELWP - Energy webpage.

Mitigation	Response	Recovery
<ul style="list-style-type: none"> <li>• legislative framework e.g. Electricity Safety Act, national electricity laws and rules</li> <li>• system redundancy (N-1)</li> <li>• urban development and planning</li> <li>• tower barriers, signage and fencing</li> <li>• security controls and surveillance</li> <li>• public awareness</li> <li>• maintenance inspections</li> <li>• SCADA and automated protection scheme</li> <li>• system modelling</li> <li>• design and construct standards for transmission assets</li> <li>• market mechanisms</li> <li>• load management strategies including segmented customers to minimise community impacts</li> <li>• public communication and engagement.</li> </ul>	<ul style="list-style-type: none"> <li>• SCADA and automated protection scheme</li> <li>• critical spares and temporary equipment e.g. mobile towers</li> <li>• mutual aid agreements within industry</li> <li>• emergency response and recovery plans to recover and restore network (all parties)</li> <li>• market mechanisms</li> <li>• load management strategies</li> <li>• State Health Emergency Response Plan</li> <li>• public communication and engagement.</li> <li>• relief programs (including financial assistance)</li> <li>• public appeal by government for voluntary load reduction</li> <li>• emergency powers under the Electricity Industry Act</li> <li>• appointment of Class 2 controller.</li> </ul>	<ul style="list-style-type: none"> <li>• emergency response and recovery plans</li> <li>• black start recovery plan</li> <li>• VEEC protocols</li> <li>• public communication and engagement.</li> </ul>
<b>Quality assurance:</b> Emergency preparedness training and desktop exercises		



Under the National Electricity Law and Rules, AEMO has extensive powers of direction in relation to registered NEM participants in order to manage 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 AEMO, 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.

#### Websites and publications for further hazard-specific information

Emergency Management Victoria & Department of Environment, Land, Water and Planning:

[www.emv.vic.gov.au/responsibilities/state-emergency-plans/state-electricity-and-gas-supply-sub-plan](http://www.emv.vic.gov.au/responsibilities/state-emergency-plans/state-electricity-and-gas-supply-sub-plan)

[www.energy.vic.gov.au/electricity/about-the-electricity-sector](http://www.energy.vic.gov.au/electricity/about-the-electricity-sector)

Australian Energy Market Operator:

The Australian Energy Market Operator (AEMO) website includes information on system reliability and security.

[www.aemo.com.au](http://www.aemo.com.au)

Energy Safe Victoria:

Energy Safe Victoria (ESV) is the independent technical regulator responsible for electricity, gas and pipeline safety in Victoria. The ESV website includes extensive information about electrical safety and education. It also promotes gas safety through a number of campaigns, for example look up and live.

[www.esv.vic.gov.au/safety-education/emergencies/power-outage/](http://www.esv.vic.gov.au/safety-education/emergencies/power-outage/)

Australian Energy Regulator:

The Australian Energy Regulator (AER) website includes information on how preparedness is intertwined into the design of the NEM.

[www.aer.gov.au](http://www.aer.gov.au)

Community advice for electricity supply disruption:

[www.betterhealth.vic.gov.au/health/servicesandsupport/emergencies-coping-without-gas-or-electricity](http://www.betterhealth.vic.gov.au/health/servicesandsupport/emergencies-coping-without-gas-or-electricity)

[www.energy.vic.gov.au/safety-and-emergencies/power-outages](http://www.energy.vic.gov.au/safety-and-emergencies/power-outages)

[www.emergency.vic.gov.au/prepare/#power-outage/power-outages](http://www.emergency.vic.gov.au/prepare/#power-outage/power-outages)

[www2.health.vic.gov.au/about/publications/factsheets/power-outages-food-safety-after-a-power-failure](http://www2.health.vic.gov.au/about/publications/factsheets/power-outages-food-safety-after-a-power-failure)

# Emergency animal disease

## Introduction

Emergency animal diseases are diseases of animals (including bees and fish) that could result in:

- serious socioeconomic effects on farming and associated industries and communities (through international trade losses, production losses and market disruptions) and risks to animal welfare (production losses, market disruptions and risks to animal welfare)
- risks to public health in the case of zoonosis<sup>17</sup>
- 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 (for example avian influenza, bluetongue virus)
- environmental and population dynamics result in susceptible populations of animals being exposed to the disease agent (for example, anthrax, hendra virus)

The credible worst-scenario for emergency animal disease in Victoria is based on a foot and mouth disease (FMD) outbreak. In the event of an FMD outbreak, socio-economic impacts may occur at the individual, household and community levels. Many such impacts are initially generated by producers' loss of access to markets and the rapid resulting loss of income for producers and associated enterprises and sectors. Other impacts may result from the control measures used to manage and eradicate FMD. Psycho-social impacts are likely to include increased mental health issues and domestic violence. The severity of these

impacts will be influenced not only by the size of the outbreak and time out of export markets, but also the vulnerability of a community and its ability to recover. Communities with good economic performance and socio-advantage are likely to be more resilient and recover more quickly from an FMD outbreak.<sup>18</sup>

## Examples of emergency animal disease outbreaks affecting Victoria

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 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 relatively high.

Outbreaks of highly pathogenic avian influenza have 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 due to breaches of importation and quarantine arrangements, there was an outbreak of equine influenza in New South Wales 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, clearly demonstrating that Australia is not impervious to illegal animal and animal product imports and the diseases that accompany them.

---

17 An animal disease that can also affect humans

---

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

Until recently, Australia was the only country in the world that was free of Varroa mite, which causes disease in honeybees. In May 2019, an incursion of Varroa mites in a colony of feral Asian honeybee was detected in Townsville, Queensland. Eradication and surveillance programs within the Townsville area are being led by Biosecurity Queensland and will continue until April 2021. This incursion is unrelated to a similar incursion detected in Townsville in 2016, which has been eradicated. The spread of Varroa mite in Australia, has the potential to significantly impact bee health and the effectiveness of pollination of food crops.

### Major reviews or significant government policies and strategies

Animal Health Australia (AHA) manages the Emergency Animal Disease Response Agreement (EADRA), a contractual arrangement between Australia's governments and industry groups to collectively reduce the risk of emergency animal disease incursions and manage a response if an outbreak occurs. This Agreement is a unique contractual arrangement, signed in 2002, that brings together Australian state and territory governments and livestock industry groups to collectively increase Australia's capacity to prepare for—and respond to—emergency animal disease incursions.

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, identified eleven areas to further strengthen Australia's preparedness. As a result, the Australian Government, state and territory senior biosecurity officials (through the National Biosecurity Committee) developed a National FMD Action Plan.

The Australian Veterinary Emergency Plan (AUSVETPLAN) is prepared by the National Biosecurity Committee and published by AHA. AUSVETPLAN contains the nationally-agreed approach for the response to emergency animal disease incidents in Australia. It covers numerous diseases and disease response activities (for example, farm decontamination, control centre management).

Mitigation	Response	Recovery
<ul style="list-style-type: none"> <li>• customs and quarantine infrastructure and services</li> <li>• international standards and conventions</li> <li>• australian border controls policy and operations</li> <li>• regulated control of risk activities associated with animal feeding</li> <li>• regulated control of vaccinations and therapeutics</li> <li>• regulated control of farm biosecurity practices</li> <li>• disease surveillance activities - epidemiological information (data and analysis)</li> <li>• international surveillance / intelligence including bioterrorism considerations</li> <li>• regulated control of native wildlife rehabilitation and licensing</li> <li>• farming industry supply chain best practice and accreditation</li> <li>• specialist training of staff and industry</li> <li>• awareness raising, education and information dissemination.</li> </ul>	<ul style="list-style-type: none"> <li>• international standards and conventions</li> <li>• diagnostic capacity and infrastructure</li> <li>• statutory requirements for notification</li> <li>• research and development for disease control</li> <li>• emergency preparedness arrangements including national and state governance framework, national response plan, funding arrangements, international and national resources agreements, vaccine banks, animal welfare, resource capacity and capability, industry partnerships</li> <li>• agreed compensation schemes</li> <li>• destruction and disposal arrangements</li> <li>• regulated control of livestock identification</li> <li>• disease surveillance activities - epidemiological information (data and analysis).</li> </ul>	<ul style="list-style-type: none"> <li>• international standards and conventions</li> <li>• state governance framework</li> <li>• agreed compensation schemes</li> <li>• diagnostic capacity and infrastructure</li> <li>• disease surveillance activities - epidemiological information (data and analysis)</li> <li>• restocking protocols.</li> </ul>
<b>Quality Assurance:</b> Emergency preparedness training and desktop exercises		

In Victoria, the Department of Jobs, Precincts and Regions (DJPR) is the control agency for emergency animal disease. DJPR is involved in various training and simulation exercises (either at state or national level) aimed at preparing staff to respond to animal disease emergencies. It has also developed highly specialised software packages aimed at outbreak management.

### Websites and publications for further hazard-specific information

Animal Health Australia:

[www.animalhealthaustralia.com.au/](http://www.animalhealthaustralia.com.au/)

[www.animalhealthaustralia.com.au/our-publications/ausvetplan-manuals-and-documents/](http://www.animalhealthaustralia.com.au/our-publications/ausvetplan-manuals-and-documents/)

Emergency Management Victoria & Department of Jobs, Precincts and Regions:

<https://files-em.em.vic.gov.au/public/EMV-web/SERP-StateBiosecuritySub-Plan.pdf>

<https://djpr.vic.gov.au/about-us/overview/responsibilities-and-functions/emergency-functions>

Department of Agriculture, Water and Environment (Commonwealth):

[www.agriculture.gov.au/biosecurity/emergency](http://www.agriculture.gov.au/biosecurity/emergency)

[www.outbreak.gov.au/how-we-respond-to-outbreaks](http://www.outbreak.gov.au/how-we-respond-to-outbreaks)

[www.agriculture.gov.au/publications](http://www.agriculture.gov.au/publications)

Farm Biosecurity:

[www.farmbiosecurity.com.au/](http://www.farmbiosecurity.com.au/)

National pest & disease outbreaks:

[www.outbreak.gov.au/](http://www.outbreak.gov.au/)

Community advice for managing biosecurity risks:

[www.agriculture.gov.au/travelling/bringing-mailing-goods](http://www.agriculture.gov.au/travelling/bringing-mailing-goods)

# Emergency plant pest

## Introduction

Emergency plant pests (exotic pests and diseases not present in Victoria) have the potential to destroy our food production and agriculture industries and could damage our natural environment. Keeping Victoria's plant industries and environment free from plant pests and diseases is critical to maintaining access to markets and ensuring a healthy environment for all Victorians. Plant pests (including plague locusts, bees and other insects) and plant diseases (predominantly bacteria, fungi and viruses) are found all over the world, wherever there are plants.

Agriculture Victoria has identified 272 emergency plant pest threats, all ranked and prioritised according to the risks they pose to the state. Furthermore, Australia has a national top 40 unwanted plant pest list. Victoria's biosecurity preparedness work is focussed on activities that will help us to respond quickly and effectively to unwanted pests and diseases. Victoria's biosecurity team works to stop the entry, establishment and spread of plant pests and diseases that can affect plant production, plant industries' access to markets, and the environment.

Losses from Emergency Plant Pest incursions may include direct production losses to crops, as well as increased costs associated with implementing controls and restrictions on market access to other states or international markets. For example, a major outbreak of karnal bunt (a fungal infestation of wheat) in Victoria would likely have major economic and social consequences as trade restrictions would be imposed by many countries.

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 ecosystems. The continuation of high-quality Australian exports depends on the sector's freedom from the most destructive pests.

## Examples of plant pests and diseases affecting Victoria

Victoria responds to detections of hundreds of suspect emergency plant pests annually. When a suspect detection is made, investigations commence immediately.

In June 2018, the varroa destructor mite was intercepted at the Port of Melbourne on a ship from the United States. Varroa is listed as number ten on Australia's top 40 unwanted plant pest list. Varroa destructor is the breed of mite that affects European honey bees, which agriculture industries around the world rely on for pollination. Australia is one of the last remaining countries in the world to be free of the mite, which has already devastated bee colonies in New Zealand, the United States and Europe. The bee colony on board the ship was destroyed and a surveillance program was implemented within a 2km radius of the Port. The State Quarantine Response Team, comprising members of the beekeeping community, worked alongside Agriculture Victoria's Incident Management Team (IMT) to conduct four rounds of bee hive surveillance over a six week period following the interception. No further varroa mites were detected. This collaborative work between government, industry and the community highlights that everyone has a role to play in protecting Victoria's bee and pollination industries.

