

PRACTICE GUIDE

10.1

National Emergency Risk Assessment Guidelines



Australian Institute for
Disaster Resilience



Note to the reader

This practice guide, formerly published as Handbook 11 by Emergency Management Australia, is now published by the Australian Institute for Disaster Resilience.

For further information on the revision of handbooks and manuals visit www.aidr.org.au.

AUSTRALIAN EMERGENCY MANAGEMENT HANDBOOK SERIES

National Emergency Risk Assessment Guidelines: practice guide

© Commonwealth of Australia 2015

ISBN 978-1-925290-34-9 (print)

978-1-925290-35-6 (online)

Edited and published by the Australian Government Attorney-General's Department

Technical editing and typesetting by Biotext, Canberra and Melbourne.

Copyright

The Australian Government Attorney-General's Department encourages the dissemination and exchange of information provided in this publication.

The Commonwealth of Australia owns the copyright in all material produced by this department.

All material presented in this publication is provided under a Creative Commons Attribution 3.0 Australia licence, with the exception of:

- the Commonwealth Coat of Arms
- this department's logo
- materials specifically not provided under a Creative Commons Attribution 3.0 Australia licence
- content supplied by third parties.

The details of the relevant licence conditions are available on the Creative Commons website, as is the full legal code for the CC BY 3.0 AU licence.



See: Creative Commons Attribution 3.0 Australia

Attribution

Material obtained from this publication is to be attributed to this department as:

Source: Australian Government Attorney-General's Department.

Third-party copyright

Wherever a third party holds copyright in material presented in this publication, the copyright remains with that party. Their permission may be required to use the material.

The Australian Government Attorney-General's Department has made all reasonable efforts to:

- clearly label material where the copyright is owned by a third party
- ensure that the copyright owner has consented to this material being presented in this publication.

This document contains Standards Australia Ltd and ISO copyrighted material that is distributed by SAI Global on behalf of Standards Australia Ltd and ISO. It may be reproduced in accordance with the terms of SAI Global Ltd's Licence 1411-c083 to the Commonwealth of Australia ('the licensee').

All licensed copies of this document must be obtained from the licensee. Standards Australia Ltd and ISO's material is not for resale, reproduction or distribution in whole or in part without written permission from SAI Global Ltd: tel + 61 2 8206 6355 or copyright@saiglobal.com.

Using the Commonwealth Coat of Arms

The terms of use for the Coat of Arms are available from the It's an Honour website.

See: It's an Honour (www.itsanhonour.gov.au)

Contact

Enquiries regarding the licence and any use of this document are welcome at:

Attorney-General's Department
3-5 National Circuit
BARTON ACT 2600
Telephone +61 (0) 2 6141 6666

Disclaimer

The Australian Government Attorney-General's Department, 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 Commonwealth of Australia (acting through the Attorney-General's Department) 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.

History of the Manual/Handbook Series

The first publication in the original Australian Emergency Manual Series (Handbook Series) of mainly skills reference manuals was produced in 1989. In August 1996, on advice from the National Emergency Management Principles and Practice Advisory Group, the Handbook Series was expanded to include a more comprehensive range of emergency management principles and practice reference publications.

The Handbook Series has been developed to help the management and delivery of support services in a disaster context. It comprises principles, strategies and actions compiled by practitioners with management and service-delivery experience in a range of disaster events.

The series has been developed by a national consultative committee representing a range of state and territory agencies involved in the delivery of support services, and is sponsored by the Australian Government Attorney-General's Department. The series was expanded to introduce handbooks so that it would better align with the *National Strategy for Disaster Resilience*.

Details of the Handbook Series are available at www.emknowledge.gov.au.

Australian Emergency Management Handbook Series (2011–)

Handbook 1 *Disaster health*

Handbook 2 *Community recovery*

Handbook 3 *Managing exercises*

Handbook 4 *Evacuation planning*

Handbook 5 *Communicating with people with a disability – National Guidelines for Emergency Managers*

Handbook 6 *National Strategy for Disaster Resilience – community engagement framework*

Handbook 7 *Managing the floodplain: a guide to best practice in flood risk management in Australia*

Handbook 8 *Lessons management*

AUSTRALIAN EMERGENCY MANAGEMENT HANDBOOK SERIES

Building a disaster resilient Australia

Handbook 9 *Australian Emergency Management Arrangements*

Handbook 10 *National Emergency Risk Assessment Guidelines*

Handbook 11 *National Emergency Risk Assessment Guidelines: practice guide*

Australian Emergency Manual Series Principles and Reference (1996–2011)

Manual 2 *Australian Emergency Management Arrangements*

Manual 3 *Australian Emergency Management glossary*

Manual 4 *Australian Emergency Management terms thesaurus*

Manual 18 *Community and personal support services*

Manual 29 *Community development in recovery from disaster*

Manual 15 *Community emergency planning*

Manual 27 *Disaster loss assessment guidelines*

Manual 28 *Economic and financial aspects of disaster recovery*

Manual 8 *Emergency catering*

Manual 1 *Emergency management concepts and principles*

Manual 23 *Emergency management planning for floods affected by dams*

Manual 5 *Emergency risk management – applications guide*

Manual 43 *Emergency planning*

Manual 20 *Flood preparedness*

Manual 22 *Flood response*

Manual 21 *Flood warning*

Manual 44 *Guidelines for emergency management in culturally and linguistically diverse communities*

Manual 25 *Guidelines for psychological services: emergency managers guide*

Manual 26 *Guidelines for psychological services: mental health practitioners guide*

- Manual 45 *Guidelines for the development of community education, awareness and education programs*
- Manual 13 *Health aspects of chemical, biological and radiological hazards*
- Manual 6 *Implementing emergency risk management – a facilitator’s guide to working with committees and communities*
- Manual 17 *Multi-agency incident management*
- Manual 31 *Operations centre management*
- Manual 7 *Planning safer communities – land use planning for natural hazards*
- Manual 14 *Post disaster survey and assessment*
- Manual 24 *Reducing the community impact of landslides*
- Manual 12 *Safe and healthy mass gatherings*
- Manual 41 *Small group training management*
- Manual 46 *Tsunami*
- Manual 16 *Urban search and rescue – capability guidelines for structural collapse*

Skills for Emergency Services Personnel Series (1989)

- Manual 38 *Communications*
- Manual 39 *Flood rescue boat operation*
- Manual 37 *Four-wheel-drive vehicle operation*
- Manual 35 *General and disaster rescue*
- Manual 33 *Land search operations*
(refer to website <http://natsar.amsa.gov.au/land-search-manual.asp>)
- Manual 32 *Leadership*
- Manual 36 *Map reading and navigation*
- Manual 34 *Road rescue*
- Manual 30 *Storm and water damage operations* (information may not be appropriate to all situations)

AUSTRALIAN EMERGENCY MANAGEMENT HANDBOOK SERIES

Building a disaster resilient Australia

CONTENTS

| | | |
|------------|--|-----------|
| 1 | INTRODUCTION | 1 |
| 1.1 | Purpose | 1 |
| 1.2 | Navigating this Practice Guide | 1 |
| 2 | BACKGROUND TO EMERGENCY-RELATED RISK ASSESSMENT | 5 |
| 2.1 | Emergency-related risk assessment: definitions | 5 |
| 2.2 | Why emergency risk management is necessary | 6 |
| 2.2.1 | A structured process | 7 |
| 2.2.2 | Public expectations | 7 |
| 2.2.3 | Disruption response and recovery is unique | 7 |
| 2.3 | The emergency risk management process | 8 |
| 2.4 | The emergency risk management project team | 9 |
| 3 | COMMUNICATION AND CONSULTATION | 10 |
| 3.1 | Goals and elements of communication and consultation | 10 |
| 3.1.1 | Guiding principles | 11 |
| 3.1.2 | Processes and planning | 12 |
| 3.2 | Communication and consultation throughout the risk management process | 16 |
| 3.2.1 | Establish the context | 16 |
| 3.2.2 | Risk identification | 16 |
| 3.2.3 | Risk analysis | 17 |
| 3.2.4 | Risk evaluation | 17 |
| 3.2.5 | Risk treatment | 17 |
| 3.2.6 | Monitoring and review | 18 |
| 3.2.7 | Risk registers | 18 |
| 4 | ESTABLISH THE CONTEXT | 20 |
| 4.1 | Internal and external parameters or environment | 21 |
| 4.2 | Context for the emergency-related risk assessment process | 22 |
| 4.2.1 | Community objectives | 22 |
| 4.2.2 | Responsibilities for the project | 23 |
| 4.2.3 | Scope of risk assessment | 23 |

| | | |
|------------|---|-----------|
| 4.2.4 | Stakeholders | 23 |
| 4.3 | Risk criteria | 24 |
| 5 | RISK IDENTIFICATION | 26 |
| 5.1 | Systematic discovery | 26 |
| 5.1.1 | Historical information and data | 27 |
| 5.1.2 | Scenarios | 29 |
| 5.2 | Risk identification outputs | 30 |
| 5.2.1 | Expressing risk descriptions | 30 |
| 5.2.2 | Understanding the risk possibilities | 31 |
| 5.2.3 | Thinking broadly | 31 |
| 6 | RISK ANALYSIS | 33 |
| 6.1 | Risk analysis outputs | 33 |
| 6.2 | Identifying controls | 34 |
| 6.3 | Consequence criteria and levels | 37 |
| 6.4 | Likelihood | 37 |
| 6.5 | Risk level | 41 |
| 6.6 | Confidence | 42 |
| 6.6.1 | Separate confidence assessments of consequence and likelihood | 42 |
| 7 | RISK EVALUATION | 45 |
| 7.1 | Risk evaluation outputs | 46 |
| 7.2 | Determining risk priority | 48 |
| 7.2.1 | Revisiting consequence criteria | 48 |
| 7.2.2 | Informing priority through levels of confidence | 48 |
| 8 | MONITORING AND REVIEW | 53 |
| 8.1 | Changes in the context | 54 |
| 8.2 | Changes in the risk assessment | 54 |
| 8.2.1 | Sources of risk | 54 |
| 8.2.2 | The community and its objectives | 55 |
| 8.2.3 | Measuring consequences and analysing risk | 55 |
| 8.3 | Changes in treatments and controls | 56 |

| | | |
|-------------------|--|-----------|
| 9 | RISK TREATMENT | 57 |
| 9.1 | The project team | 57 |
| 9.2 | Developing a risk treatment plan for decision makers | 58 |
| 9.2.1 | Selection criteria | 60 |
| 9.2.2 | Generating options for risk treatments | 62 |
| 9.2.3 | Choosing options for each risk that is to be treated | 63 |
| 9.2.4 | Prioritising the risk treatments | 64 |
| 9.2.5 | Recording the process | 65 |
| 9.2.6 | Preparing an implementation plan | 65 |
| 9.2.7 | Documenting risk treatment | 66 |
| APPENDIX A | EMERGENCY RISK MANAGEMENT AND ITS ASSOCIATED GUIDES | 68 |
| APPENDIX B | ENGAGEMENT TECHNIQUES FROM THE COMMUNITY ENGAGEMENT FRAMEWORK | 69 |
| APPENDIX C | SAMPLE OBJECTIVE AND SCOPING STATEMENT | 72 |
| APPENDIX D | SAMPLE COMMUNICATIONS PLAN | 73 |
| APPENDIX E | SAMPLE CONTEXT STATEMENT | 74 |
| APPENDIX F | SAMPLE RISK SCENARIOS | 76 |
| APPENDIX G | EXAMPLES OF RISK STATEMENTS | 85 |
| APPENDIX H | SAMPLE RISK REGISTER | 86 |
| APPENDIX I | SAMPLE RISK TREATMENT PLAN SUMMARY | 87 |
| APPENDIX J | SUMMARY OF PRACTICE HINTS | 88 |
| REFERENCES | | 96 |

LIST OF FIGURES

| | | |
|------------|---|----|
| Figure 1: | Complete risk management process and corresponding Practice Guide structure | 3 |
| Figure 2: | Example of the risk identification section in the risk management process | 3 |
| Figure 3: | Risk register components and order of completion | 4 |
| Figure 4: | Example of 'Risk identification' in the risk register | 4 |
| Figure 5: | Complete risk management process and corresponding Practice Guide structure | 8 |
| Figure 6: | The Community Engagement Framework | 13 |
| Figure 7: | 'Establish the context' relationship to the risk register | 21 |
| Figure 8: | 'Risk identification' relationship to the risk register | 27 |
| Figure 9: | The process of risk identification | 28 |
| Figure 10: | 'Risk analysis' relationship to the risk register | 34 |
| Figure 11: | Determining risk level | 41 |
| Figure 12: | 'Risk evaluation' relationship to the risk register | 46 |
| Figure 13: | Selecting risk priority from confidence tables | 49 |
| Figure 14: | A flowchart used to help determine whether further risk analysis is required | 52 |
| Figure 15: | Treatment planning process | 60 |
| Figure 16: | Programs and activities supporting disaster prevention, preparedness, response and recovery | 63 |
| Figure 17: | Components of a treatment plan | 66 |
| Figure 18: | Highest recorded Forest Fire Danger Index for Tasmania, 2000–10 | 75 |
| Figure 19: | Example of a risk register | 86 |

LIST OF TABLES

| | | |
|-----------|--|----|
| Table 1: | The Community Engagement Framework: techniques and expectations | 14 |
| Table 2: | Engagement techniques across a risk management project for a range of stakeholders | 15 |
| Table 3: | Qualitative descriptors of risk control strength and expediency | 36 |
| Table 4: | Level of existing risk control matrix | 36 |
| Table 5: | Likelihood level | 39 |
| Table 6: | Qualitative risk level matrix | 41 |
| Table 7: | Confidence level descriptions | 43 |
| Table 8: | Likelihood–consequence confidence matrix | 44 |
| Table 9: | Priority descriptors | 47 |
| Table 10: | Priority levels at highest confidence | 49 |
| Table 11: | Priority levels at high confidence | 49 |
| Table 12: | Priority levels at moderate confidence | 50 |
| Table 13: | Priority levels at low confidence | 50 |
| Table 14: | Priority levels at lowest confidence | 50 |
| Table 15: | Indicators for monitoring change in the context | 55 |
| Table 16: | Criteria for assessing treatment options | 61 |
| Table 17: | Sample CODE RED communication action plan | 73 |
| Table 18: | Summary of the 2009 H1N1 swine flu virus | 79 |
| Table 19: | Summary of the Spanish flu virus | 83 |
| Table 20: | Risk scenarios for bushfire and cyclone | 84 |
| Table 21: | Sample risk treatment plan summary for a severe storm | 87 |

CONTENTS

This handbook will be updated in soft copy, so any proposed changes or other relevant publications can be brought to the attention of the editor (email empublications@ag.gov.au with the subject 'National Emergency Risk Assessment Guidelines').