During the 2018-19 summer period, Agriculture Victoria responded to three incursions of the brown marmorated stink bug (BMSB) – the number nine unwanted plant pest for Australia. BMSB is an exotic pest that could cause major damage to agricultural crops, nursery stock and ornamental plants. It's also a nuisance because it seeks shelter in large numbers, in buildings and equipment

during the winter months and has a foul-smelling odour when crushed or disturbed. Agriculture Victoria commenced a 12-week trapping and surveillance program in a two-kilometre radius around the three detection points in Dandenong South, Clayton and Port Melbourne. A substantial communications program was launched with thousands of residents and businesses being contacted in the vicinity of detections. Local communities were encouraged to report any suspicious looking bugs to Agriculture Victoria. Fortunately, no populations of BMSB were found. This is another example of government and community working together to resolve a shared biosecurity problem.

In 2010-11 Victoria responded to a major plague of locusts (Australian plague locusts) that also affected agricultural areas in other states. Swarms of flying adults and bands of 'hoppers' can cause substantial economic losses by destroying crops including pasture, as well as widespread community disruption by affecting major events, drinking water quality, air travel and wellbeing generally. 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. The whole of government response ensured that the locust plague was effectively managed. Agriculture Victoria is currently reviewing its preparedness for locusts in the event of a potential future plague – the better prepared we are to respond, the more likely that we will be able to deliver a rapid, effective emergency response.

### Major reviews or significant government policies and 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 Intergovernmental Agreement on Biosecurity (IGAB), signed by the Commonwealth and all state and territory governments sets out Australia's national commitments to biosecurity. The IGAB strengthens Australia's biosecurity system by enhancing national collaboration among Australian governments and supporting our biosecurity system to meet current and future biosecurity challenges. The report makes 42 recommendations for strengthening the national biosecurity system, all of which have been agreed in principle by Australia's agriculture ministers. The IGAB is scheduled for review in 2024.

The Victorian Government's Agriculture Victoria Strategy helps Victorian industries to grow by delivering services that attract investment, increase exports and create jobs. The Strategy recognises the sector's vital contribution to economic growth and its potential for enhancing social and economic wellbeing across Victoria. It also provides direction and guidance for Agriculture Victoria's activities, and aligns with the Victorian Government's aspirations for the agriculture sector and regional communities.



## National biosecurity arrangements

Australia's national biosecurity system operates under Commonwealth, state and territory legislation, administered and managed by respective governments. The Victorian legislation (including the *Plant Biosecurity Act 2010*; Plant Biosecurity Regulations 2016; and international agreements that control the transportation of agricultural commodities) covers 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; however, a national approach is maintained through a national committee framework. The sequential approach of prevention, eradication, containment and asset-based protection is used. In July 2016, the National Biosecurity Committee endorsed the National Framework for the Management of Established Pests and Diseases of National Significance (the Framework). The Framework provides a strategic, consistent, scientific and risk-based approach to managing the impacts of Established Pests and Diseases of National Significance (EPDNS). The ten year National Plant Biosecurity Strategy (NPBS) outlines strategies to strengthen Australia's plant biosecurity system to 2020, and is currently being reviewed.

The Emergency Plant Pest Response Deed (EPPRD) covers the management and funding of responses to emergency plant pest incidents. All states and territories and almost fifty industry parties are signatories to this agreement. Underpinning the EPPRD is PLANTPLAN, (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 2017, Victoria agreed to a national ten-year plan to eradicate red imported fire ant from south east Queensland. The plan continues the eradication effort underway since 2002 and has a total budget of \$411 million (including indexation). Eradication of the Queensland infestation is an important measure to protect Victoria from this significant pest.



Prevention	Response	Recovery
<ul style="list-style-type: none"> <li>• preparedness and contingency plans</li> <li>• surveillance programs</li> <li>• diagnostic testing</li> <li>• national border control</li> <li>• state border control</li> <li>• education and stakeholder engagement</li> <li>• conditions on movement (e.g. insecticide requirements for red imported fire ant host materials)</li> <li>• pest and disease alerts</li> <li>• farm biosecurity / awareness</li> <li>• public awareness campaigns</li> <li>• plant health certification and auditing</li> <li>• data gathering and modelling</li> <li>• chemical control.</li> </ul>	<ul style="list-style-type: none"> <li>• investigations and response</li> <li>• trace forward and trace back</li> <li>• surveillance for early detection and area freedom</li> <li>• public identification and reporting</li> <li>• quarantine zones and movement controls</li> <li>• treatment tools and chemicals</li> <li>• public communications</li> <li>• stakeholder engagement</li> <li>• eradication</li> </ul>	<ul style="list-style-type: none"> <li>• long term control</li> <li>• ongoing management</li> <li>• government assistance with industry adaptation to the established pest/disease status</li> <li>• state government education program for industry and general public (for example, commercial and private beekeepers)</li> <li>• research and development</li> <li>• state government community support programs for mental health impacts.</li> </ul>
<b>Quality assurance:</b> Emergency preparedness training and desktop exercises		

Preventing outbreaks and incursions is a combined effort of governments, industry and community. The primary controls to prevent emergency plant pests are border controls at national and state levels, early detection surveillance programs, education aimed at stakeholder awareness raising and reporting of pests and diseases.

Despite not being Emergency Plant Pests, the Victorian government also manages a number of established pests and diseases to ensure established pests do not become an issue for the state. Victoria has extensive containment and management programs in place for a number of established pests and diseases including Queensland fruit fly, grapevine phylloxera and potato cyst nematode. These pests and diseases are trade and market access sensitive issues and if not managed effectively could have significant impacts on Victorian businesses being able to move horticultural produce out of the state.

## Websites and publications for further hazard-specific information

Emergency Management Victoria & Department of Jobs, Precincts and Regions:

<https://files-em.em.vic.gov.au/public/EMV-web/SERP-StateBiosecuritySub-Plan.pdf>

<https://djpr.vic.gov.au/about-us/overview/responsibilities-and-functions/emergency-functions>

<http://agriculture.vic.gov.au/agriculture/pests-diseases-and-weeds>

<http://agriculture.vic.gov.au/about-us/agriculture-victoria-strategy>

Department of Agriculture, Water and the Environment (Commonwealth Government):

[www.agriculture.gov.au/biosecurity/partnerships/nbc/intergovernmental-agreement-on-biosecurity/national-framework](http://www.agriculture.gov.au/biosecurity/partnerships/nbc/intergovernmental-agreement-on-biosecurity/national-framework)

[www.agriculture.gov.au/pests-diseases-weeds/locusts](http://www.agriculture.gov.au/pests-diseases-weeds/locusts)

[www.agriculture.gov.au/biosecurity/partnerships/nbc/intergovernmental-agreement-on-biosecurity](http://www.agriculture.gov.au/biosecurity/partnerships/nbc/intergovernmental-agreement-on-biosecurity)

Steering Committee for the National Red Imported Fire Ant Eradication Program:

[www.daf.qld.gov.au/business-priorities/biosecurity/invasive-plants-animals/ants/fire-ants/eradication/10-year-plan/steering-committee](http://www.daf.qld.gov.au/business-priorities/biosecurity/invasive-plants-animals/ants/fire-ants/eradication/10-year-plan/steering-committee)

Plant Health Australia:

[www.planthealthaustralia.com.au/](http://www.planthealthaustralia.com.au/)

[www.planthealthaustralia.com.au/biosecurity/emergency-plant-pest-response-deed/](http://www.planthealthaustralia.com.au/biosecurity/emergency-plant-pest-response-deed/)

[www.planthealthaustralia.com.au/biosecurity/incursion-management/plantplan/](http://www.planthealthaustralia.com.au/biosecurity/incursion-management/plantplan/)



# Flood

## Introduction

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 either high tides or storm surges or both, 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 in Victoria. The rarest flood events can cause severe damage to key infrastructure such as roads and bridges, water, sewerage and electrical assets, as well as possible loss of life and economic losses in affected regions.

Social disruption also occurs, particularly 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 in various regions across Victoria every 10 to 20 years. The long-term average of flood damage in Victoria has been estimated at \$350 million per annum.

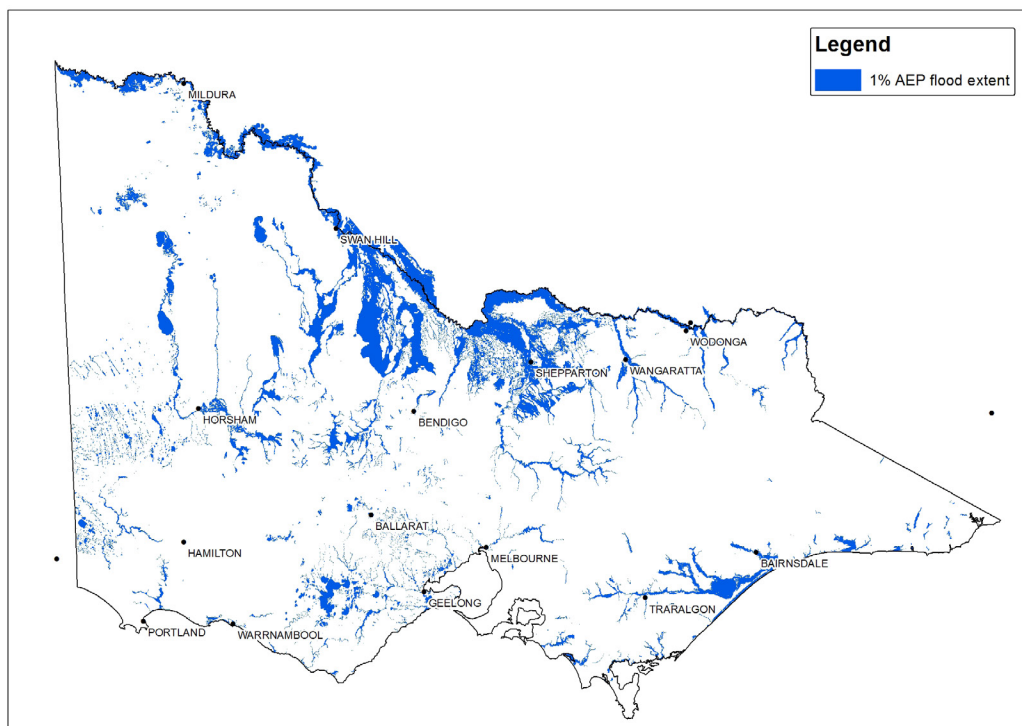
The floods of 2010-11 covered about one-third of Victoria, affecting 70 of 79 municipal districts with flood or storm damage. The total gross cost of the floods exceeded \$1.3 billion, covering property such as houses and vehicles, commercial damage and business interruption, plus significant damage to public infrastructure such as roads, bridges and buildings.

In March 2012 floods affected parts of Victoria, including Broken Creek, Melbourne, Shepparton, and in June 2012 the Latrobe Valley and other parts of Gippsland were impacted.

Major floods also occurred in Victoria during 2016. This included severe flash flooding in Geelong in January, riverine flooding in Gippsland in July and widespread flooding commencing in September. The September 2016 floods resulted in extensive damage to roads and community facilities in North Eastern Victoria, Loddon Mallee, Wimmera and Barwon South West. Economic consequences also followed, with significant losses for agriculture and tourism sectors.

## Distribution of the flood hazard across Victoria

The map of Victoria below [Figure 6] shows, for each catchment, the known outer extent of flooding for floods that have a 1 percent annual chance of occurring in any one year. All are included on one map to indicate the flood hazard across Victoria. Generally, if an area is coloured blue the likelihood of flooding every year will be 1 percent or more, and for the other areas the likelihood will be less than 1 percent.



**Figure 6: Map of Victoria showing flood hazard distribution**

This map is the output of analysing the probabilities for a large number of actual floods. It 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 percent for one area, 2 percent for another area, 5 percent for yet another area, et cetera.

#### Major reviews or significant government policies and strategies

The major flooding that occurred in Victoria from September 2010 to February 2011 is still the worst recorded flood event for the State. The 2010-11 flooding impacted widespread areas of Victoria

resulting in significant damage to regional, urban and rural communities. The gross economic losses from flooding and storms during this period is estimated to be \$1.3 billion.

Following the 2010-11 flooding, Mr Neil Comrie AO, APM led a review focussing on the flood warnings and response management. The Review of the 2010-11 Flood Warnings and Response (Flood Review) involved a detailed examination of the emergency management arrangements in Victoria.

The Victorian Government responded to the recommendations in two ways. The recommendations about emergency management arrangements have been addressed through the Victorian Emergency Management Reform White Paper (White Paper).

The White Paper consolidated the strategies developed to address the recommendations of both the 2009 Victorian Bushfires Royal Commission and the Flood Review.

A significant number of the Flood Review's emergency management recommendations have been completed, including improvements to the arrangements for flood response, flood recovery, emergency warnings and evacuation. Further works have transitioned under the auspice of the:

- Emergency Management Strategic Action Plan
- Victorian Floodplain Management Strategy 2016
- Victoria State Emergency Service Community Resilience Strategy 2016-19 and Renewal Strategy 2019-22.

The government's initial response to the 31 flood-specific recommendations was released in November 2012 under The Victorian Floods Review - Improving Flood Warning Systems Implementation Plan (the Plan). Building on initiatives already in place to reduce the impacts of floods on communities, the Plan integrates and aligns flood planning with other emergency management planning. This improves 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. The Government's response to 40 recommendations provides direction for managing levees and waterways for flood mitigation purposes.

Collectively these initiatives are driving extensive reforms to reduce the impacts of flooding on

communities, including updating the Victoria's floodplain management strategy. The Victorian Floodplain Management Strategy was released in April 2016 and the Victorian government subsequently allocated \$23 million over four years to implement the strategy.

Key changes as a result of the new strategy include:

- governance arrangements for sustainably managing existing and new levees
- acknowledgement of the value of Aboriginal communities both in planning and responding to floods
- adapting to climate change to manage flood risk
- clarification of emergency management roles and responsibilities
- guiding principles to support the role of catchment management authorities in land use planning
- clarification of responsibility for maintaining flood warning gauges, and
- consideration of the environmental benefits of flooding.

Works and projects have been advanced significantly including:

- delivery of Regional Floodplain Management Strategies
- local flood studies, flood mitigation works and warning systems, and
- enhancements to the Flood Intelligence Platform (FloodZoom).

Mitigation	Response	Recovery
<ul style="list-style-type: none"> <li>• legislative policy framework incl. floodplain management strategy, reform (lessons learnt)</li> <li>• land use planning (strategic and statutory)</li> <li>• flood mitigation infrastructure e.g. levees, retarding basins</li> <li>• vegetation / waterway management</li> <li>• property modifications</li> <li>• community engagement, education and awareness</li> <li>• flood emergency planning including readiness</li> <li>• flood data / intelligence and mapping</li> <li>• Total Flood Warning System (TFWS).</li> </ul>	<ul style="list-style-type: none"> <li>• emergency access routes for evacuation from flooded areas (preventing loss of life)</li> <li>• relief programs (including establishing relief centres)</li> <li>• flood warning and forecasting systems including trigger points</li> <li>• temporary flood mitigation infrastructure for example sandbags, temporary levees</li> <li>• community engagement, education and awareness</li> <li>• implementing flood emergency plan.</li> </ul>	<ul style="list-style-type: none"> <li>• legislative policy framework</li> <li>• emergency recovery of individuals, households, communities and industries / businesses (state resources exceeded - national support would be required)</li> <li>• public health surveillance program</li> <li>• flood emergency response including residual water, environmental asset restoration</li> <li>• community engagement and support</li> <li>• research, review and monitoring.</li> </ul>
<b>Quality Assurance:</b> Emergency preparedness training and desktop exercises		

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, and
- 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.

The Department of Environment, Land, Water and Planning (DELWP) is responsible for the development and holding of flood knowledge in Victoria, in conjunction with Melbourne Water and the regional catchment management authorities. Municipal 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.

The control agency for flood in Victoria is the Victoria State Emergency Service (VICSES) with management arrangements governed by the State Emergency Response Plan and State Flood Sub-plan. In addition, VICSES actively promotes community and household flood awareness through the FloodSafe program.

### Websites and publications for further hazard-specific information

Emergency Management Victoria & Victoria State Emergency Service:

[www.emv.vic.gov.au/responsibilities/state-emergency-plans/state-flood-sub-plan](http://www.emv.vic.gov.au/responsibilities/state-emergency-plans/state-flood-sub-plan)

[www.ses.vic.gov.au/get-ready/floodsafe](http://www.ses.vic.gov.au/get-ready/floodsafe)

Department of Environment, Land, Water and Planning (floodplain management & planning schemes):

[www.water.vic.gov.au/managing-floodplains/floodplain-management](http://www.water.vic.gov.au/managing-floodplains/floodplain-management)

[www.planning.vic.gov.au/](http://www.planning.vic.gov.au/)

[www.planning.vic.gov.au/schemes-and-amendments/get-information-about-your-planning-scheme/vicplan](http://www.planning.vic.gov.au/schemes-and-amendments/get-information-about-your-planning-scheme/vicplan)

Note: The VicPlan interactive map includes a Floodway Overlay (FO) and Land Subject to Inundation Overlay (LSIO) under Land Management.

Flood Victoria:

[www.floodvictoria.vic.gov.au/](http://www.floodvictoria.vic.gov.au/)

Victorian Floods Review:

[www.floodsreview.vic.gov.au/](http://www.floodsreview.vic.gov.au/)

Australian Disaster Resilience Knowledge Hub – Managing the Floodplain & Land Use Planning for Disaster Resilient Communities:

<https://knowledge.aidr.org.au/resources/handbook-7-managing-the-floodplain/>

<https://knowledge.aidr.org.au/resources/handbook-land-use-planning/>

Bushfire and Natural Hazards Cooperative Research Centre (flood & coastal management research projects):

[www.bnhcrc.com.au/research/cluster/flood-coastal-management](http://www.bnhcrc.com.au/research/cluster/flood-coastal-management)

Geoscience Australia:

[www.ga.gov.au/scientific-topics/community-safety/flood](http://www.ga.gov.au/scientific-topics/community-safety/flood)





# Gas supply disruption

## Introduction

Victoria has the highest residential gas demand in Australia, with reticulated natural gas available in most Victorian cities and large towns. The majority of gas is supplied from the Longford processing plant near Sale. The Iona Underground Storage Facility near Port Campbell is also a key source of supply for Victoria, which is required to support demand during the peak winter season. The Dandenong Storage Facility can be used for peak winter shaving and system security. Historically, Victoria was a nett exporter of gas to other states via the gas transmission network. However, the volume of exports to other jurisdictions is expected to decline. The Australian Energy Market Operator's (AEMO's) 2020 update to the Victorian Gas Planning Report notes that there is a risk of gas supply restrictions and curtailment in Victoria from 2024 and potentially as early as 2023 without additional gas supply, the removal of pipeline constraints, or a liquefied natural gas (LNG) import terminal.

The reliable supply of gas is critical to many social and economic activities. In the case of natural gas, potential causes of disruption include technical failure or unplanned maintenance at key facilities, damage to underground infrastructure caused by third parties digging, or damage from natural causes such as flood, earthquake or fire. A significant disruption to natural gas supply may also impact on natural gas-fired peaking electricity generation and hence on the availability of electricity. This is considered most likely in winter but may also occur during peak summer periods. Natural gas emergencies may also arise when natural gas in the system is off-specification and is therefore unsafe to use. Response times may be very limited in the event of an emergency as minimum transmission pipeline pressures will need to be maintained. The public may therefore be required to rapidly reduce its use of gas, especially if the emergency occurs in winter.

Victoria's 1900 km Declared Transmission System (DTS), covering Melbourne and large parts of

Victoria, is owned by APA GasNet and operated by AEMO. AEMO is responsible for the secure operation of the DTS and the Victorian Delared Wholesale Gas Market. AEMO publishes a national Gas Statement of Opportunities (GSOO) and provides regular updates to the Victorian Gas Planning Report (VGPR). The information is provided to allow gas market participants to make informed decisions for their own planning and market strategies. Three distribution businesses own and operate the natural gas distribution network in Victoria; Australian Gas Networks, Multinet (both part of the Australian Gas Infrastructure Group) and AusNet Services.

Separate businesses own and operate gas pipelines that connect Victoria with neighbouring states. This interconnection of gas markets between Victoria, New South Wales, South Australia and Tasmania means that a gas emergency in Victoria has the potential to impact on these states. Similarly, a gas emergency arising in New South Wales could potentially impact Victoria.

## Examples of major gas supply disruptions in Australia

In September 1998, an industrial accident at the Esso gas plant in Longford, Victoria (Gippsland region) caused an explosion and fire. Two workers were killed and eight sustained serious injury, and gas supply to Victoria was significantly disrupted for two weeks. It is estimated that 1.4 million households and 89,000 businesses were affected, with estimated economic losses of \$1.3 billion.

In June 2008, a major disruption to natural gas supply in Western Australia was caused by the rupture of a corroded pipeline and subsequent explosion at a processing plant on Varanus Island, off the state's north west coast. Gas supply to Western Australia was significantly restricted until December 2008 with estimated economic losses of \$6.7 billion. No workers were injured as a result of the incident.

## Major reviews or significant government policies and strategies

Victoria implemented much of the current regime for regulating major hazard facilities after the 1998 Longford Gas Plant explosion and subsequent Royal Commission. The Royal Commission concluded that employees were not properly trained, and supervisors and higher management did not have the necessary knowledge to deal with the dangers caused by a pump shutdown. It was found that the ultimate cause of the accident was a failure to equip employees with appropriate knowledge to deal with the events that occurred – the Commission found Esso fully responsible for the accident:

‘The causes of the accident on 25 September 1998 amounted to a failure to provide and maintain so far as practicable a working environment that was safe and without risks to health. This constituted a breach or breaches of Section 21 of the *Occupational Health and Safety Act 1985*.’

In 2017, the Victorian Government commissioned an Independent Review of Victoria’s Electricity and Gas Network safety framework. Dr Paul Grimes was appointed as independent chair for the review, which examined the design and adequacy of the safety regulatory obligations, incentives and other arrangements governing Victoria’s safety of the electricity and gas networks.

The Grimes Review found that while Victoria has many of the key elements of a leading regulatory system, it also identified areas for improvement, making 43 recommendations chiefly focused on:

- strengthening the governance of Energy Safe Victoria (ESV), Victoria’s technical and safety regulator for electricity, gas and pipelines
- broadening ESV’s capabilities and preparedness to take strong regulatory action
- consolidating energy safety legislation to create

a single energy safety law

- promoting workforce engagement through the establishment of a consultative committee to improve the engagement and share best practice.

The Victorian Government supported 42 of the 43 recommendations, either in full or in principle, to strengthen Victoria’s electricity and gas network safety framework. ESV and the Department of Environment, Land, Water and Planning (DELWP) are responsible for leading actions to implement the recommendations. Implementation of the significant reform agenda is well underway, including the establishment of ESV as a three-person commission (from a single member agency), supported by a Technical Advisory Committee and Chief Executive Officer by 1 January 2021. More information on the Grimes Review, including a copy of the final report and the government response, can be found on the Engage Victoria – Electricity and Gas Network Safety Review webpage.

Mitigation	Response	Recovery
<ul style="list-style-type: none"> <li>legislative and Regulatory framework, including: <i>Gas Safety Act 1997</i> and associated Gas Safety Cases, National Gas Law and National Gas Regulations, critical infrastructure resilience requirements under the <i>Emergency Management Act 2013</i></li> <li>buried pipelines, signage and fencing</li> <li>security controls and surveillance incl. patrol and inspection</li> <li>dial before you dig</li> <li>public awareness</li> <li>maintenance inspections</li> <li>system modelling</li> <li>AEMO maintenance coordination and direction powers, including 24x7 control room and gas duty system</li> <li>GEMCF / NGERAC Industry forums, including regular emergency exercises</li> <li>Annual Victorian Gas Planning Report</li> </ul>	<ul style="list-style-type: none"> <li>AEMO system security and market intervention processes</li> <li>Gas Emergency Protocol (AEMO procedures)</li> <li>VEGCP and SISP Gas</li> <li>GEMG</li> <li>voluntary reductions / public appeal</li> <li>mandatory restrictions and enforcement (<i>Gas Industry Act 2001</i> and/or <i>Gas Safety Act 1997</i>)</li> <li>Gas Company Emergency Response Plans</li> <li>mutual aid agreement between industry partners</li> <li>State Health Emergency Response Plan</li> <li>relief programs (including financial assistance)</li> <li>Gas and Electricity SERP Sub Plan.</li> </ul>	<ul style="list-style-type: none"> <li>Gas Emergency Protocol (AEMO procedures)</li> <li>Gas Company Emergency Response Plans.</li> </ul>
<b>Quality assurance:</b> Emergency preparedness training and desktop exercises		

In Victoria, DELWP is the control agency for natural gas supply disruption. Like other energy-related emergencies, safe and reliable supply is a combined effort of governments and the private sector. Gas supply networks are managed within economic and legislative frameworks that minimise disruptions and incentivise prompt restoration of supply disruptions. As well as focussing on restoration of supply, responses to energy emergencies involve managing any consequences that emerge during the supply disruption and minimising the adverse consequences to communities.

Restoration of the system after a significant gas supply disruption involving isolation of parts of the distribution network is likely to be time consuming and resource intensive due to the need to undertake purging of pipeline before consumers can safely relight appliances.