To support the advancement of lessons management, the Australian Government will allow approved overseas organisations to reproduce the content in this publication owned by the Australian Government with acknowledgement but without payment of copyright fees.

1 INTRODUCTION

1.1 Purpose

This Practice Guide (Handbook 11 in the Australian Emergency Management Handbook Series) is a companion piece to the *National Emergency Risk Assessment Guidelines* (NERAG; available as Handbook 10 in the Australian Emergency Management Handbook Series). Those involved in implementing NERAG at state or local government levels should use this guide. It is designed for more experienced practitioners and for those new to emergency management; therefore, some of the concepts are more fully described.

This guide takes you through the emergency-related risk assessment and treatment process, offering both examples and practice hints. These are ideas and suggestions that may support your project team activities in specific parts of the risk management process. They describe approaches that may be helpful, but are discretionary.

Before using this guide, it is recommended that you first familiarise yourself with NERAG. The Practice Guide is intended for use Australia-wide, and to complement existing practices and guidance within each jurisdiction.

Throughout this guide, it is assumed that a 'project team' will undertake the risk assessment work. This team may take the form of a committee, working group, project team, permanent work unit or consulting firm.

You should keep in mind that – as NERAG is applied, practised and strengthened over time – the opportunity for additional and more sophisticated case studies will also increase. It is also critical that you consider the context and scale of your emergency-related risk assessment project, and relate this Practice Guide to it.

1.2 Navigating this Practice Guide

This Practice Guide is designed to take the user through the risk assessment process, as described in *AS/NZS ISO 31000:2009 Risk management – principles and guidelines* (see Appendix A). Documenting your outcomes as you follow the process will produce a completed risk register.

Two visual devices have been used to assist you navigate through both the process and the part of the risk register that will be completed. Figure 1 shows the complete risk management process. At the beginning of each chapter, there will be a visual device that shows which part of the process you are working in, where the current section is highlighted. (For example, see Figure 2. Risk identification is highlighted when working in Chapter 5.)

Figure 3 shows a risk register template – essentially, what you will produce as you work through your risk assessment. The numbers indicate the order in which it is completed. At the beginning of each relevant chapter, there will be a figure that indicates which parts of the risk register will be completed within the section (see Figure 4 for an example).

Each section of the Practice Guide describes how to approach one part of the risk management process. Figure 1 also serves as a visual guide to which section deals with which part of the process.

Appendices C–I include case studies and/or samples of each component of the process. The Practice Guide does not follow a single case study from beginning to end, since doing so would inappropriately narrow the focus for broad applicability.

This guide also includes practice hints from experienced practitioners, to help you undertake specific aspects of the emergency-related risk management process. These are shown in boxes throughout the chapters. Appendix J lists all the practice hints.

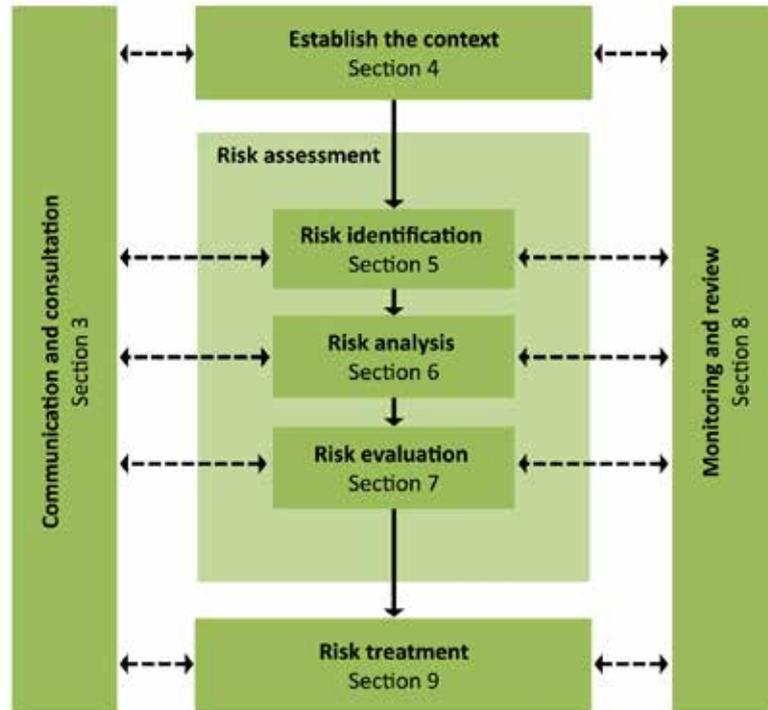


Figure 1: Complete risk management process and corresponding Practice Guide structure

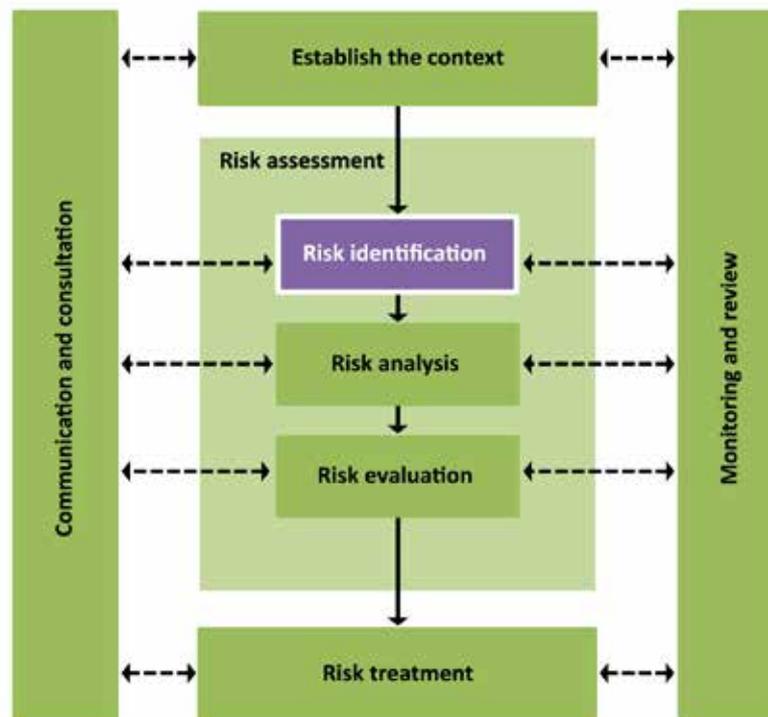


Figure 2: Example of the risk identification section in the risk management process

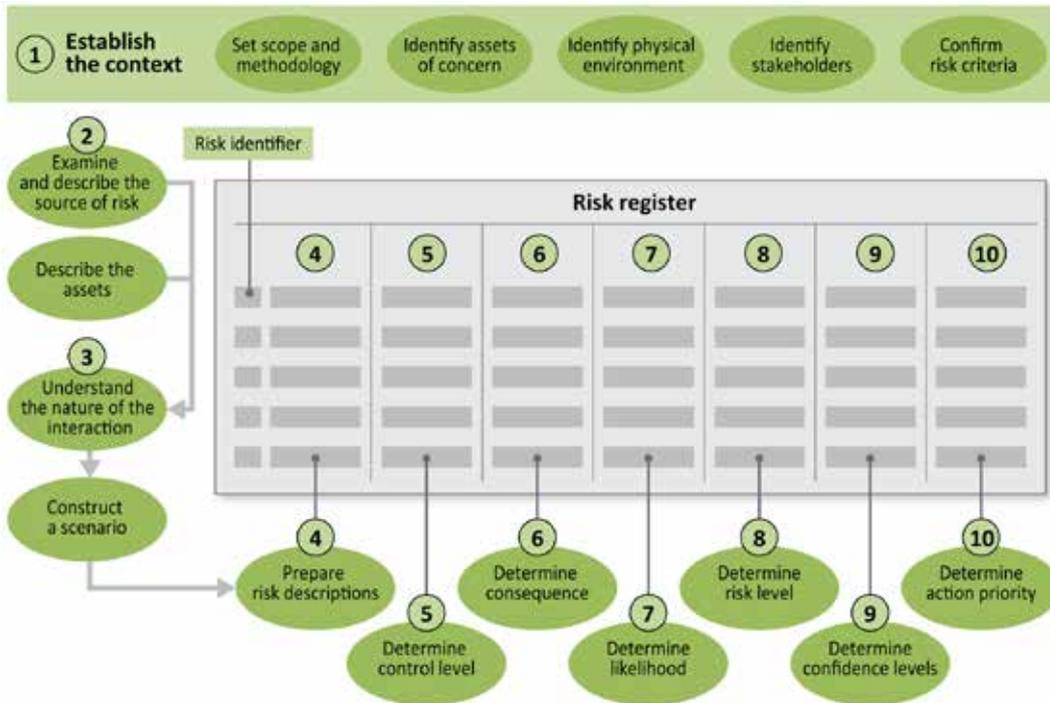


Figure 3: Risk register components and order of completion

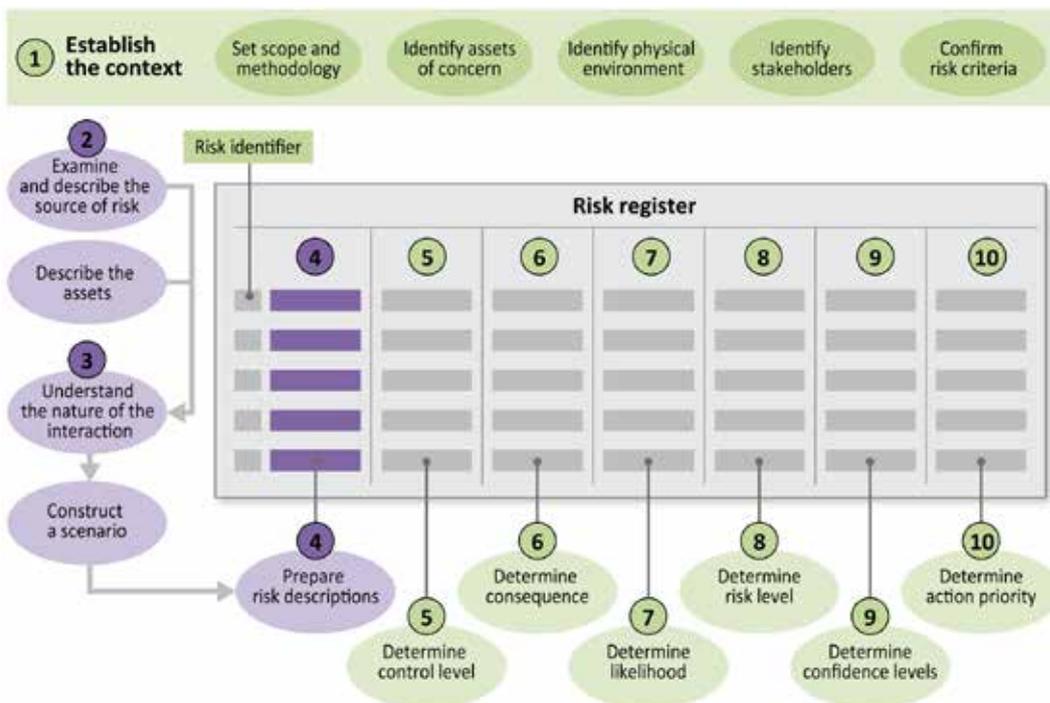


Figure 4: Example of 'Risk identification' in the risk register

2 BACKGROUND TO EMERGENCY-RELATED RISK ASSESSMENT

A successful emergency-related risk management project enables an emergency risk management project team to make recommendations, on behalf of their stakeholders, about where to best expend limited community resources to achieve the greatest gain. This is done within the value set of the stakeholder group and in an uncertain environment.

This Practice Guide is structured to explain:

- key concepts, words and terminology that are fundamental to the understanding and application of the principles and processes outlined in the *National Emergency Risk Assessment Guidelines* (NERAG)
- some ways to establish the management regime, scope and context for emergency management risk projects
- some methodologies for designing and implementing engagement strategies to ensure effective emergency risk management processes and outcomes
- ways to assist application in various frameworks (the practice hints)
- some methodologies for identifying and describing risk, analysing it and, subsequently, evaluating risk.

2.1 Emergency-related risk assessment: definitions

Some terms and definitions used in NERAG and this Practice Guide include the following:

- **Stakeholder** is used widely in this guide, and is defined as a person or organisation that can affect, be affected by, or perceive themselves to be affected by, a decision or activity. (Note: A decision maker can be a stakeholder). It is necessary to ensure that stakeholders, relevant to the risk assessment, are identified and engaged as part of the risk assessment process. Organisations cannot undertake emergency risk assessment in isolation.
- **Risk** is the effect of uncertainty on objectives.
- **Emergency-related risks** are a category of risks to community objectives. Emergency-related risks are typically rare (low likelihood), but have highly disruptive

consequences to the stakeholder groups under analysis. Managing these types of risk requires significant and coordinated activity, including planning, mitigating, recovering from and responding to them.

- **Emergencies**, or disruptive events, are the manifestation of emergency-related risks. Emergencies are such that stakeholders such as government, businesses, not-for-profit organisations, communities and individuals need to activate coordinated emergency arrangements to respond and recover from them.
- **Emergency risk management** is risk management applied in the emergency management context. It involves analysis and decision making about emergency-related risks. Emergency risk management generally focuses on the larger and less likely emergencies, rather than the routine events. Section 2.3 of NERAG describes the emergency risk framework.

Handbook 1 – *Disaster health* – in the Australian Emergency Management Handbook Series describes emergency risk management as follows:

Emergency risk management deals with a family of risks that have the potential for very significant impacts on the objectives of a community or organisation. The consequences of these risks will be of a magnitude requiring non-routine management or activities; for example, a cyclone, an extended power failure or a pandemic. Most public safety risks can be managed by routine operations and practices (business as usual) such as clearing roads of foliage, immunisation programs, attending road accidents and putting out house fires. However, some risks if they materialise require many organisations to work together to ensure the best outcomes for the community. Typically these low-probability high-consequence phenomena are associated with natural, biological, technological and industrial sources of risk. (AEMI 2011a)

2.2 Why emergency risk management is necessary

Emergency risk management helps to maximise limited resources, including time and energy. We take risks to make gains, hoping that the gain will be greater than the cost. Risk management helps make informed decisions and decisions about trading off the

costs and benefits of development. Other reasons for emergency risk management are that:

- it holds organisations accountable
- it is expected from the public
- emergency management is a complex problem that often requires tailored strategies and treatments.

2.2.1 A structured process

The risk management process can guide the project team through a step-by-step decision-making process. The process is ordered, is recordable and provides accountability.

2.2.2 Public expectations

The Australian public expects that its various levels of government have measures in place to mitigate, plan for, respond to and recover from disruptive events in their communities. The emergency risk management process, as described in NERAG, provides an approach for local, regional and state government bodies to determine the most appropriate suite of measures that will reduce the emergency-related risk.

2.2.3 Disruption response and recovery is unique

Management structures designed for 'business as usual' do not always work for disruption response and recovery. Communities, governments and organisations are structured to efficiently and comfortably achieve their everyday, or routine, objectives. In many cases, this can result in silos within them that efficiently achieve the outcomes the organisation has been created to achieve. Without the appropriate and continual cultural, governance and practice approaches, the drive to efficiency can significantly reduce the potential for the public sector to deal with problems and challenges that sit outside of, or across, these silos. Emergency management bridges these silos because it is an activity that involves multiple agencies and organisations.

2.3 The emergency risk management process

It is necessary to step through a range of sub-processes to effectively identify, analyse and evaluate risks, and then to make recommendations regarding which risks are the most important to treat first. A risk register of the outcomes of these sub-processes will be created, as will documents that support the risk register. These documents will contain more detailed records of the decision-making processes and rationale. Figure 3 shows the components of the risk register and the order in which they are completed. Figure 5 shows the Practice Guide structure in relation to the risk management process.

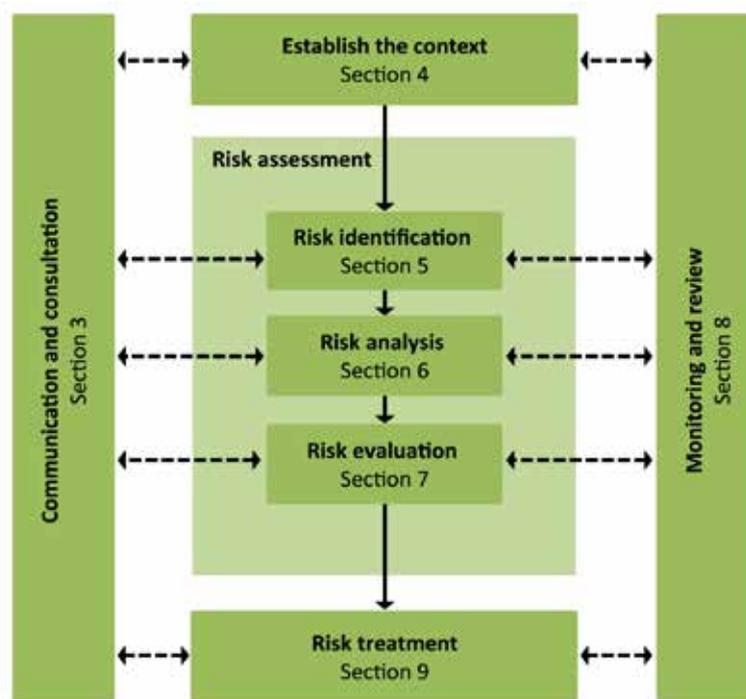


Figure 5: Complete risk management process and corresponding Practice Guide structure

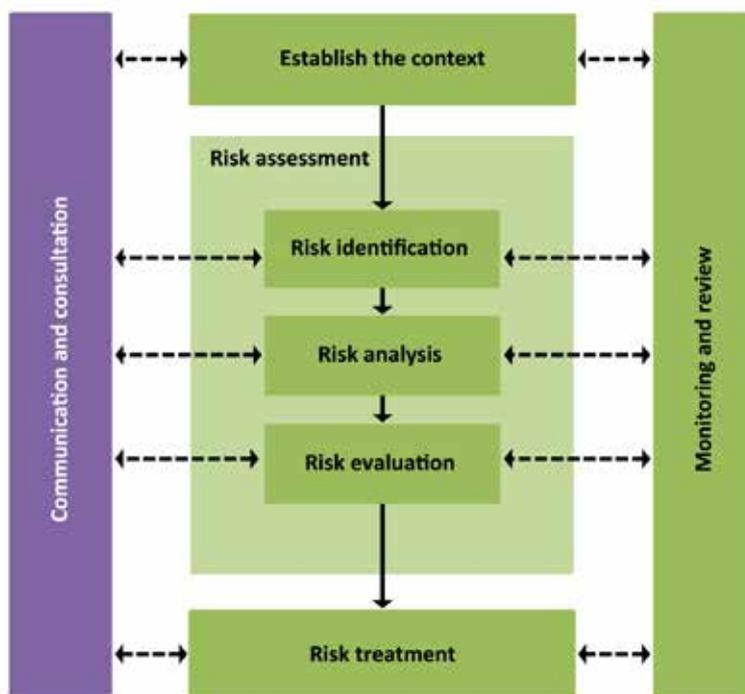
2.4 The emergency risk management project team

An emergency risk management process needs to involve a range of representatives from agencies and organisations that have an interest in the project outcomes.

The process is typically conducted by a project team that will consult heavily with stakeholders throughout the project. The project team will also plan and drive the process, record the outcomes and make recommendations for action about identified risks.

A different or slightly modified team may implement treatment in the risk treatment phase. The same agencies and organisations may continue to be represented, but different individuals may be involved.

3 COMMUNICATION AND CONSULTATION



3.1 Goals and elements of communication and consultation

Emergency risk management takes place in a social and political context, and involves a wide range of stakeholders. Each stakeholder or stakeholder group may have different knowledge, understanding and views on the risks they face. Effective risk management requires the sharing of information and perspectives on risk, with the goal of achieving a better allocation of limited resources to improve community wellbeing. This is particularly the case when dealing with low-probability and high-consequence risks, because they may not be amenable to typical statistical analyses compared with, for example, road accidents, for which there are good data. In most cases, risk treatments will depend on the willingness of organisations and community members to commit resources (e.g. time, money, assets, labour), and change behaviours, values and objectives to manage risk.

Risk assessment is a critical process in building understanding and a commitment to act. Whereas the technical aspects of risk assessment are essential, effective communication and consultation underpins every aspect of the process. Even when risk

can be managed through direct treatments, such as legislation and regulation, their effectiveness still largely depends on stakeholder support and acceptance.

3.1.1 Guiding principles

Communication and consultation with external and internal stakeholders should take place during all stages of the risk management process.

Therefore, plans for communication and consultation should be developed at an early stage. The project leader should ensure communication and consultation plans are developed in collaboration with those who will be engaging with the various stakeholders, and should ensure that such plans identify who will be undertaking the consultation and communication activities. The plans should address issues relating to the risks, the sources of risk, the consequences (if known), and the controls and treatments being used to manage the risks. Effective external and internal communication and consultation is essential to ensure that those accountable for implementing risk management and stakeholders understand the basis on which decisions are made, and the reasons why particular actions are required.

An effective approach to communication and consultation will:

- help establish the context appropriately
- ensure that the interests, values and expectations of the stakeholder(s) are understood and considered
- help ensure that the risks are adequately identified
- bring different areas of expertise together for analysing risks
- ensure that different views are appropriately considered when defining risk criteria and when evaluating risks
- secure endorsement and support for implementing a treatment plan
- develop an appropriate external and internal communication and consultation plan.

Communication and consultation with stakeholders is important, because they make judgements about risk. Perceptions of risk can vary due to the stakeholders' differences

in values, needs, experience, assumptions, concepts and concerns. As their views can have a significant impact on the decisions made, the stakeholders' perceptions should be considered in the decision-making process.

Communication and consultation should facilitate truthful, relevant, accurate and understandable exchanges of information, taking confidentiality and personal integrity into account.

Communication and consultation activities should be planned and documented as part of the risk management reporting process.

3.1.2 Processes and planning

For the ongoing trust and credibility of the project, and the agencies and individuals undertaking it, it is critical that these processes are undertaken with integrity and sensitivity to the people and the processes involved. Communication and consultation processes for the risk management project should be identified and planned. They require an understanding of the context and the purpose of the consultation. The Community Engagement Framework (the Framework) provides useful guidance to achieve this.

The Framework focuses on engagement with the community, but the focus in Figure 6 is adapted to inform engagement with the community, as well as with the many other stakeholders in the risk management process.

Engagement should be based on the following principles:

- understand the stakeholders, and their capacity, strengths and priorities
- recognise the complexity inherent in the diversity of the stakeholders
- partner with stakeholders to support existing networks and resources.

Table 1 provides guidance for using the Framework during a risk management project. It has been specifically adapted for the risk management process. Appendix B also describes some engagement techniques that you can use.