National arrangements have been established to manage an electricity or natural gas supply emergency where the disruption affects or has the potential to affect multiple jurisdictions. These arrangements include national advisory committees comprised of AEMO, industry and

Australian, state and territory government representatives that can provide advice on the management of the supply emergency. Annual emergency exercises regularly test the effectiveness of the national arrangements.

### Websites and publications for further hazard-specific information

Emergency Management Victoria & Department of Environment, Land, Water and Planning:

[www.emv.vic.gov.au/responsibilities/state-emergency-plans/state-electricity-and-gas-supply-sub-plan](http://www.emv.vic.gov.au/responsibilities/state-emergency-plans/state-electricity-and-gas-supply-sub-plan)

[www.energy.vic.gov.au/gas/about-the-gas-sector](http://www.energy.vic.gov.au/gas/about-the-gas-sector)

<https://engage.vic.gov.au/electricity-network-safety-review>

Australian Energy Market Operator:

The Australian Energy Market Operator (AEMO) website includes information about its national and Victorian roles for gas emergencies as well as forecasting and planning reports at the national and state levels.

[www.aemo.com.au/energy-systems/gas/emergency-management](http://www.aemo.com.au/energy-systems/gas/emergency-management)

<https://aemo.com.au/energy-systems/gas/gas-forecasting-and-planning>

Energy Safe Victoria:

Energy Safe Victoria (ESV) is the independent technical regulator responsible for electricity, gas and pipeline safety in Victoria. The ESV website includes extensive information about gas safety and education. It also promotes gas safety through a number of campaigns, for example dial before you dig.

[https://esv.vic.gov.au/about-esv/energy\\_regulatory\\_framework/](https://esv.vic.gov.au/about-esv/energy_regulatory_framework/)

<https://esv.vic.gov.au/campaigns/dial-before-you-dig/>

<https://esv.vic.gov.au/technical-information/gas-appliances-and-equipment/>

<https://esv.vic.gov.au/technical-information/gas-infrastructure-and-pipelines/>

Australian Energy Regulator:

The Australian Energy Regulator (AER) website includes information about the operation of wholesale gas markets in Australia.

[www.aer.gov.au/](http://www.aer.gov.au/)

COAG Energy Council – National Gas Emergency Response Advisory Committee:

The National Gas Emergency Response Advisory Committee (NGERAC) was established in 2005 as part of a Memorandum of Understanding on the National Gas Emergency Response Protocol. NGERAC works with states and territories, energy industry participants and users to develop response management arrangements and to provide advice to government on mitigating the effects of multi-jurisdictional natural gas supply shortages during an emergency.

[www.coagenergycouncil.gov.au/current-projects/gas-emergency-response](http://www.coagenergycouncil.gov.au/current-projects/gas-emergency-response)

Community advice for gas supply disruption:

<https://esv.vic.gov.au/safety-education/emergencies/gas-emergency/>

[www.betterhealth.vic.gov.au/health/servicesandsupport/emergencies-coping-without-gas-or-electricity](http://www.betterhealth.vic.gov.au/health/servicesandsupport/emergencies-coping-without-gas-or-electricity)

[www.apa.com.au/emergencies/](http://www.apa.com.au/emergencies/)

[www.emergency.vic.gov.au/prepare/#gas-supply-disruptions/gas-supply-disruption](http://www.emergency.vic.gov.au/prepare/#gas-supply-disruptions/gas-supply-disruption)

# Hazardous materials incident

## Introduction

There are many places in Victoria where hazardous materials are manufactured, stored, transported, used and disposed of, due to its advanced industrialised economy. The term hazardous materials includes:

- 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 or respiratory illness.

Major emergencies involving hazardous materials are usually associated with large chemical fires in populated areas causing the release of toxic plumes, for example, a major hazard facility or waste management facility. The loss containment of materials that are in storage or being transported could also lead to a large explosion or release of toxic gas in populated areas. The consequences of major hazardous materials incidents include:

- human health impacts (injury, illness and death)
- environmental pollution (contamination of local ecosystems)
- economic losses (supply chain and widespread business interruption).

The safe management of hazardous materials in Victoria is underpinned by a rigorous legislative and enforcement regime governing the importation, production, transport, storage, sale and use of a range of substances.

## Examples of hazardous materials incidents in Victoria

This assessment has focused on major emergencies with potential state-level consequence, rather than the daily or weekly low-level releases, for example the presence of asbestos in insulation and building products. Examples of major hazardous materials incidents in Victoria include:

- 1991: Coode Island chemical explosion and fire over two days damaged or destroyed some 16 chemical tanks with approximately 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 (refer to gas supply disruption).
- 2007: Footscray/Tottenham Westpoint Industries fire 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, which averted a significant environmental damage.
- 2012: Wangaratta NuPlex chemical incident caused by an uncontrolled chemical reaction in a reactor vessel, which released an extremely odorous vapour in the surrounding community.
- 2015: Somerton tip fire occurred at a private refuse facility operated by Ecotec Solutions – the fire spread through compacted building waste. There was limited impact on the community due to the smoke column being blown in a favourable direction across open grassland for much of the time.
- 2017: Coolaroo SKM recycling plant fire resulting in toxic fumes impacting neighbouring communities and businesses.
- 2017: Stawell tyre dump posing a significant risk to human health was cleaned up through pro-active multi-agency emergency management intervention. If ignited, the smoke plume from the fire would have resulted in major health impacts to the residents of Stawell and surrounding communities.

- 2019: Campbellfield Bradbury Industrial Services hazardous waste storage facility fire. Two workers were injured and smoke from the fire impacted neighbouring communities, including school closures.

### Major recent reviews or significant government policies and 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.

In recent years, the risk of fires in waste management facilities has increased significantly due to problems in the industry. In March 2019, the Victorian Government established a Dangerous Goods/Waste Crime Taskforce as a senior governance decision body responsible for the development and implementation of a framework to identify, inspect and manage high-risk sites.

A parliamentary inquiry into recycling and waste management was also established in March 2019 to inquire into the issue of the devastating industrial fires that have taken place as a result of the illegal or inappropriate stockpiling of dangerous chemicals. The final report was tabled in parliament on 27 November 2019. The Victorian Government response to this inquiry is expected to drive further reform.



Mitigation	Response	Recovery
<ul style="list-style-type: none"> <li>• reduction/substitution of HAZMAT use (incl. inventory minimisation)</li> <li>• land use planning and regulation, and process facility/residential/commercial development designs</li> <li>• HAZMAT storage design and maintenance (incl. transport design)</li> <li>• HAZMAT transport requirements (e.g. prohibitions, material volume and selection, route and timing selection, transport mode, stakeholder engagement e.g. Worksafe, FVR, VicRoads, transporter, receiver).</li> <li>• pre-transport consequence modelling and readiness - plume modelling etc.</li> <li>• DG transporter maintenance, training, licensing, inspection etc. (road/rail/marine, pipeline) legislation / Regulation and enforcement (e.g. MHF, DG Code preventative requirements), supported by audits and inspection.</li> </ul>	<ul style="list-style-type: none"> <li>• real time transport consequence modelling and readiness - plume modelling, SCC readiness, specialist response personnel on standby etc.</li> <li>• leak detection and notification</li> <li>• carrier/operator emergency response protocols, supported by training, exercises etc. (incl. MHF, DG Code requirements) and consultation with relevant government and private agencies</li> <li>• response agency (e.g. FVR, CFA, EPA) atmospheric monitoring</li> <li>• emergency response communication to community using Vic Emergency platform and media etc.</li> <li>• evacuation and relief programs</li> <li>• emergency response agency protocols and containment, incl. bunding, Vulnerable Persons Register etc.</li> <li>• use of mitigating/neutralising measures/materials - relies on material stockpiles/supply and capacity to implement, PPE etc.*</li> <li>• government emergency response protocols, supported by training, exercises etc.</li> <li>• *emergency services do not currently have mitigation strategies to address all HAZMAT scenarios (e.g. AHF).</li> </ul>	<ul style="list-style-type: none"> <li>• insurance and offsets</li> <li>• health system support for longer term health impacts</li> <li>• built and natural environment remediation</li> <li>• alternative transport arrangements (diversions and closures for significant periods)</li> <li>• DHHS recovery activities for community (displacement, mental health impacts etc.)</li> <li>• business continuity measures for responder agencies (e.g. to address workforce health impacts).</li> </ul>

**Quality assurance:** Emergency preparedness training and desktop exercises



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 are subject to a safety management system that is underpinned by regulations, codes of practice, and subordinate guidance documents. The oversight regime subjects major hazard facilities to five-year licencing, with annual risk-based inspections. Operators are required to have emergency management plans in place, the objective of which is effective containment of incidents to prevent escalation.

In terms of local planning, operators of major hazard facilities are required to engage local 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.

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

Fire rescue Victoria and the Country Fire Authority are responsible for managing the response to hazardous materials incidents in their respective areas. Both fire services maintain specialist crews, vehicles and equipment to deal with spills and fires involving hazardous materials. The

principal support agencies are WorkSafe and the Environment Protection Authority who advise the fire services about the nature of the materials involved, and how to minimise environmental consequences.

### Websites and publications for further hazard-specific information

Country Fire Authority and Fire Rescue Victoria:

[www.cfa.vic.gov.au/plan-prepare/dangerous-goods](http://www.cfa.vic.gov.au/plan-prepare/dangerous-goods)

[www.frv.vic.gov.au/dangerous-goods-0](http://www.frv.vic.gov.au/dangerous-goods-0)

[www.frv.vic.gov.au/high-risk-dangerous-goods-and-hazardous-waste](http://www.frv.vic.gov.au/high-risk-dangerous-goods-and-hazardous-waste)

Worksafe Victoria:

[www.worksafe.vic.gov.au/dangerous-goods-act-and-regulations](http://www.worksafe.vic.gov.au/dangerous-goods-act-and-regulations)

Environment Protection Authority:

[www.epa.vic.gov.au/for-business/find-a-topic/about-hazardous-leaks](http://www.epa.vic.gov.au/for-business/find-a-topic/about-hazardous-leaks)

Parliamentary Inquiry into Recycling and Waste Management – final report:

[www.parliament.vic.gov.au/epc-lc/article/4154](http://www.parliament.vic.gov.au/epc-lc/article/4154)

Australian Government:

Department of Health – National Industrial Chemicals Notification and Assessment Scheme

[www.nicnas.gov.au/chemical-information](http://www.nicnas.gov.au/chemical-information)

Department of Infrastructure, Transport, Regional Development and Communications – Australian Dangerous Goods Code (Edition 7.5)

[www.ntc.gov.au/codes-and-guidelines/australian-dangerous-goods-code](http://www.ntc.gov.au/codes-and-guidelines/australian-dangerous-goods-code)

Community safety advice for hazardous materials:

<https://www.betterhealth.vic.gov.au/health/healthyliving/workplace-safety-hazardous-substances>

# 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.

The definition of extreme heat, or heatwave, varies from place to place and is influenced by humidity, demographics, urban and rural design. It is generally acknowledged as a period of unusual and uncomfortable hot weather that could negatively affect human health. People’s own adaptation to

their climate also needs to be considered when defining a heatwave.

The Bureau of Meteorology (BoM) defines a heatwave as occurring when the maximum and the minimum temperatures are unusually hot over a three-day period at a location. This is considered in relation to the climate and past weather at a location.

BoM also classifies heatwaves based on intensity:

Intensity	Description
Low	More frequent during summer – most people can cope during these heatwaves.
Severe	Less frequent and are likely to be more challenging for vulnerable people such as the elderly, particularly those with medical conditions.
Extreme	Rare – they are a problem for people who don’t take precautions to keep cool—even for people who are healthy. People who work or exercise outdoors are also at greater risk of being affected.

Victoria’s Department of Health and Human Services (DHHS) defines extreme heat based on its heat health temperature thresholds. The thresholds are based on the daily mean temperature for a particular location. Heatwaves occur when extreme heat lasts for three or more consecutive days. Extreme heat can affect everyone; however, some people are more vulnerable. These include:

- people over 65 years
- babies and young children
- pregnant and nursing mothers
- people who are physically unwell, especially heart disease, high blood pressure or lung disease
- people taking medication for mental illness.

Extreme heat also affects community infrastructure

such as electricity supply, transport (roads and rail) and other services resulting in power outages, delays or cancellations of rail services or failures of traffic management systems. A single day of extreme heat may have an impact infrastructure and services and the severity of impact increases with multiple days of extreme temperatures. Economic losses are also possible due to some industry shutdowns and impacts to agriculture, for example stock losses.