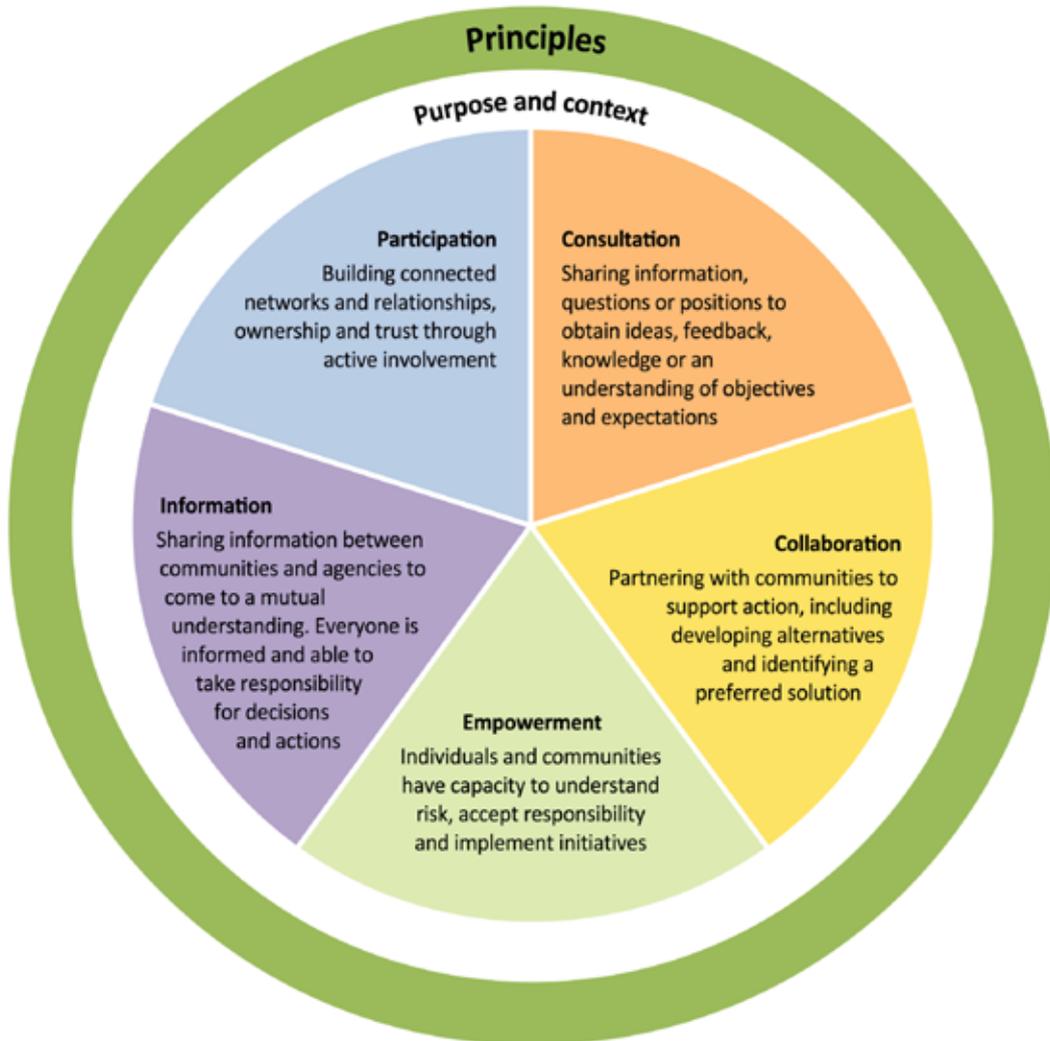


Figure 6: The Community Engagement Framework

Table 1: The Community Engagement Framework: techniques and expectations

| Technique | Goal | Expectations | Example tools and processes |
|----------------------|--|---|---|
| Information | To share information among participants to come to a mutual understanding. Everyone is informed and able to take responsibility for decisions and actions. | <p>You will keep participants informed during the identified stage of the process.</p> <p>Information will be relevant, accurate, targeted, credible and consistent.</p> <p>Information is broadly accessible and provided through a variety of channels.</p> <p>Participants will not be expected to respond unless they wish to.</p> <p>Key messages are repeated.</p> | <p>Fact sheets</p> <p>Interactive video display kiosks</p> <p>Media release</p> <p>Public meeting</p> |
| Consultation | To share information, questions or positions to obtain ideas, feedback, knowledge, or an understanding of objectives and expectations. | <p>You will allow sufficient time for participants to consider an issue and provide input.</p> <p>You will keep participants informed.</p> <p>You will ask for feedback, and listen to and acknowledge concerns.</p> <p>Your decisions and actions will be informed by participants' feedback.</p> <p>You will communicate how participants' input influenced the stage of the process.</p> | <p>Brainstorming</p> <p>Briefings</p> <p>Focus groups</p> <p>Submissions</p> <p>Surveys</p> |
| Participation | To build connected networks and relationships, ownership and trust through active involvement. | <p>You will provide the opportunity to actively involve participants in decisions or actions that potentially affect or interest them.</p> <p>You will use a variety of ways to involve participants.</p> <p>Participants will have an opportunity to connect with each other.</p> <p>You will communicate how participants' input influenced the stage of the process.</p> | <p>Field trip</p> <p>Focus groups</p> <p>Mind mapping</p> <p>Scenario testing</p> <p>World cafe</p> |
| Collaboration | To partner with participants to support action, including developing alternatives and identifying a preferred solution. | <p>You will look to participants for advice.</p> <p>You will seek participants' input to creative solutions.</p> <p>You will incorporate participants' advice and solutions to the maximum extent possible.</p> <p>You will tell participants how their input has influenced the stage of the process.</p> <p>Participants will recognise their influence on the process.</p> | <p>Appreciative enquiry</p> <p>Mind mapping</p> <p>Scenario testing</p> <p>Workshops</p> |
| Empowerment | To establish the capacity of participants to understand risk, and accept responsibility and implement initiatives. | <p>You will accept the considered input of the participants.</p> <p>You will act on the advice of the participants.</p> <p>You will facilitate a negotiated outcome between participants, if appropriate.</p> <p>Participants will recognise their input or be active participants in the rollout of the process.</p> | <p>Deliberative democracy processes</p> <p>Gallery walk</p> <p>Planning for real scenarios</p> <p>Scenario testing</p> <p>Workshops</p> |

Practice hints – communication and consultation**1. Consider how to engage throughout the process**

Different stakeholders require different styles and depths of engagement throughout the process. Some will need to be deeply involved at one stage, but only need to know that the project is continuing at another. Table 2 illustrates this concept across a range of stakeholders.

2. Construct a communications plan

Consider who should be consulted about what, when and in what form. Appendix D shows part of a sample communications plan. Although it was developed for a particular purpose, the structure and format can be useful.

Table 2: Engagement techniques across a risk management project for a range of stakeholders

| Component | Stakeholder 1 | Stakeholder 2 | Stakeholder 3 | Stakeholder 4 | Stakeholder 5 | Stakeholder 6 |
|------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Establish the content | Information | Collaboration | Collaboration | Consultation | Participation | Participation |
| Identify the risk | Consultation | Collaboration | Empowerment | Information | Participation | Information |
| Analyse the risk | Consultation | Collaboration | Empowerment | Information | Consultation | Information |
| Evaluate the risk | Consultation | Collaboration | Collaboration | Information | Consultation | Information |
| Treat the risk | Information | Collaboration | Empowerment | Information | Participation | Participation |

3.2 Communication and consultation throughout the risk management process

Each stage of the risk management process requires communication and consultation with identified stakeholders.

3.2.1 Establish the context

Establishing the context is critical to all other stages of the risk management process, therefore broad and considered consultation with stakeholders is required to effectively:

- outline the objectives and scope of the risk management project
- understand and communicate the environment within which the risk management project is taking place
- understand the relationships with, perceptions and values of the various stakeholders in the project, and the objectives of the community of interest
- agree on the risk criteria, and customise them where appropriate
- ensure that all stakeholders have an opportunity to contribute to the project
- ensure that all project team members understand the mandate and the framework for the project.

3.2.2 Risk identification

Risk identification must involve people with appropriate knowledge. Communication and consultation with broadly based stakeholder group representatives are critical so that:

- all areas of risk are identified, and sources of risk, areas of impact and risk scenarios are appropriately described
- an appropriate structuring of risks is determined, avoiding an unwieldy number of risk statements, but not masking any significant aspect of a risk
- a comprehensive understanding of the risks is developed.

3.2.3 Risk analysis

Risk analysis involves developing an understanding of the risk and provides input to risk evaluation. Therefore, communication and consultation is required to:

- consider the causes and sources of events or scenarios
- obtain information on existing controls and their effectiveness
- determine the consequences of risk events or scenarios
- determine the likelihood of the consequences.

3.2.4 Risk evaluation

Risk evaluation is based on the outcomes of the risk analysis, and helps to make decisions about which risks need treatment and the priority for treatment implementation. Communication and consultation is therefore required to ensure that:

- assessments are credible
- decisions are taken in the full understanding of the wider risk context, and include consideration of the risk tolerance, values, and expectations of the community's and other stakeholders' views.

3.2.5 Risk treatment

Risk modification through risk treatment is the goal of the risk management process. To appropriately identify, select and implement treatment options, communication and consultation is critical to:

- identify a comprehensive and credible range of available treatment options
- select treatment options that reflect the values and expectations of the community and other stakeholders
- ensure that the inherent risks of implementing treatment options are known and understood
- prioritise the order in which risk treatments will be implemented

- ensure that the community and other stakeholders are aware of the nature and extent of the residual risk.

As risk treatments are implemented, it may be appropriate to have regular contact with the community and other stakeholders to ensure the continued effectiveness of the controls now in place.

3.2.6 Monitoring and review

Monitoring and reviewing risks may be scheduled either *ad hoc* or in response to changes in the context. Continued communication and consultation required to:

- ensure continuing effectiveness of controls
- detect changes in the external and internal environment
- identify emerging risks.

3.2.7 Risk registers

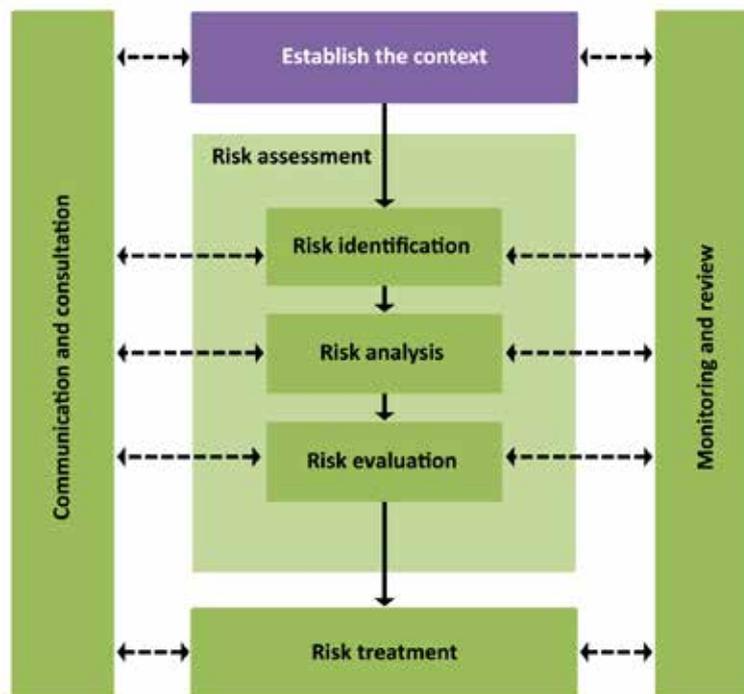
Risk registers are a useful communication tool for risk practitioners, decision makers and risk owners to demonstrate their current levels of understanding, and to support and substantiate the resulting priorities for risk reduction. In the context of communication, risk registers are one of numerous media that can be used to convey risk information to other risk practitioners and decision makers. In essence, risk registers are technical instruments designed to be used by professional planners, policy makers and emergency management practitioners.

The purpose of a risk register includes:

- informing risk-based decision making
- providing input to planning processes
- informing capability assessment decisions for resourcing emergency management plans and actions
- identifying risk treatments, including resilience-building strategies
- demonstrating more broadly that risks have been assessed
- providing evidence that authorities have appropriate governance and capabilities.

It is important that risk registers are not used in isolation to communicate risk information. Effective risk communication through risk registers requires that they be accompanied by adequate information materials and supported by robust consultation processes. If you are using a risk register, you need to be aware of the context in which the register was created, and understand the risk assessment methodology and criteria used to identify, analyse and evaluate the risks. For this reason, it is generally not appropriate to use risk registers to communicate with the community or the public.

4 ESTABLISH THE CONTEXT



Establishing the context provides the overall structure within which all of the other parts of the process sit (see Figure 7), and identifies and explains the:

- objectives that will be considered in the area under consideration
- stakeholder and project team responsibilities
- scope of the risk assessment structure, resources, techniques and tools
- stakeholders and their objectives to contribute to the communication and consultation strategy
- external and internal parameters/environment
- *National Emergency Risk Assessment Guidelines* (NERAG) risk criteria and how they apply in the specific context.

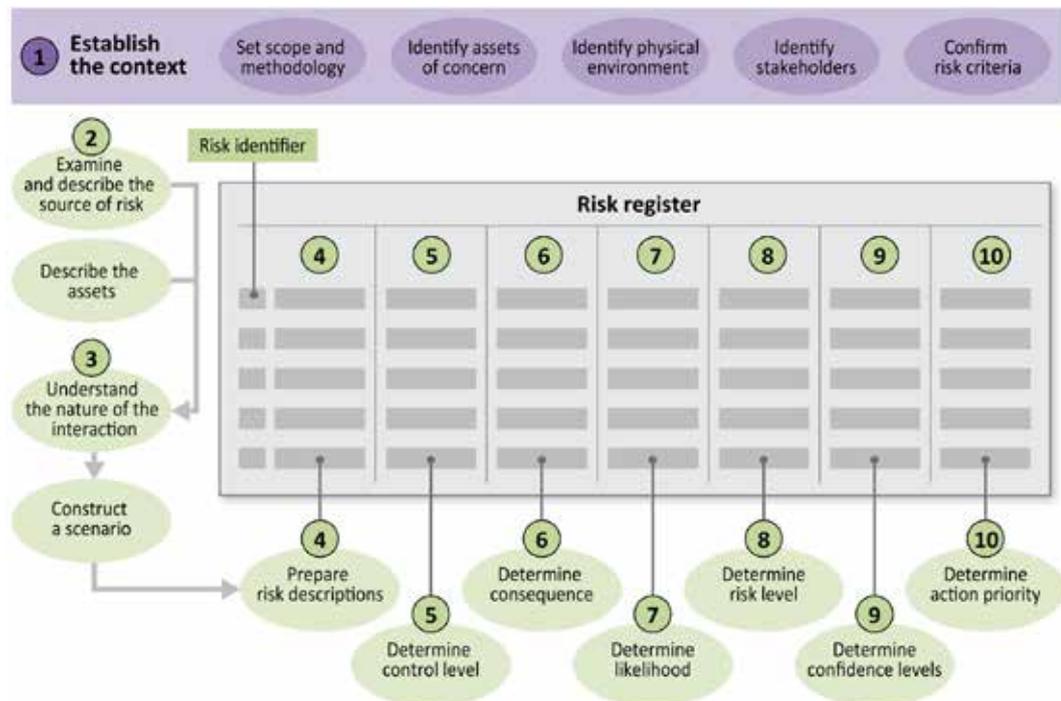


Figure 7: 'Establish the context' relationship to the risk register

4.1 Internal and external parameters or environment

A range of factors affect the risk management assessment; these factors exist internally and externally to the organisations represented by the project team. Consideration should be given to the range of interests, operations, areas of influence, and capabilities of the individuals, organisations, associations, industries and government departments that have an interest in the area under study. It is critical to consider the prevailing cultures of both organisations and the community because they can contribute to or hinder the risk assessment and the effectiveness of controls.

The project team should consider the factors in the external environment that cannot be controlled, but that may impact the risk management project.

4.2 Context for the emergency-related risk assessment process

4.2.1 Community objectives

Risk is defined as the effect of uncertainty on objectives. For emergency risk management, the relevant objectives are those of the community of interest. These may be very general and would hold true for much of Australia. Stated objectives can be based around wellbeing, covering areas such as health, property, economic performance and environmental quality, and what sustains these broad social and economic goals. Emergencies that destroy and do damage interfere with achieving the objectives. As knowledge about the emergency-related risk increases and a community adapts itself more effectively to its risk environment, uncertainty is reduced and objectives are more likely to be achieved. This equates to the risks being better managed.

Victoria has approached objectives in this way:

The objectives of the public sector in Victoria are not necessarily articulated, although the State Government of Victoria does articulate broad objectives from time to time. A previous Victorian Government articulated its broad objectives in its 2001 statement Growing Victoria Together in which the objectives were stated to be:

- *Thriving economy*
- *Quality health and education*
- *Healthy environment*
- *Caring communities*
- *Vibrant democracy.*

All of these objectives are challenging to achieve, not the least because expectations are high, there are competing demands inherent between them, and resources are never sufficient to meet the demand.

Progress toward all of the above objectives can be set back by the impact of emergencies affecting either the whole state or, more often, smaller areas. (Victorian Government 2011)

4.2.2 Responsibilities for the project

The context must make clear who will be responsible for each aspect of the risk assessment project.

4.2.3 Scope of risk assessment

Defining the scope of the specific risk assessment project will include setting the parameters and identifying how it relates to the state-level framework for emergency-related risk. In some jurisdictions, these studies are based around a single source of risk or hazard in an area. A single source of risk may, for example, be seismic activity. Ideally, however, the assessment will take an all-hazards approach.

4.2.4 Stakeholders

Identifying and working with stakeholders is a fundamental part of the emergency risk assessment process. The project team will need to ensure that there is a balanced cross-section of disciplines, but that key institutions and organisations are included for each area under consideration. For example:

- relevant government departments, which may include representatives from all levels of government
- elected officials (especially at local government level)
- operators and/or owners of infrastructure
- major industries located within, or with significant interest in, the area
- community-based organisations and non-government organisations
- emergency service organisations
- special interest groups
- expert groups across social and physical sciences.

4.3 Risk criteria

NERAG describes a set of nationally consistent criteria that covers:

- consequence
- likelihood
- risk level
- confidence.

The consequence criteria act as proxies for the full range of consequences of emergencies. It is possible to have a larger number of criteria to capture the full range of consequences on objectives; however, the goal is to produce a prioritised list of risks so that treatment strategies can be selected and emergency management resources can be efficiently allocated.

There will always be a trade-off between precision, accuracy and uncertainty, and the time and resources available for the assessment. One of NERAG's goals is to improve national consistency by creating a nationally agreed set of criteria. Having pre-existing agreed criteria creates efficiency, so that time and budgets are not used up by starting from scratch.

The NERAG methodology and its criteria are best suited to a multihazard emergency risk assessment. They may not be sufficiently detailed or targeted to perform risk assessments for a single hazard. However, they may be used for single hazard risk assessment. In such a case, careful consideration should be given to whether the consequence and risk criteria are appropriate for use unchanged or need some adaptation. If change is required, the basic structure of those criteria should be followed as much as possible.

Practice hints – consequence criteria**3. Take the time to describe the context**

Understanding and describing the context is critical to the remainder of the project, because it sets the foundation for the rest of your work. Do not rush this part of the project, since time invested here will bring rewards later on.

4. Involve a broad range of stakeholders

It is important to ensure that a variety of people who represent the range of responsibilities covered are involved, as well as subject matter experts and decision makers, all of whom will be impacted by the final outcomes of the risk assessment.

5. Customise the consequence descriptors

After understanding and describing the context, but before beginning the analysis, you should customise, where necessary, in the consequence descriptor tables so that they better relate to the area of your analysis. For example, in the economic consequences, express the specific gross product of the area in dollars, and do something similar for each of the consequence categories. This will also ensure that those involved in the project can more easily gauge the level of consequence.

It is important, though, to ensure that the relativities within the tables remain constant and in line with the NERAG tables.

6. Determine the criteria for analysis

Some practitioners have found it useful to focus only on the impacts on people and the economy in the first instance. They have found that these give a broad indication of consequence level, and that the remaining areas of consequence, or criteria, can inform which risk treatment options may be suitable.

Some practitioners have also added consequence categories that will further inform analysis in the area. For example, a separate category for agriculture consequence could be used in some locations where it is seen as a significantly substantial and specific category of impact. This decision should be made while establishing the project context. Care should be taken, however, to ensure that by adding categories, certain consequences are not accounted for twice.

7. Evaluate the consequence level

Where a scenario is likely to affect several consequence categories, it is important to have a project team understanding about how the consequence level or rating will be decided, before embarking on the risk analysis journey. The approach should be decided upon while establishing the context, and NERAG requires that the highest level should be used.

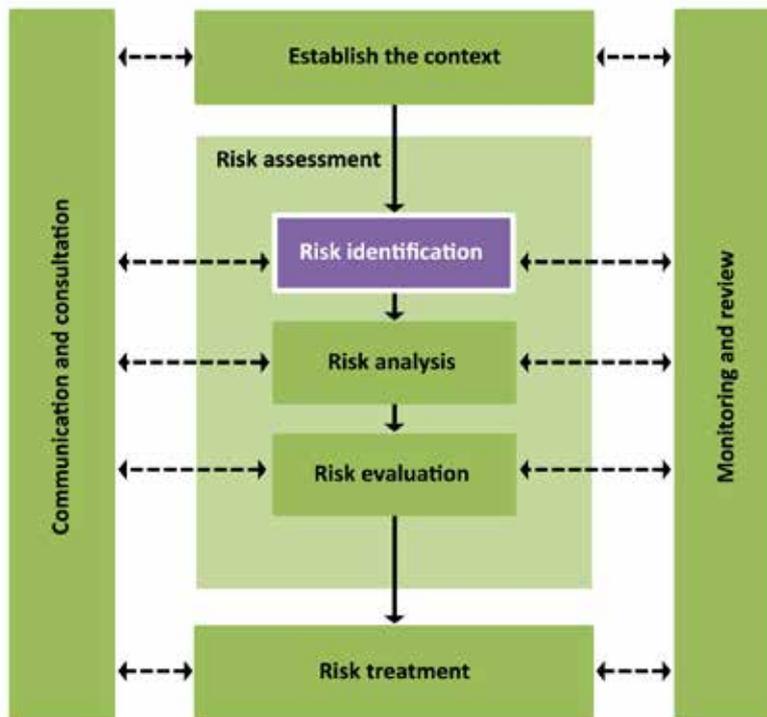
8. Consider single-hazard risk assessment

If your project is focused on a single hazard, give careful consideration to customising the risk and consequence criteria. If adaptation is required, the basic structure of the NERAG criteria should be followed as far as possible.

9. Ensure the right people are involved

You, as part of the project team, should engage with agencies and individuals who are likely to be involved in treatment implementation throughout the project, including experts in the behaviour of the hazard. Gaining their support at the beginning of the process will lay the groundwork for accepting responsibility for implementing aspects of the risk treatments.

5 RISK IDENTIFICATION



5.1 Systematic discovery

Risk identification should be systematic and comprehensive, but there is no need to identify absolutely everything that might occur – and its knock-on effects – for every possible situation. What is important is that enough emergency events are described to characterise the range of emergency-related risks within the project scope, and that they can then be analysed and subsequently evaluated. It is also critical that they inform any potential suite of risk treatments.

Identifying risks should be done systematically on the basis of the best available information and in collaboration with the appropriate range of stakeholders. The risks, and the processes that produced them, must be properly recorded. Figure 8 summarises the risk identification process and where the results are recorded in the risk register. The entire process is shown in Figure 9.

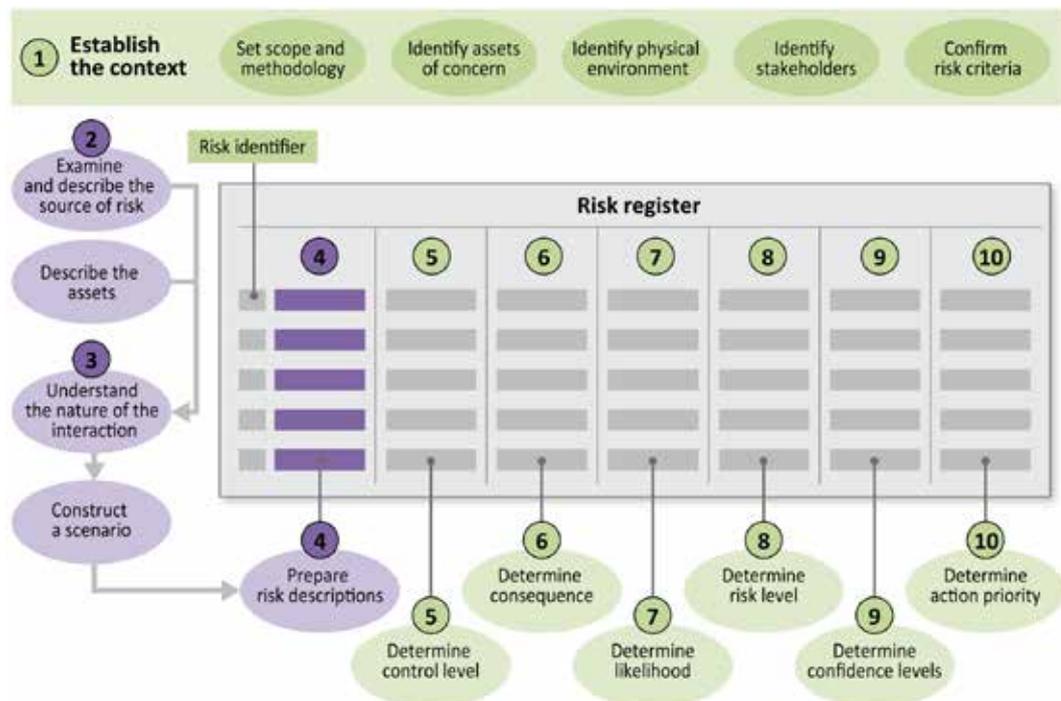


Figure 8: 'Risk identification' relationship to the risk register

5.1.1 Historical information and data

In many cases, it is possible to use information from disaster events that have occurred in the location, or a similar location. Information and data may be freely available, and there may be general understanding of the nature of the impact.

It is not always the case, however, that historical information alone is adequate; things may have changed or potential future situations may be different. For example, settlement patterns may have radically changed since a previous event occurred, projected weather patterns may be quite different or new technologies may be in use. It can therefore be useful to generate a range of credible scenarios to illustrate possible future situations in which a locality, local government area or region might find itself. Potential future risks can then be identified from those scenarios.