### Examples of heatwave in south-eastern Australia

Historically, the second week in January 1939 is regarded as the most severe heatwave to affect south-eastern Australia in the 20th century, with the devastating ‘Black Friday’ bushfires occurring

in Victoria on 13 January. From 1907-2010, the greatest numbers of heat-associated deaths in Australia occurred in Victoria.<sup>19</sup>

A significant heatwave affected south-eastern Australia in late January 2009. Melbourne endured three consecutive days of temperatures above 43°C followed by a record 46.4°C on 7 February. Many records were set for maximum and minimum temperatures, as well as the duration of extreme heat, and the period culminated in the Black Saturday bushfires on 7 February. Community impacts and consequences of the heatwave included:

- widespread impacts on the health system with 374 excess deaths in comparison to the same time period in previous years – representing a 62 percent increase in total all-cause mortality (unrelated to bushfires)
- tram and train infrastructure and services severely affected with over 1,000 train services cancelled in Melbourne in one week
- minor power outages with a major blackout on the third day that affected part of Southbank and areas west of Melbourne.

From 14–17 January 2014 Victoria experienced its hottest four-day period on record. The maximum temperatures were slightly lower than 2009, however mean temperatures were high and the heat lasted for a longer period. Maximum temperatures were 12°C or more above average, with parts of the state recording temperatures of 45°C or more on three consecutive days, and in excess of 41°C each day in Melbourne. Community impacts and consequences of the heatwave included:

- widespread effects on the health system with 167 excess deaths in comparison to the same time period in previous years – representing a 24% increase in total all-cause mortality
- public transport service disruptions with major delays across the system
- heat-related power outages affected approximately 35,000 people in Victoria during the evening of 14 January
- Australian Open tennis tournament disrupted with players and spectators affected by heat.

### Major recent reviews or significant government policies/strategies

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

The strategy sets out nine actions to address the health risk of extreme heat, including the development of the DHHS Heat Health Alert System (established in 2008) and support for municipal council heatwave planning.

*The January 2009 Heatwave in Victoria: an Assessment of Health Impacts* was released by the Office of the Chief Health Officer describing the health impacts of the period of extreme heat. In November 2009, the Victorian Parliament (Legislative Council) Standing Committee on Finance and Public Administration commenced an Inquiry into Departmental and Agency Performance and Operations for the 2009 Heatwave in Victoria. The Committee released its final report in May 2010.

In December 2009, DHHS released the Heatwave Plan for Victoria, which set out the risks associated with extreme heat and how DHHS prepare and

---

19 Exploring 167 years vulnerability: An examination of extreme heat events in Australia 1844-2010, Bushfire and Natural Hazards Cooperative Research Centre / Risk Frontiers – Coates, L, et al (2014)

respond to extreme heat and heatwaves. The latest version of DHHS's Heat health plan for Victoria (formerly Heatwave Plan for Victoria) was released in November 2019. The objectives of the plan are to:

- protect the health of the Victorian community from heat-related harm
- communicate the actions of the department to prepare for and respond to extreme heat
- outline preparedness and response activities for local government and the health and human services sectors to reduce the impact of extreme heat on the Victorian community.

Victoria's Climate Change Adaptation Plan 2017-2020 identifies a number of strategies

for increasing public and private resilience to climate risks, including heatwave. The Plan identifies a number of priority areas for action, including:

- addressing the impacts on health and human services
- preparing for and responding to extreme weather events.

Reducing the risk of heatwave is a key component for these priorities. While acknowledging a range of actions underway to reduce risks, the Plan details strategies to improve our understanding of the impacts of climate change on health and wellbeing, and emergency management.

### Controls in place for heatwave prevention (mitigation), response and recovery

Prevention	Response	Recovery
<ul style="list-style-type: none"> <li>• education – survive the heat campaign</li> <li>• weather forecasting</li> <li>• planning (state and agency preparedness)</li> <li>• heat health information surveillance and alert system including social media broadcasting</li> <li>• urban planning (water fountains, cool places – parks, a/c facilities)</li> <li>• community resilience campaigns</li> <li>• rescheduling public events</li> <li>• industry shutdown / changed work hours</li> <li>• well designed and maintained (resilient) infrastructure.</li> </ul>	<ul style="list-style-type: none"> <li>• victorian ambulance, health care and hospital system</li> <li>• emergency relief programs</li> <li>• where feasible electricity load shedding priority arrangements with vulnerable customers and facilities e.g. hospital, aged care facilities</li> <li>• agency response plans (local councils, DHHS, PTV, VicRoads, AEMO, water authorities etc.)</li> <li>• agreed triggers to activate response and communication protocols incl. heat health alert</li> <li>• rail - line specific extreme weather speed restrictions (real time monitoring and response to track temperature)</li> <li>• electricity load shedding priority arrangements for critical infrastructure (infrastructure supporting essential services)</li> <li>• timely response to failures by crew.</li> </ul>	<ul style="list-style-type: none"> <li>• emergency recovery plans and programs</li> <li>• state and agency debrief process and improvement report</li> <li>• infrastructure assessment and replacement/ restoration as required.</li> </ul>

**Quality assurance:** Emergency preparedness training and desktop exercises

Emergency Management Victoria (EMV) is the control agency for heatwave because its effects are not confined to an easily-defined sector. In 2017, EMV issued the second edition of the State Emergency Response Plan Extreme Heat Sub-plan. This Sub-plan supports the DHHS Heat Health Plan for Victoria, and other department or agency extreme heat plans, by ensuring a multi-agency approach is used to manage heat events.

The Heat Health Alert System (managed by DHHS) is a key prevention and preparedness strategy for minimising the impacts of heatwave on human health. Using the same districts as the BoM's weather forecast districts and the CFA's total fire ban districts, the system provides notifications to subscribers, which include members of the public, local governments, DHHS health and human services and community service providers of forecast extreme heat conditions that are likely to impact on human health. Individuals and organisations can subscribe to receive alerts.

DHHS also works with local government and the health and community sector to raise community awareness about the health impacts of heat. It provides advice and communication resources to stakeholders to provide to their clients, and works closely with local government to support the development and implementation of heatwave plans.

A Survive the Heat campaign runs through summer to provide key heat health messages to the community. Various media channels including radio, print and online are used. Emergency advice is provided for early forecasts of extreme heat or heatwave in particular locations.

Websites and publications for further hazard-specific information

Emergency Management Victoria:

[www.emv.vic.gov.au/responsibilities/state-emergency-plans/state-extreme-heat-sub-plan](http://www.emv.vic.gov.au/responsibilities/state-emergency-plans/state-extreme-heat-sub-plan)

Department of Health and Human Services:

[www2.health.vic.gov.au/public-health/environmental-health/climate-weather-and-public-health/heatwaves-and-extreme-heat](http://www2.health.vic.gov.au/public-health/environmental-health/climate-weather-and-public-health/heatwaves-and-extreme-heat)

[www2.health.vic.gov.au/public-health/environmental-health/climate-weather-and-public-health/heatwaves-and-extreme-heat/heatwave-planning](http://www2.health.vic.gov.au/public-health/environmental-health/climate-weather-and-public-health/heatwaves-and-extreme-heat/heatwave-planning)

Bureau of Meteorology:

[www.bom.gov.au/australia/heatwave/knowledge-centre/](http://www.bom.gov.au/australia/heatwave/knowledge-centre/)

Community safety advice:

[www.betterhealth.vic.gov.au/health/HealthyLiving/heat-stress-and-heat-related-illness](http://www.betterhealth.vic.gov.au/health/HealthyLiving/heat-stress-and-heat-related-illness)

[www.energy.vic.gov.au/safety-and-emergencies/power-outages](http://www.energy.vic.gov.au/safety-and-emergencies/power-outages)

[www2.health.vic.gov.au/public-health/environmental-health/climate-weather-and-public-health/heatwaves-and-extreme-heat/heat-health-alerts-subscribe](http://www2.health.vic.gov.au/public-health/environmental-health/climate-weather-and-public-health/heatwaves-and-extreme-heat/heat-health-alerts-subscribe)

## Maritime emergency (non-search and rescue)

### Introduction

Victoria receives almost 4300 port visits from cargo ships each year, loading and discharging more than 43 million tonnes of freight, valued at \$80 billion (Australian Sea Freight 2016-17, BITRE 2019). The relative density of ship traffic is greatest at the commercial ports, in particular Port Phillip Bay. Other areas of concentrated vessel activity include the approaches to Port Phillip Bay and the waters off Wilsons Promontory. Victoria's four commercial ports are the:

- Port of Melbourne is Victoria's largest port and the largest container port in Australasia – includes over 500 hectares of port land (bordering four municipal councils) and 21 kilometres of waterfront. The Port of Melbourne manages an estimated 3000 vessel movements annually in over 30 commercial berths. (Refer to information below regarding the responsibilities of the Victorian Ports Corporation (Melbourne))\*.
- The Port of Geelong (GeelongPort) is Victoria's second largest port located in Corio Bay, 75 km by road southwest of Melbourne. GeelongPort includes 15 berths across two primary precincts, Corio Quay and Lascelles and manages over 600 vessel visits every year, with a majority of the shipping activity linked to the bulk liquid berth at Refinery Pier. (Refer to information below regarding the responsibilities of the Victorian Regional Channels Authority)\*\*.
- The Port of Hastings is located in Western Port approximately 72 km south east of Melbourne. The Port manages major international and domestic shipping for the import and export of oil, liquid petroleum gas (LPG), steel and unleaded petrol (ULP) – around 100-150 vessels

are recorded at the Port each year. It also supports refining and fractionation plants, gas and oil storage and load-out facilities and it is the southern terminal for several pipelines carrying gas and oil to coastal markets. (Refer to information below regarding the responsibilities of the Victorian Regional Channels Authority)\*\*.

- The Port of Portland is a deep-water port servicing the forest production area of Victoria and South Australia, centred on Portland and Mt Gambier. The Port provides tugboat, pilotage and mooring services required by the more than 300 vessels visiting the port each year. It has six commercial berths and managed 7.5 million tonnes of cargo in 2016-17. Specialising in the export of bulk commodity products, the Port currently handles sustainable forestry products, livestock, grain, mineral sands, fertiliser, smelter products and wind turbines.

\*Victorian Ports Corporation (Melbourne) is a statutory authority created by the Victorian Government in 2016 following the successful completion of the lease of the commercial operations for the Port of Melbourne. Known as Victorian Ports Melbourne, its responsibilities include the management of commercial shipping in Port Phillip, safe navigation in the port waters of the Port of Melbourne, waterside emergency and marine pollution response, and the management of Station Pier as Victoria's premier cruise shipping facility. The critical work of the harbour master also resides with Victorian Ports Melbourne.

\*\*While GeelongPort and the Port of Hastings Development Authority manage their respective wharf and land-side infrastructure, the Victorian Regional Channels Authority (VRCA) is responsible for channel management and commercial navigation of commercial waters in and around these ports.



The number of cruise ship arrivals in Victoria has more than doubled over the past 10 years with 108 docking at Station Pier and one at Victoria Dock in during the 2017-18 cruise season (spring to autumn). Approximately 340,000 passengers and crew were aboard these vessels.<sup>20</sup>

Victoria also has 14 local ports that play a vital part in local communities and support industries of importance to Victoria's economy. Local ports provide services to the oil and gas industry, commercial fishing industry, charter boats, and recreational fishing and boating interests. The ports are key recreation and tourist assets and contribute significantly to the local economies. Local ports are managed by Parks Victoria, Local Government or local committees of management.

A range of maritime emergencies can potentially occur including:

- an environmental incident resulting from heavy crude or bunker oil being released from a large vessel or offshore industry operations
- a casualty incident (disabled vessel) such as a cruise ship in a regional location remote from a commercial port – potentially exacerbated severe weather
- the grounding or sinking of one or more large ships in a shipping channel – blocking port access for an extended period.

The consequences of maritime emergencies (non-search and rescue) can include:

- deaths and serious injuries
- economic losses – disruption to local and international trade, tourism, aquaculture, etc cetera

- severe impairment of marine ecosystems – animals killed and injured, and habitats destroyed.

### Examples of maritime emergencies (non-search and rescue) in Australia

There have only been a few notable maritime casualties, ship sinkings and near misses in Australia.

On 19 August 2016 at about 3pm, a Port Phillip Sea pilot boarded the Bow Singapore ship outside Port Phillip, Victoria. At about 4.15pm, as the ship neared the eastern end of the of the South Channel, the rudder temporarily ceased responding to helm inputs causing the ship to ground on the edge of the channel. The Bow Singapore was re-floated in the early hours of the 20 August, with the assistance of the rising tide and a tug. No damage was found on the ship's hull.

On 10 February 2017, the starboard propulsion unit of the Norwegian Star cruise ship failed while it was in Bass Strait about 22 NM south-west of Cape Liptrap– 2130 passengers and 1017 crew were on board. Favoured by relatively calm conditions, the ship was towed back to Melbourne without further incident.

---

20 Victorian Ports Melbourne cruise ship statistics

Significant oil spill incidents have also occurred in Australia in recent years.

Date	Ship / oil platform and location	Oil spilled in tonnes
11 March 2009	Pacific Adventurer – Cape Moreton, Queensland	270
21 August 2009	Montara Wellhead oil platform – NW Australian coast	4750
3 April 2010	Shen Neng 1 – Great Keppel Island, Queensland	4
9 January 2012	MV Tycoon – Christmas Island	102

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 and strategies](#)

The 2011 Marine Pollution Coastal Risk Assessment conducted by the 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. 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 was used to inform equipment and capability planning.

The State Maritime Emergencies (non-search and rescue) State Emergency Response Sub Plan was developed in 2016 to ensure an integrated and coordinated approach to Victoria's management of maritime emergencies (non-search and rescue) to reduce the impact and consequences of the events on the community, infrastructure and services, and environment. The scope of this Plan includes the

following maritime emergencies:

- marine pollution by oil, oily mixtures and undesirable substances
- marine pollution by hazardous and noxious substances (HNS)
- marine casualties, for example, vessels - non-search and rescue
- wildlife affected by marine pollution.

The National Plan for Maritime Environmental Emergencies (National Plan) sets out national arrangements, policies and principles for the management of maritime environmental emergencies. The National Plan gives effect to a number of international conventions and agreements to which Australia is a party. It also uses relevant domestic legislation that mandates response roles and responsibilities for government agencies and places preparedness and response obligations on various industry sectors through intergovernmental agreements. Recovery is a responsibility shared across industry, maritime agencies, other government entities and affected communities.

In May 2019, the Australian Maritime Safety Authority (AMSA) released a report titled Complex Maritime Emergencies. This Report was an output



of a national project to develop and frame a collective understanding of the national capability for managing complex maritime emergencies. The objective of this project was to improve understanding of current complex maritime emergency response capabilities and capacities, as well as to identify interdependencies and relationships between government and private sector

agencies. It is now evident that a national approach, and clarity in resource sharing arrangements, is required for the effective management of complex maritime emergencies in Australia. The project also identified gaps as highlighted in the report recommendations to improve management arrangements.

## Controls in place for maritime emergency (non-search and rescue) prevention (mitigation), response and recovery

Mitigation	Response	Recovery
<ul style="list-style-type: none"> <li>condition surveys for vessel class, commercial charter, and insurance requirements</li> <li>IMO licensing requirements and audits for vessel crews</li> <li>implementation of ISM Code requirements (i.e. safety management system)</li> <li>legislation and enforcement (e.g. compulsory marine pilotage / exempt masters, Harbour master directions, safety duty (SFAIRP) obligations of Port manager, Port operator, vessel operators, offshore facility operators etc.)</li> <li>state and national audits and inspection of commercial vessels, port infrastructure, offshore facilities (note vessel condition monitoring done by Commonwealth - AMSA &amp; NOPSEMA)</li> </ul>	<ul style="list-style-type: none"> <li>vessel/offshore facility emergency response procedures - pollution response, evacuation/ lifeboats, firefighting, etc.</li> <li>agreed escalation protocols between offshore leaseholders, AMSA, DoT, Navy, offshore industry etc.</li> <li>marine pollution reporting (statutory agencies, industry and community)</li> <li>marine pollution assessment and response capabilities (assets and equipment)</li> <li>State Response Team supported by Victorian Oil Pollution Contingency Plan (comprising of the State Maritime Emergencies (non-search and rescue) Subplan - Parts A and B and the National Plan stakeholders</li> </ul>	<ul style="list-style-type: none"> <li>marine pollution contingency plans (national and state) - four response plans: wildlife, HNS, casualty and oil response</li> <li>state recovery programs for community, environmental and economic impacts</li> <li>investigations and lessons identified to inform future planning</li> <li>medium/long term wreck recovery (e.g. from coast).</li> </ul>

Mitigation	Response	Recovery
<ul style="list-style-type: none"> <li>• licensed, current and competent pilots</li> <li>• Navigational Systems including charts, VTS, DUKC, marks, aids to navigation (wave, wind, tide, swell etc.), personal pilotage units etc.</li> <li>• Melbourne and Geelong harbour tug fleet capacity and redundancy for normal operations (limited)</li> <li>• capacity for coastal operations).</li> </ul>	<ul style="list-style-type: none"> <li>• CFA/FRV maritime hazmat (and firefighting) response capability (assets and equipment)</li> <li>• DELWP wildlife response capability (assets and equipment)</li> <li>• private industry capacity (with State/AMSA oversight) - e.g. salvors, AMOSC etc.</li> <li>• MSAR response capability (assets and equipment)</li> <li>• Immediate wreck recovery (e.g. from channel)</li> <li>• EPA investigation/litigation.</li> </ul>	

**Quality assurance:** Emergency preparedness training and desktop exercises

The controls for marine oil pollution and maritime vessel casualties are largely achieved through ship and industry standards, safe navigation rules, port operations procedures, maritime training, legislation and regulation. These involve state-based, national and international rules, agreements and arrangements.

Although it is always the first responsibility of the ship-owner and operator to seek assistance when an incident occurs, Australian state, territory and Commonwealth governments cooperate to provide an integrated emergency response capability.

In Victoria, maritime emergencies (non-search and rescue) are categorised by levels and control agencies may be determined based on this level.

- Level 1 relates to local incidents that are relatively minor in nature and can be addressed locally
- Level 2 are larger requiring state involvement have broader consequences and additional

resource requirements

- Level 3 where state and/or national support is required and have significant consequences to the state.

The Australian Transport Safety Bureau (ATSB) has completed 360 maritime safety investigations since 1982. The ATSB does not investigate for the purpose of taking administrative, regulatory or criminal action. It conducts 'no blame' marine safety investigations in accordance with the *Transport Safety Investigation Act 2003*. A recent ATSB investigation included the Norwegian Star incident in 2017.

Websites and publications for further hazard-specific information

Victorian Government:

[www.emv.vic.gov.au/responsibilities/state-emergency-plans/state-maritime-emergencies-non-search-and-rescue-plan](http://www.emv.vic.gov.au/responsibilities/state-emergency-plans/state-maritime-emergencies-non-search-and-rescue-plan)

[www.vicports.vic.gov.au/Pages/default.aspx](http://www.vicports.vic.gov.au/Pages/default.aspx)

<https://vrca.vic.gov.au/>

<https://transportsafety.vic.gov.au/maritime-safety>

<https://ref.epa.vic.gov.au/your-environment/water/victorias-marine-environments>

[www.wildlife.vic.gov.au/wildlife-emergencies/wildlife-emergencies](http://www.wildlife.vic.gov.au/wildlife-emergencies/wildlife-emergencies)

Victorian Ports:

[www.portofmelbourne.com/](http://www.portofmelbourne.com/)

<https://geelongport.com.au/>

[www.portofhastings.com/](http://www.portofhastings.com/)

[www.portofportland.com.au/](http://www.portofportland.com.au/)

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

[www.amsa.gov.au/marine-environment/maritime-casualty-response](http://www.amsa.gov.au/marine-environment/maritime-casualty-response)

[www.amsa.gov.au/marine-environment/national-plan-maritime-environmental-emergencies](http://www.amsa.gov.au/marine-environment/national-plan-maritime-environmental-emergencies)

[www.amsa.gov.au/marine-environment/maritime-casualty-response/complex-maritime-emergencies-report](http://www.amsa.gov.au/marine-environment/maritime-casualty-response/complex-maritime-emergencies-report)

[www.environment.gov.au/marine/marine-pollution](http://www.environment.gov.au/marine/marine-pollution)

Major oil spill incidents in Australia:

[www.amsa.gov.au/marine-environment/incidents-and-exercises/major-historical-incidents](http://www.amsa.gov.au/marine-environment/incidents-and-exercises/major-historical-incidents)

The Bureau of Infrastructure, Transport and Regional Economics (BITRE):

Reports that provide information on Australian sea freight movements, vessel activity, the use of coastal trading licences, and the size and composition of the Australian trading fleet. This report contains statistics on maritime freight and shipping activities in Australia from 2007-08 to 2016-17:

[www.bitre.gov.au/publications/2019/australian-sea-freight-2016-17](http://www.bitre.gov.au/publications/2019/australian-sea-freight-2016-17)

The National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA):

Australia's independent expert regulator for health and safety, environmental management, structural and well integrity for offshore petroleum facilities and activities in Commonwealth waters:

[www.nopsema.gov.au/](http://www.nopsema.gov.au/)

Australian Transport Safety Bureau (ATSB) Investigations:

[https://www.atsb.gov.au/publications/investigation\\_reports/2017/mair/329-mo-2017-003/](https://www.atsb.gov.au/publications/investigation_reports/2017/mair/329-mo-2017-003/)

# Mine emergency

## Introduction

Mines currently operating in Victoria utilise both open cut and underground methods of mineral extraction, including large open cut coal mines that supply brown coal for electricity generation. Mining activities involve earth moving operations using a variety of mechanical equipment operated by skilled people and can also include blasting.

Mines and mining operations are intrinsically hazardous. In particular, they can:

- be in close proximity to town centres, essential infrastructure (road, rail, power, gas, et cetera) and sensitive natural environments (rivers, lakes, et cetera)
- involve hazardous, toxic and/or radioactive substances
- increase fire risk (for example coal mines)
- result in discharges to land, air, surface water, groundwater, and also be the source of additional noise.

The consequences of a major mine emergency can include:

- multiple deaths and serious injuries, either directly (for example miners, other people in close proximity) or indirectly (for example due to electricity supply disruption), and long-term psycho-social impacts
- economic impacts due to business interruption – potential widespread impacts from disruption to electricity supply, loss of a major highway or complete loss of a mine
- local to regional environmental impacts to water and air quality or permanent loss of local ecosystem.

In Victoria, the most significant type of mine emergencies relate to the large open cut coal mines in the Latrobe Valley, which are critical for electricity generation. The stability of open cut

mine walls (batters) can be affected by mining activity, 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 overlaid with highly reactive soils, meaning soils that expand and contract with a variation of moisture content, exacerbating mine instability. The increased focus on rehabilitation plans also presents novel risks to the state in terms of stability, water usage and fire management in the long term.

## Examples of mine emergencies 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 500m long and 80m high, encompassing about six million cubic metres of material. The failure resulted in the entire Latrobe River flowing into the mine, damage to mining infrastructure and cessation of coal production from the East Field. 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 extensive remedial works and the Princes Freeway re-opened in September 2011, having been 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.

Hazelwood Mine Fire (2014): On 9 February, embers from bushfires burning in close proximity to the Hazelwood open cut mine spotted into the mine. Brown coal in the mine burned for 45 days sending smoke and ash over the township of Morwell and surrounding areas, resulting in significant community impacts. The Hazelwood mine fire is the largest and longest burning mine fire that has occurred in the Latrobe Valley to date. In essence this fire constituted two emergencies: a major complex fire emergency and a serious public health emergency.

### Major recent reviews or significant government policies and strategies

Hazelwood Mine Fire Board of Inquiry: On 11 March 2014, a day after the Hazelwood mine fire was declared under control the Victorian Government announced an independent inquiry into the fire. The Governor in Council officially established the Hazelwood Mine Fire Board of Inquiry on 21 March 2014. The terms of reference for the Board of Inquiry required it to inquire into and report on a range of issues, including:

- the origin of the fire
- the firefighting response
- fire prevention and preparedness measures taken by the owner, operator and licensee of the mine and regulatory agencies
- the fire's impacts on the health and wellbeing of affected communities
- the response to the health emergency.

The Board of Inquiry made 18 recommendations to the state and GDF Suez (mine owner/operator), including:

- expediting legislative amendments to require mine (licencee) work plans specifically address fire prevention, mitigation and suppression, et cetera

- developing a capability to undertake rapid air quality monitoring in any location in Victoria, to inform decision-making within 24 hours of an incident occurring
- developing and widely disseminating an integrated State Smoke Guide, to incorporate the proposed State Smoke Plan for the management of public health impacts from large scale, extended smoke events
- extend the community health study to at least 20 years, and appoint an independent board (including Latrobe Valley community representatives) to govern the study and publish reports.

Mineral Resources Strategy 2018-2023: Victoria's Mineral Resources Strategy 2018-2023 – titled State of Discovery – delivers a whole-of-government approach across the mining life cycle. This includes the administration and enforcement of the regulatory framework for managing the social, environmental and economic conditions of industry. The Strategy aims to grow investment and jobs in Victoria's minerals sector and promote the responsible exploration and development of Victoria's minerals by:

- building community confidence in social, environmental and economic performance of mineral exploration and development
- improving Victoria's attractiveness for minerals investment, and
- strengthening Victoria's position as a global mining and mining services centre.