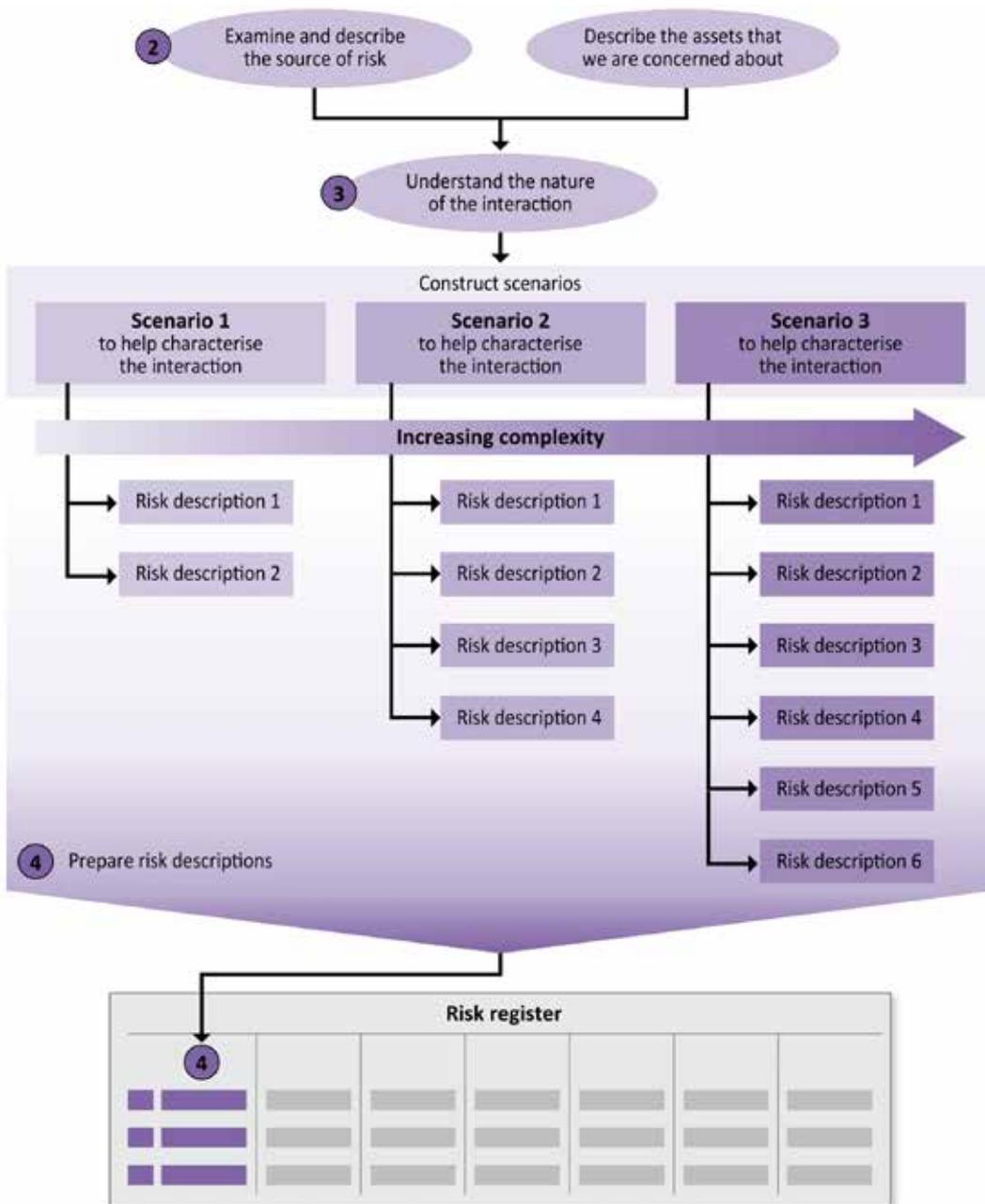


Figure 9: The process of risk identification

5.1.2 Scenarios

In emergency-related risk assessments, establishing the context can include developing one or more scenarios of emergency events to be considered. A scenario is one or more representative emergency events that are used to illustrate identified emergency management issues and provide the focus for assessment. Scenarios may be based on historical events, data from previous events or simulated events based on modelling.

The intent of using scenarios is to balance the resources available for risk assessments by limiting the consideration of all possible risks and focusing on areas of importance.

For example:

- an extreme weather risk scenario may consider only events that affect a particular asset or population
- a disease scenario may assess the risks from a particular representative pathogen, rather than from all possible pathogens.

Scenarios are not the only tool for assessing risk; other data-driven approaches may be considered. However, for many rare emergency events where data are limited or the emergencies being considered have not occurred previously, a scenario can provide more insight during the risk assessment process.

Scenario planning is an established and well-recognised method for exploring and describing a range of possible futures. It enables decision makers to consider the uncertainties involved, and to follow through some logical effects and impacts. It also provides a vehicle for the individuals involved to further understand the capabilities, assumptions and vulnerabilities of the other organisations in the process. There is a readily accessible body of research, and advice and guidance supporting scenario planning.

Scenario analysis can be used to determine cause-effect relationships for complex situations at all stages of ERM but is particularly helpful at identifying and analysing risks. Risk scenarios can describe sources of risk in a manner that will help with the generation and selection of risk treatments.

A scenario can be constructed by combining a number of possible conditions and cause-effect relationships. Importantly, any scenario analysis must examine the relationship between the immediate, residual, and latent risks and how these may combine to trigger, contribute to, or escalate, an event. (EMA 2004)

For emergency-related risk scenario development, it is critical that the people and organisations involved are experts in the range of policy areas included in the specific scenario. These may include experts in meteorology, sociology, psychology, economics, biology and epidemiology. Owners and operators of infrastructure services should also be involved. This is true even when the scenario is based on a single source of risk or category of impact. It is important that enough emergency events are described to characterise the range of emergency-related risks flowing from the scenario. They can then be analysed and subsequently evaluated.

Examples of developed scenarios for emergency-related risks are included in Appendices C–I.

5.2 Risk identification outputs

5.2.1 Expressing risk descriptions

When the risk is appropriately identified, it is expressed in the form of a risk description. NERAG outlines this as follows:

A risk description, as described in ISO Guide 73:2009 Risk management – vocabulary, is a structured statement linking one or more sources of risk to a consequence. It contains the following parts:

- *the source of risk*
- *the emergency event that emerges from the source of risk*
- *the consequences that result from the emergency event occurring*
- *any causal links between the source, event and consequence that are relevant to the risk description*

- *where relevant, temporal factors of the event. This describes whether the event is a current possibility or something that may happen in future. This may, for example, predict risks for proposed assets, the effects of climate change or other future events that may alter the risk profile. (AGD 2015, p. 45)*

Risk descriptions can be specific or generic, depending on what is needed for the scope of the emergency risk management project. They need to be descriptive enough to inform analysis, but not so broad as to be meaningless or ambiguous for treatment. They may take the form of a single sentence, or of a paragraph that contains more detailed, descriptive information. The completed risk descriptions are recorded in the first column of the risk register. It is these statements, or groups of statements, upon which the remainder of the process depends.

Examples can be found in Appendices C–I.

5.2.2 Understanding the risk possibilities

It is important to understand:

- the nature of the source(s) of risk
- the nature and exposure of the various aspects of the community or region under analysis
- the nature of the interaction of the two, and the effect the interaction is likely to have on objectives.

Together with reference to the scope of the emergency risk management project, gathering an understanding of responsibilities can inform where emphasis should be placed in the risk analysis, and what areas can be reasonably set aside for a separate or subsequent project.

5.2.3 Thinking broadly

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 the best available

information and knowledge, and in consultation and engagement with all relevant stakeholders.

A systematic and comprehensive approach needs to be taken to ensure that no significant risk is excluded. For instance, it is important that a sufficiently comprehensive pool of expertise is assembled to study all significant causes and emergency scenarios, because there are many ways an emergency event can occur. This might involve considering historical information from, or modelling of, similar events. Identifying these scenarios can lead to reasonable predictions about current and evolving issues.

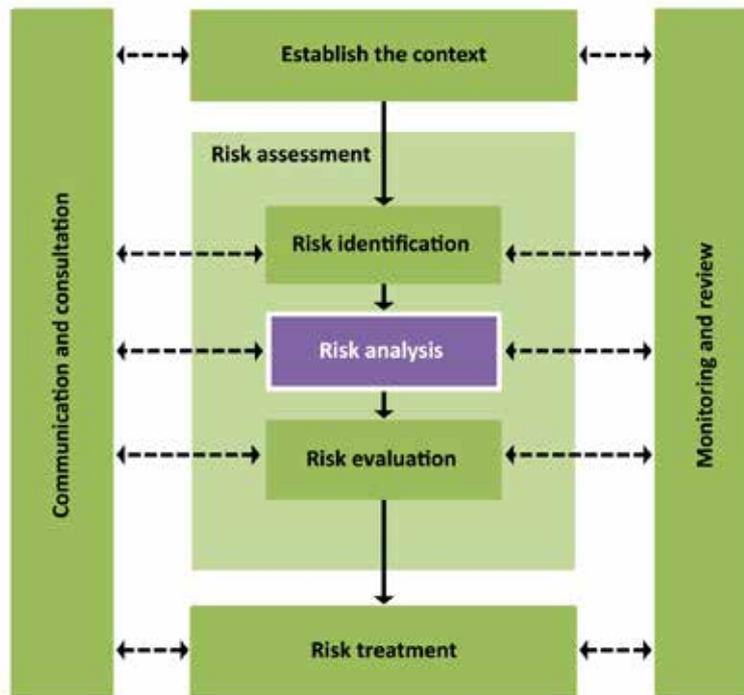
At the conclusion of this phase, all risks of interest should be identified and recorded.

Practice hints – risk identification

10. Use scenarios

There is a near-infinite number of possibilities for emergency events, so it is necessary to select a sample to make the process manageable and comparable. To cope with both the complexity and volume of possibilities, you will find it useful to generate three or more scenarios of increasing complexity or consequence intensity for each emergency-related risk being considered. These will allow for a reasonable range of risks to be identified for further analysis and evaluation, and may help to identify the scale of emergency at which particular emergency-related risks emerge.

6 RISK ANALYSIS



6.1 Risk analysis outputs

Once the risks are described, they need to be analysed in terms of the effectiveness of the controls that are in place, the consequences should the risks eventuate and the likelihoods of the consequences occurring.

All of these aspects of the risks are consolidated into a risk register (see Figure 10).

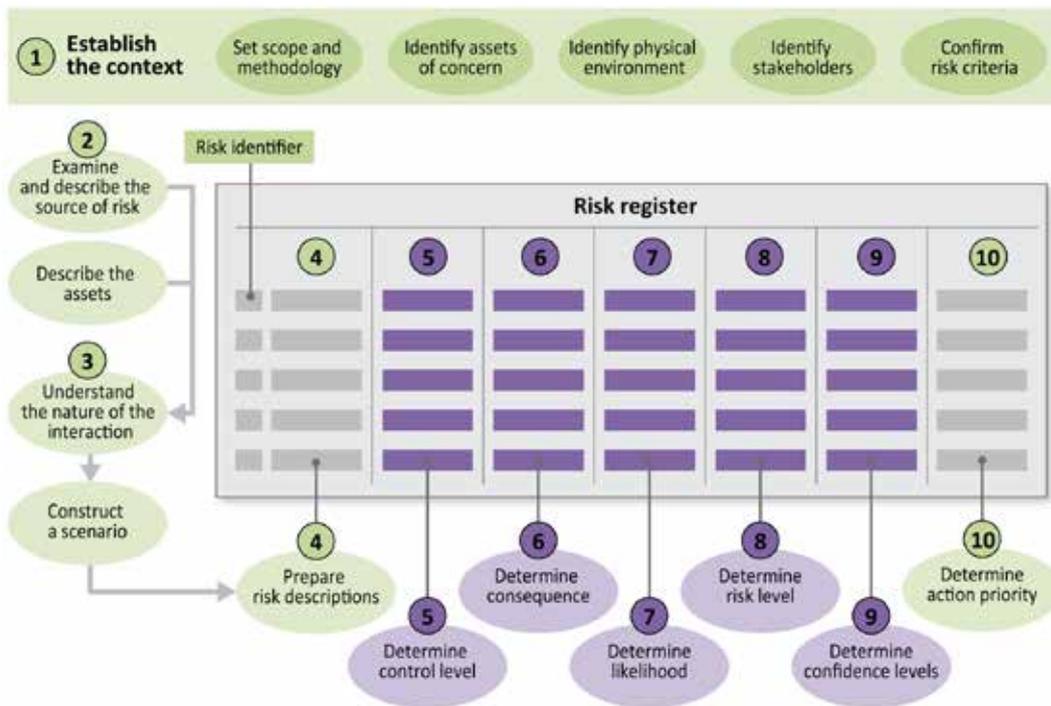


Figure 10: 'Risk analysis' relationship to the risk register

6.2 Identifying controls

The *National Emergency Risk Assessment Guidelines* (NERAG) state:

For each risk description, relevant prevention, preparedness, response and recovery controls need to be identified. These are the controls that are currently in place for that risk and have an effect in reducing the level of risk – that is, reducing the severity or likelihood of defined consequences occurring as a result of the emergency event.

(AGD 2015, p. 46)

Treatment options that have been identified, but not implemented, in previous risk studies may be identified during this phase and recorded (including relevant information on their current status and impediments to implementation) to inform risk treatment planning.

It is important to understand the distinction between risk controls and risk treatments.

NERAG states that risk controls are actions that have been taken to modify the level of risk. These may be evident as procedures or regulations, or as built or constructed forms such as modified drainage channels (AGD 2015). There will generally be a suite of controls in place to modify each of the identified risks. Not all risk controls will be equally effective, and their degree of effectiveness should be taken into account during the risk analysis. Effectiveness can change over time as behavioural controls can be forgotten or neglected, structural controls can deteriorate, and all controls – including technological ones – can be overtaken by progress and increased sophistication, and relevance to the context.

Risk treatments are considered to be risk controls that are yet to be implemented. Therefore, a range of options will be generated and some selected for recommended implementation. Once in place, they are considered to be risk controls.

Risk controls are evaluated for how well they reduce the risk, and how easily they can be activated and used. The evaluation can be applied to a single control, or to a group of measures that together act as a control.

To evaluate risk control strength and expediency, see Tables 3 and 4 (which are also found in NERAG).

Risk control levels are documented in the risk register.

Practice hints – risk control levels

11. Consider a pre-existing structure

If you are working within a pre-existing risk management arrangement, it is advisable to consider the methodology for analysing controls in that arrangement. It is important to maintain relativities across a risk analysis, so it is wise to use the same tools and tables consistently.