Mitigation	Response	Recovery
<ul style="list-style-type: none"> <li>• legislation / regulation and enforcement of: Mineral Resources Sustainable Development Act 1990 and regulations (licensing and approvals process for operators of declared mines), <i>OH&amp;S Act 2004, Emergency Management Act 2013, Emergency Management (Critical Infrastructure Resilience) Regulations 2015, CFA Act 1958 and Regulations 2014, ESV Act 2005</i></li> <li>• operator implementation of TARP (incl. consultation with Government agencies) and monitoring/maintenance</li> <li>• implementation of risk-based mine Work Plans and RAMPs, addressing specific mine stability, fire, explosion, flooding etc. controls.</li> <li>• audits and inspection</li> <li>• planning consent and work plan approvals (initial and on-going)</li> <li>• imposition of licensee and work plan conditions on the mines to manage identified risks</li> <li>• technical review board (provides independent advice to DJPR and the Minister on mine stability).</li> </ul>	<ul style="list-style-type: none"> <li>• emergency evacuation and relief programs</li> <li>• mine operator implementation of site TARP (including consultation with Government agencies) and emergency response plan</li> <li>• escalation protocol and primary agencies based on scenario type - Class 1 / Class 2 emergencies and EMMV Part 7.</li> </ul>	<ul style="list-style-type: none"> <li>• operator site recovery processes informed by incident investigation</li> <li>• implementation of Municipal Recovery Plan</li> <li>• implementation of EMMV recovery measures.</li> </ul>
<b>Quality assurance:</b> Emergency preparedness training and desktop exercises		

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

#### Websites and publications for further hazard-specific information

Department of Jobs, Precincts and Regions:

<https://djpr.vic.gov.au/what-we-do/mining-and-resources>

<https://earthresources.vic.gov.au/>

Environment Protection Authority:

<https://www.epa.vic.gov.au/for-community/monitoring-your-environment/about-epa-airwatch>

Department of Health and Human Services:

<https://www2.health.vic.gov.au/emergencies/hazelwood>

Hazelwood Mine Fire Inquiry:

<http://hazelwoodinquiry.vic.gov.au/>



# Pandemic influenza

## Introduction

Influenza, commonly known as the flu, is caused by a highly contagious virus that is spread by droplets, such as via 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 influenza pandemics tend to occur every 10-50 years.

Because of their high levels of illness and death, pandemic influenza events can have significant effects on society. In addition, there can be profound effects through the physical distancing measures (between people) that may be required. Schools may be closed and public events cancelled.

In addition, it is estimated that up to 40 percent 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 obligations 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 percent.<sup>21</sup>

## Examples of pandemic influenza emergencies affecting Australia

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 pandemic influenza was considered to be of mild to moderate severity with the overwhelming majority of patients experiencing mild symptoms and making a 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.

At the time of publishing this report a novel coronavirus known as COVID-19 is occurring as a pandemic in Australia and throughout the world. Whereas COVID-19 is not an influenza virus, it is

---

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



a severe highly transmissible virus that is likely to result in comparable consequences estimated for the credible worst-case scenario in the 2017 assessment. Pandemics due to coronaviruses, which include Severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS), should be considered as an ongoing threat globally.

#### Major recent reviews or significant government policies and strategies

Pandemic influenza emergencies are managed through the cooperative efforts of agencies under Victoria's emergency management arrangements. Victoria has two specific plans for managing pandemic influenza:

- Victorian Health Management Plan for Pandemic Influenza (2014)
- Victorian Action Plan for Human Influenza Pandemic (2015).

The latter plan is a government-wide plan for management across state and local governments, and non-government organisations.

It is important to note that the focus of this report is the uncertainty of a pandemic virus occurring in the future, rather than what is known to be occurring. Information directly related to the COVID-19 pandemic will be taken into account for future emergency risk assessment projects.

Prevention	Response	Recovery
<ul style="list-style-type: none"> <li>• routine seasonal vaccination</li> <li>• health guidelines and relevant standards and codes</li> <li>• community education</li> <li>• pandemic planning, surge capacity planning and exercises</li> <li>• surveillance and modelling data from outbreaks, research of historic events</li> <li>• research of historical events.</li> </ul>	<ul style="list-style-type: none"> <li>• emergency relief programs</li> <li>• early detection, characterisation and vaccine development, distribution and implementation.</li> <li>• quarantine, containments, physical distancing, border control</li> <li>• testing and contact tracing</li> <li>• distribution of stockpiled drugs and masks</li> <li>• prioritisation of antiviral use for pre-exposure prophylaxis and post-exposure prophylaxis and treatment.</li> <li>• implementing communication and engagement strategy with relevant stakeholders</li> <li>• state health coordination across the health system, including as necessary, dedicated influenza clinics and other appropriate models of care..</li> </ul>	<ul style="list-style-type: none"> <li>• stakeholder engagement and communication</li> <li>• business continuity plans</li> <li>• formal debrief process including lessons learnt with stakeholders including GPs, hospitals, councils, ambulance services, Nurse on Call, pharmacists, Department of Education</li> <li>• comprehensive review of plans. Updates and revisions as required.</li> </ul>

**Quality assurance:** Emergency preparedness training and desktop exercises

Control of pandemic influenza is an international activity, with worldwide surveillance for human outbreaks. There are well-developed international, national and state plans to respond to the detection of new potential influenza strains, including pandemic strains. In the event of human infection in Australia, the Australian Health Management Plan for Pandemic Influenza 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 and Human Services.

Key control activities include 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. In a declared State of Emergency under the *Public Health and Wellbeing Act 2008*, the Chief Health Officer has several specific powers to assist in dealing with an outbreak, for example restricting the movement of people or the use of specific premises.

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 H'N' pandemic.

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 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.

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

- Hygiene measures, for example enhanced hand washing
- community warnings and advice, including information about travel and home isolation or quarantine
- containment activities
  - > restricting public access to premises
  - > distancing
  - > workplace surveillance and enhanced infection control
  - > usage of personal protective equipment (facemasks, et cetera).
- Business continuity strategies
- Vaccination and use of antiviral medications.

Websites and publications for further hazard-specific information

Emergency Management Victoria and Department of Health and Human Services:

[www.emv.vic.gov.au/responsibilities/state-emergency-plans/victorian-action-plan-for-pandemic-influenza](http://www.emv.vic.gov.au/responsibilities/state-emergency-plans/victorian-action-plan-for-pandemic-influenza)

[www2.health.vic.gov.au/about/publications/policiesandguidelines/Victorian-health-management-plan-for-pandemic-influenza---October-2014](http://www2.health.vic.gov.au/about/publications/policiesandguidelines/Victorian-health-management-plan-for-pandemic-influenza---October-2014)

[www2.health.vic.gov.au/emergencies/emergency-type/infectious-diseases/pandemic-influenza](http://www2.health.vic.gov.au/emergencies/emergency-type/infectious-diseases/pandemic-influenza)

[www2.health.vic.gov.au/emergencies/shera](http://www2.health.vic.gov.au/emergencies/shera)

Commonwealth Government:

[www1.health.gov.au/internet/main/publishing.nsf/Content/ohp-ahmppi.htm](http://www1.health.gov.au/internet/main/publishing.nsf/Content/ohp-ahmppi.htm)

World Health Organisation:

[www.who.int/influenza/preparedness/pandemic/influenza\\_risk\\_management/en/](http://www.who.int/influenza/preparedness/pandemic/influenza_risk_management/en/)

Better Health Channel – for the general public:

<https://www.betterhealth.vic.gov.au/flu>

# Storm

## Introduction

Storm emergencies include windstorms, dust storms, blizzards, storm tides, and severe thunderstorms including hailstorms, tornadoes, and heavy rain. Storms affecting land based communities are divided into two broad categories: severe thunderstorms and severe weather. The Bureau of Meteorology (BoM) define a severe thunderstorm as one that produces any of the following:

- hailstones with a diameter of 2cm or more
- wind gusts of 90 km/h or greater
- flash flooding, or
- tornados.

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 from October to April, primarily due to the warm temperatures and increased moisture levels in the atmosphere. Only about 10 percent of thunderstorms are severe but these account for about 90 percent of the damage caused by all thunderstorms. All thunderstorms produce lightning which can cause death and injury, damage infrastructure and ignite bushfires.

Windstorms can occur at any time of year, although more common in the winter and spring months when intense low-pressure systems and cold fronts are stronger and more frequent. Strong winds are also associated with thunderstorms, where severe downdraughts can cause brief, and intense wind surges called microbursts, which can cause significant damage to property and infrastructure on a very localised scale.

Heavy rainfall is also associated with the passage of cold fronts and low-pressure systems that are more common in winter and spring. Some major storms have occurred during summer 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 occur mainly during the winter and early spring months but can also occur in autumn.

The consequences of storms in Victoria include:

- deaths or serious injury
- economic losses due to 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.

## Examples of storm emergencies in Victoria

Date	Type of storm, location and description
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	Windstorm: 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.
6 March 2010	Hailstorms: Severe thunderstorms developed to the north-west of 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. The SES received 7500 requests for assistance and insurance claims exceeded \$1 billion.
4 February 2011	Severe thunderstorm: 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 resulted in record rainfall in north-east and south-east Victoria. 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 24 hours. Electrical storms disrupted flights, public transport and electricity supply to tens of thousands of homes. Hail in the Mildura area caused significant crop damage. Tolmie weather station in north-east of Victoria recorded 101 mm of rain in 24 hours.
25 December 2011	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. The SES received more than 4200 requests and insurance payments exceeded \$700 million.

Date	Type of storm, location and description
21 March 2013	Tornado: At least 20 people were injured and taken to hospital, with two in a critical condition, after two tornados with wind gusts between 180 and 250 km/h cut a path of destruction across Victoria's north-east. The SES received 150 requests for assistance when the tornados 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 3600 calls for assistance. Apart from fallen trees damaging cars and houses, electricity outages affected many thousands of premises.
27 January 2016	Severe thunderstorms: Isolated heavy rainfall, high winds, hail and flash flooding impacted the Geelong area with 72mm of rainfall recorded at Avalon over a short period. Flash flooding required a significant response from emergency services with SES and CFA responding to more than 350 requests for assistance. The storm caused significant damage to over 300 properties, including 213 residences – 35 designated as uninhabitable. The storm also damaged essential assets, including roads and drains, and led to mobile phone and electricity network outages.
31 January 2020	Severe thunderstorms with microburst: Severe thunderstorms impacted much of south-eastern Australia, producing damaging to destructive winds, which impacted the west of the state in particular. Severe wind gusts of 119km/h were recorded at Mt Gellibrand, with eight electricity transmission towers toppled at nearby Cressy. This subsequently caused a separation of South Australia from the National Electricity Market for about two weeks, while temporary towers were installed.
22 May 2020	Severe weather: Likely to be a category 1 or EF1 intensity tornado, as classified by the Bureau of Meteorology, the storm destroyed four homes south of Geelong and damaged 60 others across the suburbs of Waurin Ponds, Grovedale, Armstrong Creek and Mount Duneed, with up to 160 km/h winds

Mitigation	Response	Recovery
<ul style="list-style-type: none"> <li>• key infrastructure compliant to engineering standards (Infrastructure standards / regulations)</li> <li>• drainage systems (drainage standards and strategy)</li> <li>• vegetation planning and management</li> <li>• buildings compliant to engineering standards (planning and building standards / regulations)</li> <li>• BoM weather and warning network and systems</li> <li>• community warnings</li> <li>• equipped, trained and prepared essential services incl. power, water, gas and transport</li> <li>• StormSafe community education program.</li> </ul>	<ul style="list-style-type: none"> <li>• BoM weather and warning network and systems</li> <li>• community information and warnings</li> <li>• incident preparedness (emergency planning, readiness and exercises)</li> <li>• emergency response national support (protocols in place)</li> <li>• emergency relief programs</li> <li>• industry expertise esp. power (national support)</li> <li>• mutual aid arrangement for critical infrastructure e.g. power, water, gas etc.</li> </ul>	<ul style="list-style-type: none"> <li>• BoM weather and warning network and systems</li> <li>• community information and warnings</li> <li>• emergency recovery of individuals, households, communities and industries / businesses (state resources exceeded - national support would be required)</li> <li>• implementation of business continuity and disaster recovery planning esp. essential services and critical infrastructure</li> <li>• development and implementation of government health and well-being programs for the wider community</li> <li>• relief services.</li> </ul>

**Quality assurance:** Emergency preparedness training and desktop exercises

The control agency for storm is the Victoria State Emergency Service (VICSES). Severe thunderstorm warnings are issued by the Bureau of Meteorology, and augmented on TV and radio by VICSES

preparedness messages.