12. Document the risk control levels

The degree of effectiveness of the controls, whether there is a need for them to work in concert with others, and whether they modify the risk's consequence or likelihood may also be documented. This may be in the risk register itself or in the additional material that supports the risk register.

Table 3: Qualitative descriptors of risk control strength and expediency

| Level | Control strength | Control expediency |
|----------|---|---|
| High | Control is highly effective in reducing the level of risk. | The control is frequently (and effectively) applied. A procedure to apply the control is well understood and resourced. The cost of applying the control is within current resources and budgets. |
| Medium | Control is effective in reducing the level of risk. | The control is infrequently applied and is outside the operators' everyday experience. The use of the control has been foreseen and plans for its application have been prepared and tested. Some extraordinary cost may be required to apply the control. |
| Low | Control has some effect in reducing the level of risk. | The control is applied rarely and operators may not have experience using it. The use of the control may have been foreseen and plans for its application may have been considered, but it is not part of normal operational protocols and has not been tested. Extraordinary cost is required to apply the control, which may be difficult to obtain. |
| Very low | Control has almost no effect in reducing the level of risk. | Application of the control is outside the experience and planning of operators, with no effective procedures or plans for its operation. It has not been foreseen that the control will ever need to be used. The application of the control requires significant cost over and above existing resources, and a number of stakeholders will most likely object to the cost. |

Table 4: Level of existing risk control matrix

| Control strength ^b | Control expediency ^a | | | |
|-------------------------------|---------------------------------|----------|--------|--------|
| | Very low | Low | Medium | High |
| High | Low | Medium | Medium | High |
| Medium | Low | Medium | Medium | Medium |
| Low | Very low | Low | Medium | Medium |
| Very low | Very low | Very low | Low | Low |

a How easily can the control be activated and used?

b How well does the control reduce the risk?

6.3 Consequence criteria and levels

The risk criteria were considered during the 'defining the context' phase of the risk management process. Consequences were categorised into five categories:

- people (including death, injury and illness)
- economic (including loss in economic activity and the loss of an industry)
- environment (including loss of species and landscape, and the loss of environmental value)
- public administration
- social setting.

The descriptions are extracted from the NERAG appendices. The consequence categories were selected as an appropriate sample of all the possible consequences, and are not designed to be exhaustive.

Determining consequence levels is one step in determining risk levels. This step is also used to inform the treatments that may be used to modify or mitigate the potential consequences, or respond to or recover from emergencies. Keep in mind that the final outcome of the risk analysis process is to recommend how to expend limited resources in a manner that suits the context of the project, and the needs and culture of the stakeholders.

Therefore, determining consequence levels helps to work out how critical the various risks are, and allows one category of risk to be compared with another – for example, the impact of an exotic animal disease compared with the impact of a cyclone.

6.4 Likelihood

Likelihood is 'the chance of something happening' (Standards Australia 2009). When determining the likelihood of a risk, you must consider the uncertainty component of the risk. Therefore, this is when you categorise your understanding of the chance, probability or possibility of something occurring that will impact on your objectives.

When analysing likelihood for an emergency-related risk, consider it to be the **likelihood of described negative consequences occurring as a result of an emergency event**.

NERAG describes determining the likelihood for a risk or series of risks as:

After determining a consequence level for each risk description, the likelihood level of that consequence occurring needs to be assessed.

The likelihood level reflects the probability of both:

- *the emergency event, and*
- *the estimated consequences occurring as a result of the event (e.g. deaths, damage).*

In some cases, where the effectiveness of a control(s) has been assessed as low or very low, the likelihood of the emergency event may be very similar to the likelihood of the consequence, and may therefore be used as a proxy.

Using only an emergency event to estimate likelihood is not best practice, and the assessment of confidence relating to that risk needs to reflect the uncertainties that this introduces. If the risk is identified as of sufficient priority to warrant further action, then these assumptions may need to be revisited.

Likelihood is based on probability and can be expressed in various ways, such as recurrence intervals, exceedance probabilities, return periods, probabilities or frequencies.

NERAG uses annual exceedance probability (AEP), or the chance of the event occurring once in a year, to determine likelihood, expressed as a percentage.

The use of the term 'return period' such as 'one in 100 years' can lead to confusion, as it implies that after an event occurs, it will be 99 years until it occurs again. This is an incorrect assumption. It is more accurate to say that the event has a one per cent chance of occurring each year, with the implication that such an event can occur in any year.

Average recurrence interval (ARI) is another common expression of a return period. ARI is a statistical estimate of the average period of time (usually in years) between occurrences of an event of given scale.

The descriptors for likelihood levels (e.g. likely, rare) are used in the context of emergency-related risk assessment and are not intended to be equivalent to the everyday language use of these terms, which may consider probabilities of these terms to be higher than described below. A logarithmic scale is used for likelihood levels, because the probability of emergency events and their consequences can cover several orders of magnitude. (AGD 2015, pp. 69–71)

Table 5 shows the likelihood categories.

Table 5: Likelihood level

| Likelihood | Annual exceedance probability (AEP) | Average recurrence interval (ARI) (indicative) | Frequency (indicative) |
|----------------|-------------------------------------|--|------------------------|
| Almost certain | 63% per year or more | Less than 1 year | Once or more per year |
| Likely | 10% to <63% per year | 1 to <10 years | Once per 10 years |
| Unlikely | 1% to <10% per year | 10 to <100 years | Once per 100 years |
| Rare | 0.1% to <1% per year | 100 to <1000 years | Once per 1000 years |
| Very rare | 0.01% to <0.1% per year | 1000 to <10,000 years | Once per 10,000 years |
| Extremely rare | Less than 0.01% per year | 10,000 years or more | Once per 100,000 years |

Source: AGD (2015)

Practice hints – risk identification and likelihood

13. Consider the controls that are in place

Estimate the likelihood based on your understanding of the controls that are in place and their effectiveness.

14. Invoke the scope of the project

The project scope will have considered the time over which the risk is to be analysed. Consider likelihood in the context of this time period. For some risks, extended time periods will be appropriate. For example, geophysical risks such as earthquakes or volcano eruptions are very rare, and can have annual exceedance probabilities of 0.01–0.1%.

15. Ensure the right people are informing the decision

It is critical that experts relating both to the event itself, and the types and extents of consequences, participate in the process. This will ensure that thought is given to the likelihood of a natural phenomenon occurring, as well as the nature and likelihood of specific impacts being experienced. For example, if considering the likelihood of a storm impacting on a township, there should be people participating in the decision making who understand the economic circumstances, the social dynamics and the health outcomes alongside those who understand the behaviour of the storm itself.

16. Be aware of the current circumstance

Ensure that the current environment is taken into account if using some historical input to inform the decision making. Since a previous event, it is possible that the population has changed, new industries have emerged, floor heights have been raised, building materials have improved, the density of buildings has increased and the type of vegetation has changed. In addition, building, planning and mitigation controls may have been put in place (or eroded), and the understanding of the resident population may have changed. Any of these or other changes will result in different impacts and likelihoods for future events.

17. Remember that the language matters

The international standard is careful to explain that practitioners should not think solely in a pure mathematical sense about the term 'probability'. This is why the term 'likelihood' is used. When implementing emergency risk management, it is not normally possible to make mathematical determinations in relation to any of the measures in the analysis process (and some would say it is not desirable).

The terms 'likely', 'almost certain' and 'rare' have particular and specific descriptions within the likelihood level tables. These may or may not match the everyday language of the people making the decisions. It is useful to focus on the indicators themselves, and consider these terms as labels that will inform the process. This may allay confusion.

18. Be consistent

When analysing likelihood, choose the table (or column) that best suits your risk assessment project and stick to it. Just like considering consequence, the required outcome is one that is consistent and can therefore indicate relative likelihoods.

19. Document assumptions about likelihood

The rationale for arriving at the likelihood category should be documented, along with any assumptions used. This information can then inform the consideration of confidence levels as well as future risk analyses.

6.5 Risk level

With the risk described in the risk description, and the consequence and the likelihood determined, you can now derive a risk level. Simply select the appropriate consequence level and likelihood category in the risk level matrix, and follow them to the point where the column and row intersect. This is the risk level for your risk.

Figure 11 describes this process, and Table 6 shows the risk level matrix.

| | Consequence level | | | | |
|----------------|-------------------|----------|----------|---------|--------------|
| Likelihood | Insignificant | Minor | Moderate | Major | Catastrophic |
| Almost certain | Medium | Medium | High | Extreme | Extreme |
| Likely | Low | Medium | High | Extreme | Extreme |
| Unlikely | Low | Low | Medium | High | Extreme |
| Rare | Very low | Low | Medium | High | High |
| Very rare | Very low | Very low | Low | Medium | High |
| Extremely rare | Very low | Very low | Low | Medium | High |

Figure 11: Determining risk level

Table 6: Qualitative risk level matrix

| | Consequence level | | | | |
|----------------|-------------------|----------|----------|---------|--------------|
| Likelihood | Insignificant | Minor | Moderate | Major | Catastrophic |
| Almost certain | Medium | Medium | High | Extreme | Extreme |
| Likely | Low | Medium | High | Extreme | Extreme |
| Unlikely | Low | Low | Medium | High | Extreme |
| Rare | Very low | Low | Medium | High | High |
| Very rare | Very low | Very low | Low | Medium | High |
| Extremely rare | Very low | Very low | Low | Medium | High |

Source: AGD (2015)

6.6 Confidence

Considering the robustness of the process to this point helps to inform the areas of priority action, and gives an indication of where further study, information or analysis may be required. The project team does this by analysing how confident they are in their data, analysis and expertise in determining both likelihood and consequence. They then assign a level in one of five categories from 'highest' to 'lowest', as described in Table 7. This rating is documented in the risk register. The same table may also be used when analysing for consequence and likelihood separately.

NERAG explains this process as follows:

Assessing confidence helps to avoid misleading results, because influences in the process (e.g. subjective perceptions or lack of data) can be identified and addressed. Assessing confidence also addresses decision makers' concerns for whether there is a need for more detailed risk assessment. (AGD 2015, p. 74)

Confidence refers to the:

- reliability, relevance and currency of the evidence used to support the consequence and likelihood assessments
- use of appropriate expertise as part of the risk assessment process to assign the consequence and likelihood levels
- level of agreement between stakeholders.

6.6.1 Separate confidence assessments of consequence and likelihood

The project team might want to consider separately the confidence of each of likelihood and consequence.

To determine a confidence level for each of the consequence and likelihood levels on their own, separate assessments are made for supporting evidence, expertise and participant agreement against the consequence and likelihood levels. Each assessment is then rated using the criteria in Table 7, and the lowest rating of the three assessed confidence levels for each of the consequence and likelihood levels are combined using Table 8, to determine the overall confidence level for the risk.

Table 7: Confidence level descriptions

| Confidence level | Descriptor | Supporting evidence | Expertise | Participant agreement |
|------------------|---|--|--|---|
| Highest | Assessed likelihood, consequence or risk is easily assessed to one level, with almost no uncertainty. | Recent historical event of similar magnitude to that being assessed in the community of interest, or quantitative modelling and analysis of highest quality and length of data relating directly to the affected community, used to derive results of direct relevance to the scenario being assessed. | Risk assessment team contains relevant and demonstrated technical expertise in the field being assessed, and experience in data and/or modelling of direct relevance to the scenario being assessed, and technical expertise is highly influential in the decisions of the risk assessment team. | Agreement among participants on the assessment of levels of likelihood, consequence or risk. |
| High | Assessed likelihood, consequence or risk has only one level, but with some uncertainty in the assessment. | Recent historical event of similar magnitude to that being assessed in a directly comparable community of interest, or quantitative modelling and analysis uses sufficient quality and length of data to derive results of direct relevance to the event being assessed. | Risk assessment team contains relevant technical expertise in the field being assessed, and experience with data and/or modelling relating to the event being assessed, and technical expertise is highly influential in the decisions of the risk assessment team. | Disagreement on only minor aspects, which have little effect on the assessment of levels of likelihood or consequence. |
| Moderate | Assessed likelihood, consequence or risk could be one of two levels, with significant uncertainty. | Historical event of similar magnitude to that being assessed in a comparable community of interest, or quantitative modelling and analysis with reasonable extrapolation of data required to derive results of direct relevance to the event being assessed. | Risk assessment team contains relevant technical expertise in the field being assessed, and experience in data and/or modelling of relevance to the event being assessed, and technical expertise is used by the risk assessment team. | Disagreement on significant issues, which would lead to different levels of likelihood or consequence depending on which argument was followed. |
| Low | Assessed likelihood, consequence or risk could be one of three or more levels, with major uncertainty. | Some comparable historical events through anecdotal information, or quantitative modelling and analysis with extensive extrapolation of data required to derive results of relevance to the event being assessed. | Risk assessment team contains technical expertise related to the field being assessed, and technical expertise is taken into account by the risk assessment team. | Disagreements on fundamental issues relating to the assessment of likelihood or consequence, which would lead to a range of rating levels. |
| Lowest | Assessed likelihood, consequence or risk could be one of four or more levels, with fundamental uncertainty. | No historical events or quantitative modelled results to support the levels. | No relevant technical expertise is available to the team for analysis. | Fundamental disagreement on levels of likelihood, consequence or risk, with little prospect of agreement. |