[www.ses.vic.gov.au/web/www/get-ready/stormsafe/what-do-do-in-a-storm](http://www.ses.vic.gov.au/web/www/get-ready/stormsafe/what-do-do-in-a-storm)

Websites and publications for further hazard-specific information

Australian Bureau of Meteorology:

[www.bom.gov.au/climate/storms/](http://www.bom.gov.au/climate/storms/)

Emergency Management Victoria & Victoria State Emergency Service:

[www.emv.vic.gov.au/responsibilities/state-emergency-plans/state-storm-sub-plan](http://www.emv.vic.gov.au/responsibilities/state-emergency-plans/state-storm-sub-plan)

[www.ses.vic.gov.au/get-ready/stormsafe](http://www.ses.vic.gov.au/get-ready/stormsafe)

# Water supply disruption

## Introduction

As a component of the water cycle system, water supply includes the collection, storage, treatment, delivery of water (including recycled water) for various purposes. This includes the availability and allocation of water for:

- consumption – urban, agricultural and industrial
- environmental, recreation and cultural uses.

Victoria's water grid connects the capture, production and storage infrastructure such as dams, reservoirs, irrigation districts and the desalination plant, and the delivery infrastructure, such as channels, pipes, pumps and the waterways used to deliver water.

Victoria's dams have a total storage capacity of approximately 13,400,000 megalitres. These dams include major storages such as Dartmouth dam (4,000,000 megalitres), Lake Eildon (3,300,000 megalitres) and the Thomson dam (1,070,000 megalitres), and smaller privately-owned dams on farms or lifestyle properties (most common).

Large dams, managed by water corporations on behalf of the Victorian government, store and supply water for use in towns, cities, industry or large farming areas. The areas around some of these dams may be closed off from public use to protect the quality of the water. Victoria's dam safety record is very good, but it is important to maintain effective oversight – catastrophic dam failure is a regular occurrence internationally.

A water supply disruption emergency can occur due failures that impact the delivery (quantity) of water, or its quality, particularly potable water for drinking. Such failures are more likely to coincide with the occurrence of a natural disaster.

For example:

- heavy rain run-off in a water catchment recently burnt by a bushfire,
- asset damage due to bushfires

- infrastructure failure due to flood or earthquake.

The consequences of a water supply disruption emergency include:

- human health and well being
- economic losses due to business interruption, and
- disruption to other essential services (requiring water to operate).

Note: The high impact scenario considered for the water supply disruption assessment is also the credible worst case.

## Critical dependencies

Interdependencies exist with the water sector and other critical infrastructure sectors - banking and finance, communications, energy, food supply, government, health and transport. This includes where services provided to the water sector are critical for water services delivery (upstream dependencies) and services provided by the water sector that are critical for other sectors (downstream dependencies). As part of the emergency risk assessment process, the water sector identifies significant upstream dependencies which include, electricity, liquid fuel, treatment chemicals, telecommunications and transport.

## Examples of water supply disruption emergencies in Australia

Between July and September 1998, tests indicated that Sydney's water supply was contaminated by the microscopic pathogens cryptosporidium and giardia. After decreasing water storage levels in the preceding 12 months, the contamination was caused by low-quality raw water entering the dam from rainfall. The incident was highly publicised and caused major public alarm. Three successive boil water notices were issued instructing residents to boil their tap water before use. A Commission of Inquiry was established in response to the crisis. The final report included 91 recommendations that led to significant reform of water supply governance and water management in Greater Metropolitan Sydney.



Between 1997 and 2009, Victoria experienced 13 consecutive years of drought, known as the Millennium Drought. The unprecedented dry conditions tested the effectiveness of Victoria's water management frameworks. Conditions were well outside the operational design range of Victoria's water supply systems and water sharing rules. In 2006-07, annual inflows into water storages were the lowest ever recorded, and many areas experienced severe water shortages.

### Major recent reviews or significant government policies and strategies

The Millennium Drought brought about changes in how water is managed in Victoria. Managing Extreme Water Shortage in Victoria – Lessons from the Millennium Drought (2016) documents the experiences of water managers across Victoria during the drought, and highlights the lessons learned about water planning and management. The report captures the steps taken to address low water resource availability and to ensure equitable, efficient and appropriate use of water. This includes changes to water resource management in all sectors (urban, irrigation, domestic and stock, and environmental), as well as investment in infrastructure, water efficiency and behavioural change programs.

Victoria's strategic water plan Water for Victoria was released in 2016. This plan focusses on the overall effective management of Victoria's water resources now, and into the future. It includes a range of actions that are currently being implemented in the following key areas:

- climate change
- waterway and catchment health
- water for agriculture
- resilient and livable cities and towns

- recognising and managing for indigenous values
- recognising recreational values
- water entitlements and planning
- realising the potential of the grid and markets
- jobs, economy and innovation.

In December 2017, the Department of Environment, Land, Water and Planning (DELWP) released the Integrated Water Management Framework for Victoria. The Framework aims to help government, the water sector and the community work together to better plan, manage and deliver water in Victoria's towns and cities. It uses the knowledge and experience of water sector organisations in applying integrated approaches to water cycle planning. This Integrated Water Management (IWM) Framework aims to:

- communicate the value of participating in IWM, identifying shared outcomes and driving innovative solutions
- explain the rationale for establishing collaborative IWM forums across the state
- outline the process of identifying, prioritising and investigating IWM opportunities for inclusion in IWM plans
- guide the development of IWM plans that reflect community values
- outline the proposed governance approach for the forums, including DELWP's role
- explain how IWM planning contributes to the development of urban water strategies, local government strategies and catchment management activities across Victoria
- highlight the support and guidance available to embed collaborative planning.

Victoria's water sector will also be guided by a new climate change adaptation plan, as part of the Victorian government's strategy to manage the effects of climate change. The Pilot Water Sector Climate Change Adaptation Action Plan (2018) has been delivered as part of the Water for Victoria program. The short-term and medium-term objectives of the pilot plan are to:

- build knowledge of how climate change will impact the Victorian water sector (2018-2020)
- develop the frameworks, policy and tools to enable successful adaptation in the water sector (2018-2020)
- enhance the capability and capacity of water sector staff to apply climate change adaptation to business decisions (2018-2020)
- integrate climate change adaptation into all relevant business decisions in the water sector (2025).

Meeting these objectives place the water sector in a strong position to prepare the inaugural Water Sector Adaptation Action Plan by 2021, as required under the *Climate Change Act 2017*.

The Commonwealth Government provides national leadership for water management through legislation such as the *Water Act 2007*, and policy reform such as the National Water Initiative (NWI). The NWI, agreed in 2004 by the Council of Australian Governments (COAG), is the national blueprint for water reform. It is a shared commitment by governments to increase the efficiency of Australia's water use, leading to greater certainty for investment and productivity, for rural and urban communities and for the environment. Under the NWI, governments commit to:

- prepare comprehensive water plans
- achieve sustainable water use in over-allocated or stressed water systems
- introduce registers of water rights and standards for water accounting
- expand trade in water rights
- improve pricing for water storage and delivery
- better manage urban water demands.

Mitigation	Response	Recovery
<ul style="list-style-type: none"> <li>• system resilience e.g. desal plant and grid connectivity</li> <li>• critical infrastructure resilience</li> <li>• testing and reporting, SCADA systems and telemetry</li> <li>• asset condition assessments and asset management plans</li> <li>• legislative framework and regulations including Water Act 2009 and Safe Drinking Water Act 2003 (risk management plans and audits)</li> <li>• HACCP accreditation (many authorities)</li> <li>• research of emerging issues, technology and science etc.</li> </ul>	<ul style="list-style-type: none"> <li>• treatment, operational plans and procedures</li> <li>• operator training</li> <li>• consistent emergency response across the water sector</li> <li>• back-up power supply for some facilities</li> <li>• emergency relief programs</li> <li>• all hazard approach for response</li> <li>• formal mutual aid arrangements</li> </ul>	<ul style="list-style-type: none"> <li>• business continuity plans</li> <li>• emergency recovery plans and programs</li> </ul>
<b>Quality assurance:</b> Emergency preparedness training, emergency exercises and audit		

Water efficiency programs such as permanent water saving rules and targeting lower water use has reduced average household water use in Melbourne by 35 per cent in the last 10 years. However, population growth and ongoing dry conditions associated with climate change means that further investment will be needed.

DELWP is the Control Agency for a range of water sector emergencies including disruption to water and wastewater services, dam safety, blue-green algae incidents and non-hazardous pollution of inland waters.

### Websites and publications for further hazard-specific information

Department of Environment, Land, Water and Planning – Water and Catchments:

<https://www.water.vic.gov.au/vic-water-supply>

[www.water.vic.gov.au/\\_data/assets/pdf\\_file/0030/58827/Water-Plan-strategy2.pdf](https://www.water.vic.gov.au/_data/assets/pdf_file/0030/58827/Water-Plan-strategy2.pdf)

<https://www.water.vic.gov.au/managing-dams-and-water-emergencies/dams>

<https://www.water.vic.gov.au/managing-dams-and-water-emergencies/dams/dam-safety-management>

<https://www.water.vic.gov.au/managing-dams-and-water-emergencies/emergency-management>

<https://www.water.vic.gov.au/liveable/integrated-water-management-program/iwm-framework>

<https://www.water.vic.gov.au/climate-change/millennium-drought-report>

<https://www.water.vic.gov.au/climate-change>

Commonwealth Government – Department of Agriculture:

<https://www.agriculture.gov.au/water/policy>

<https://www.agriculture.gov.au/water/policy/nwi>



# Appendix 1

## Descriptive definitions

The following sets out the meaning of 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, for example flood, fire, hazardous materials escapes

their vulnerability, that is, 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, geopolitical/strategic or lifestyle/health.

### Hazard

A hazard is a source of potential harm.

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 the loss in such terms as moderate, high or extreme. A hazard assessment is more likely to refer to exposure, that is, 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 emergency occurring.

### Mitigation controls

A term that covers a wide range of strategies and actions that reduce risk, that is, 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 an effective mitigation control. Evacuation prior to a flood or bushfire reduces the exposure of people to potential consequences. 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

Measures to eliminate or reduce the incidence or severity of emergencies.

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. 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.

The highest risk emergencies are those that are most likely to happen, and with the highest potential consequences.

### Risk description

Structured statement of risk usually containing four elements - sources, events, causes and consequences.

### Risk management and risk assessment

Risk management includes the coordinated activities of an organisation or a government to direct and control risk. The risk management process includes the activities of:

- communication and consultation
- establishing the context
- risk assessment, which includes
  - > risk identification
  - > risk analysis
  - > risk evaluation
- risk treatment
- monitoring and review.

Also refer to Figure 1 on page 4.

## 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.





# Appendix 2

## More detail about the emergency risk assessment process

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. The expert groups identified two plausible impact scenarios for Victoria – high and credible worst-case when considered at state level. Where historical events were used, their consequences were adjusted to current equivalents, for example, 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 five consequence categories of the National Emergency Risk Assessment Guidelines (NERAG) 2014.

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


- People: consequences describe deaths and injuries as a direct result of the emergency event, relative to the population being considered under the established context
- Economic: consequences include financial and economic losses resulting directly from damage due to the emergency event
- Environment: consequences include loss of species and landscapes, and loss of environmental value, as a result of the emergency event
- Public administration: public administration consequences are concerned with the impact of the emergency event on the delivery of core functions of the governing bodies for the community
- Social setting: social setting consequences are concerned with the effect on communities from the emergency event, as distinct from the individual impacts assessed in the people criteria.

Each consequence category has five levels of severity - insignificant, minor, moderate, major and catastrophic. For each scenario assessed, the highest consequence level is taken as the overall consequence level (refer to NERAG for more detailed information about the assessment criteria).

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<sup>22</sup>. The results from the disparate risk assessment workshops are then plotted onto two risk characterisation (evaluation) matrices for comparison – refer to Figures 2 and 3 on pages 15 and 16. The risk matrices are a representation of the relative significance of

---

22 A logarithmic scale is used for consequence levels, because the consequences of emergency events can cover several orders of magnitude (NERAG, p. 54)



emergency risks. A logarithmic scale is used for consequence levels, because the consequences of emergency events can cover several orders of magnitude.

### Precaution-based approach

Each risk assessment adopted a precaution-based due diligence approach to risk management, integrated with the hazard-based AS/ISO31000 approach in NERAG. This means that risk treatment recommendations made to address low likelihood high consequence events are clearly justifiable in a post-event legal review context, even when likelihood estimations are (necessarily) imprecise.

A precautionary review was undertaken for each risk assessment identifying the controls in place for prevention (mitigation), response and recovery. A due diligence sign-off was also completed at the conclusion of each risk assessment workshop involving two further questions being asked:

- was there any other issue of concern which had not been raised during the session?
- were there any other possible precautions, the value of which had not been tested?

### 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 broad comparisons between the disparate emergency 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.

**emv.vic.gov.au**

Working in conjunction with communities,  
government, agencies and business