Table 8: Likelihood–consequence confidence matrix

| Confidence in likelihood | Confidence in consequence | | | | |
|--------------------------|---------------------------|----------|----------|----------|----------|
| | Lowest | Low | Moderate | High | Highest |
| Highest | Moderate | Moderate | High | Highest | Highest |
| High | Moderate | Moderate | Moderate | High | Highest |
| Moderate | Low | Moderate | Moderate | Moderate | High |
| Low | Lowest | Low | Moderate | Moderate | Moderate |
| Lowest | Lowest | Lowest | Low | Moderate | Moderate |

Practice hints – confidence levels

20. Document assumptions about confidence levels

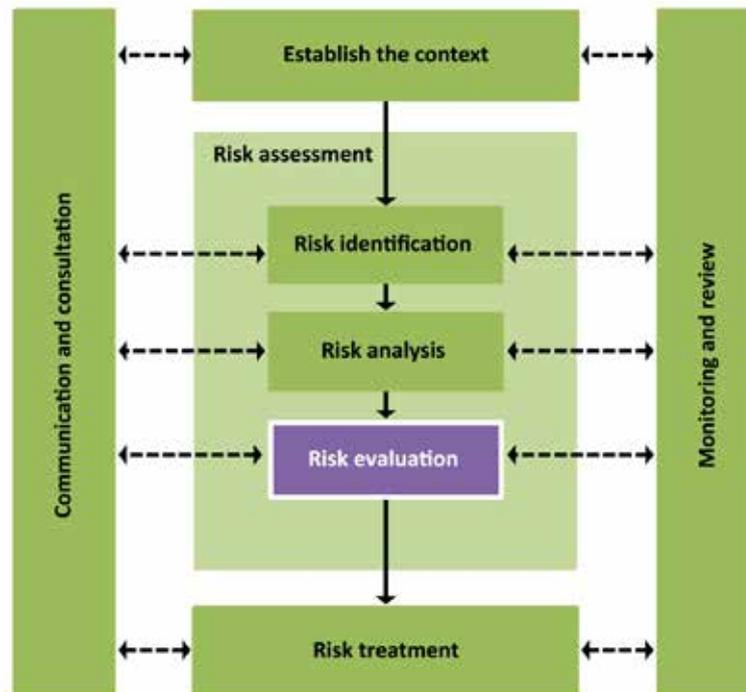
The rationale for arriving at the confidence level should be documented, along with any assumptions used. This information can then inform any further data collection and analysis that might occur.

21. Consider project team experience or preference

Depending on the experience or preference of the project team, assessment of the confidence levels for the entire project may be classified at ‘moderate’ throughout. Doing so, however, eliminates the next step in the NERAG process. If the decision is taken to choose this route, it must be:

- used as an approach throughout all risk assessments in the project
- be documented in the project materials.

7 RISK EVALUATION



Risk evaluation is the final part of the emergency risk management’s risk assessment component. Risk evaluation provides the project team with guidance on priorities for risk treatments. The purpose of risk assessment is to understand and rank what can happen in an uncertain environment, and the nature and extent of the impact. Therefore, the risk assessment process informs you on how best to expend the limited resources of or available to the community of interest, and informs the priorities for action or treatment. When the risk evaluation process is finished, the risk register will be complete, and will be a distillation of a great deal of analysis and consideration. Figure 12 shows where risk evaluation is in the risk register.

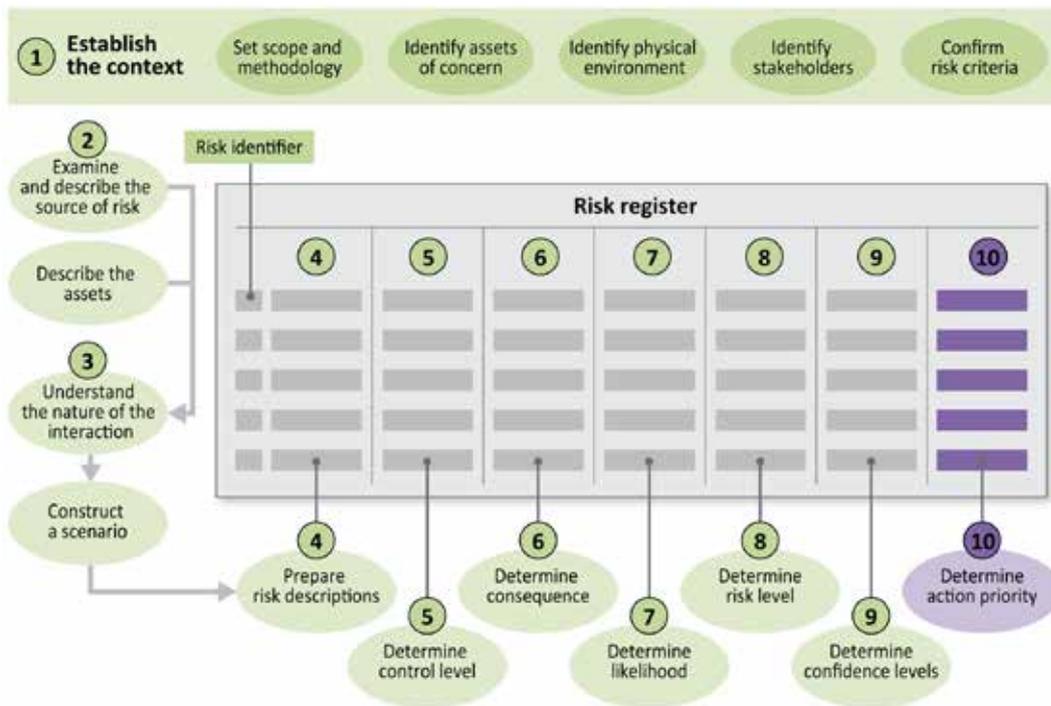


Figure 12: 'Risk evaluation' relationship to the risk register

7.1 Risk evaluation outputs

A completed risk evaluation helps you to make decisions that are based on the risk analysis outcomes, about which risks need treatment and the priority for treatment implementation. The *National Emergency Risk Assessment Guidelines* (NERAG) state:

The outcome of the risk evaluation process is to assign a priority to each risk, based on the risk level and confidence associated with that risk. The priority is a level from 1 (highest priority, requiring the highest level of attention) to 5 (lowest priority, requiring monitoring and maintenance of existing controls).

Prioritisation of risks guides practitioners and sponsors to the order in which risks need to be addressed.

The response to a level of priority is to:

- *improve the confidence level of the assessment (if possible) through research, further expert opinion or further studies*
 - *treat the risk by taking action to reduce the likelihood or consequence of the risk*
 - *monitor and review the risk as part of the ongoing risk management process.*
- [AGD 2015, p 77]

The descriptors for the risk priorities are listed in Table 9. They indicate:

- the priority level
- acknowledgement whether further investigation should be undertaken
- acknowledgement whether further actions should be planned or undertaken to manage the risk
- how and to whom reporting should be made.

Table 9: Priority descriptors

| Priority | General descriptor: action pathway |
|----------|--|
| 1 | Highest priority for further investigation and/or treatment, and the highest authority relevant to context of risk assessment must be formally informed of risks. Each risk must be examined, and any actions of further investigation and/or risk treatment are to be documented, reported to and approved by that highest authority. |
| 2 | High priority for further investigation and/or treatment, and the highest authority relevant to context of risk assessment should be formally informed of risks. Further investigations and treatment plans should be developed. |
| 3 | Medium priority for further investigation and/or treatment. Actions regarding investigation and risk treatment should be delegated to appropriate level of organisation, and further investigations and treatment plans may be developed. |
| 4 | Low priority for further investigation and/or treatment. Actions regarding investigation and risk treatment should be delegated to appropriate level of organisation, and further investigations and treatment plans may be developed. |
| 5 | Broadly acceptable risk. No action required beyond monitoring of risk level and priority during monitoring and review phase. |

7.2 Determining risk priority

The project team will be making recommendations for further action, whether that is for further investigation or for risk treatment. They will be recommending which risks should be dealt with and in what order.

Informing these recommendations are the previously determined risk level and confidence level. A higher priority is indicated by a higher risk level and a lower confidence level.

7.2.1 Revisiting consequence criteria

It is at this point when the consequence criteria can be revisited. The consequence criteria were established and confirmed during the context establishment phase, and reflect the broad values of the area under analysis. The consequence criteria may be considered when you are determining which risks should be afforded priority in the expenditure of the available resource on behalf of the affected community of interest.

7.2.2 Informing priority through levels of confidence

Priority is derived by following four steps, which is similar to the manner in which risk level was determined in the previous section:

1. Select the table to be used, based on the previously determined level of confidence.
2. Select the previously determined level of consequence.
3. Select the previously determined likelihood category.
4. Follow the row and the column until they intersect.

The priority level is the number in the resulting cell (see Figure 13).

| | Consequence | | | | |
|----------------|---------------|-------|----------|-------|--------------|
| Likelihood | Insignificant | Minor | Moderate | Major | Catastrophic |
| Almost certain | 4 | | 3 | 2 | 1 |
| Likely | 5 | | 4 | 2 | 2 |
| Unlikely | 5 | | 4 | 3 | 2 |
| Rare | 5 | | 5 | 3 | 3 |
| Very rare | 5 | 5 | 5 | 4 | 3 |
| Extremely rare | 5 | 5 | 5 | 4 | 4 |

Figure 13: Selecting risk priority from confidence tables

Tables 10–14 were developed and calibrated for NERAG, to help determine priorities for further investigation or further action.

Table 10: Priority levels at highest confidence

| | Consequence | | | | |
|----------------|---------------|-------|----------|-------|--------------|
| Likelihood | Insignificant | Minor | Moderate | Major | Catastrophic |
| Almost certain | 4 | 4 | 3 | 2 | 1 |
| Likely | 5 | 4 | 4 | 2 | 2 |
| Unlikely | 5 | 5 | 4 | 3 | 2 |
| Rare | 5 | 5 | 5 | 3 | 3 |
| Very rare | 5 | 5 | 5 | 4 | 3 |
| Extremely rare | 5 | 5 | 5 | 4 | 4 |

Table 11: Priority levels at high confidence

| | Consequence | | | | |
|----------------|---------------|-------|----------|-------|--------------|
| Likelihood | Insignificant | Minor | Moderate | Major | Catastrophic |
| Almost certain | 4 | 3 | 2 | 1 | 1 |
| Likely | 4 | 4 | 3 | 2 | 1 |
| Unlikely | 5 | 4 | 3 | 2 | 2 |
| Rare | 5 | 5 | 4 | 3 | 2 |
| Very rare | 5 | 5 | 4 | 3 | 3 |
| Extremely rare | 5 | 5 | 5 | 4 | 3 |

Table 12: Priority levels at moderate confidence

| | Consequence | | | | |
|----------------|---------------|-------|----------|-------|--------------|
| Likelihood | Insignificant | Minor | Moderate | Major | Catastrophic |
| Almost certain | 3 | 3 | 2 | 1 | 1 |
| Likely | 4 | 3 | 2 | 1 | 1 |
| Unlikely | 4 | 4 | 3 | 2 | 1 |
| Rare | 5 | 4 | 3 | 2 | 2 |
| Very rare | 5 | 5 | 4 | 3 | 2 |
| Extremely rare | 5 | 5 | 4 | 3 | 3 |

Table 13: Priority levels at low confidence

| | Consequence | | | | |
|----------------|---------------|-------|----------|-------|--------------|
| Likelihood | Insignificant | Minor | Moderate | Major | Catastrophic |
| Almost certain | 3 | 2 | 1 | 1 | 1 |
| Likely | 3 | 3 | 2 | 1 | 1 |
| Unlikely | 4 | 3 | 2 | 1 | 1 |
| Rare | 4 | 4 | 3 | 2 | 1 |
| Very rare | 5 | 4 | 3 | 2 | 2 |
| Extremely rare | 5 | 5 | 4 | 3 | 2 |

Table 14: Priority levels at lowest confidence

| | Consequence | | | | |
|----------------|---------------|-------|----------|-------|--------------|
| Likelihood | Insignificant | Minor | Moderate | Major | Catastrophic |
| Almost certain | 2 | 2 | 1 | 1 | 1 |
| Likely | 3 | 2 | 1 | 1 | 1 |
| Unlikely | 3 | 3 | 2 | 1 | 1 |
| Rare | 4 | 3 | 2 | 1 | 1 |
| Very rare | 4 | 4 | 3 | 2 | 1 |
| Extremely rare | 5 | 4 | 3 | 2 | 2 |

Practice hints – risk priority**22. Allocate priority**

The project team will need to decide whether to prioritise risks as described above from '1' to '5', with potentially multiple risks at the same priority level, or whether there are arguments for further prioritisation within categories. For instance, some practitioners may wish to prioritise risks that have a consequence to life or health more highly than those that have a consequence to other risk criteria (even within the same priority level).

23. Remember that priority for further analysis or action informs treatment decisions

Prioritising for further analysis or action informs treatment decisions. It does not necessarily take the place of reasoned treatment implementation planning based on priorities and, for example, the availability of resources, community or political will, or seasonal variations.

24. Document the rationale and assumptions for the priority level

The rationale for arriving at the priority level should be documented, along with any assumptions used. This information can then inform the consideration of appropriate treatments or direction for further analysis.

25. Make decisions about further analysis or action

NERAG gives a detailed account of a suggested decision-making process about further analysis or action. Figure 14 describes this process.

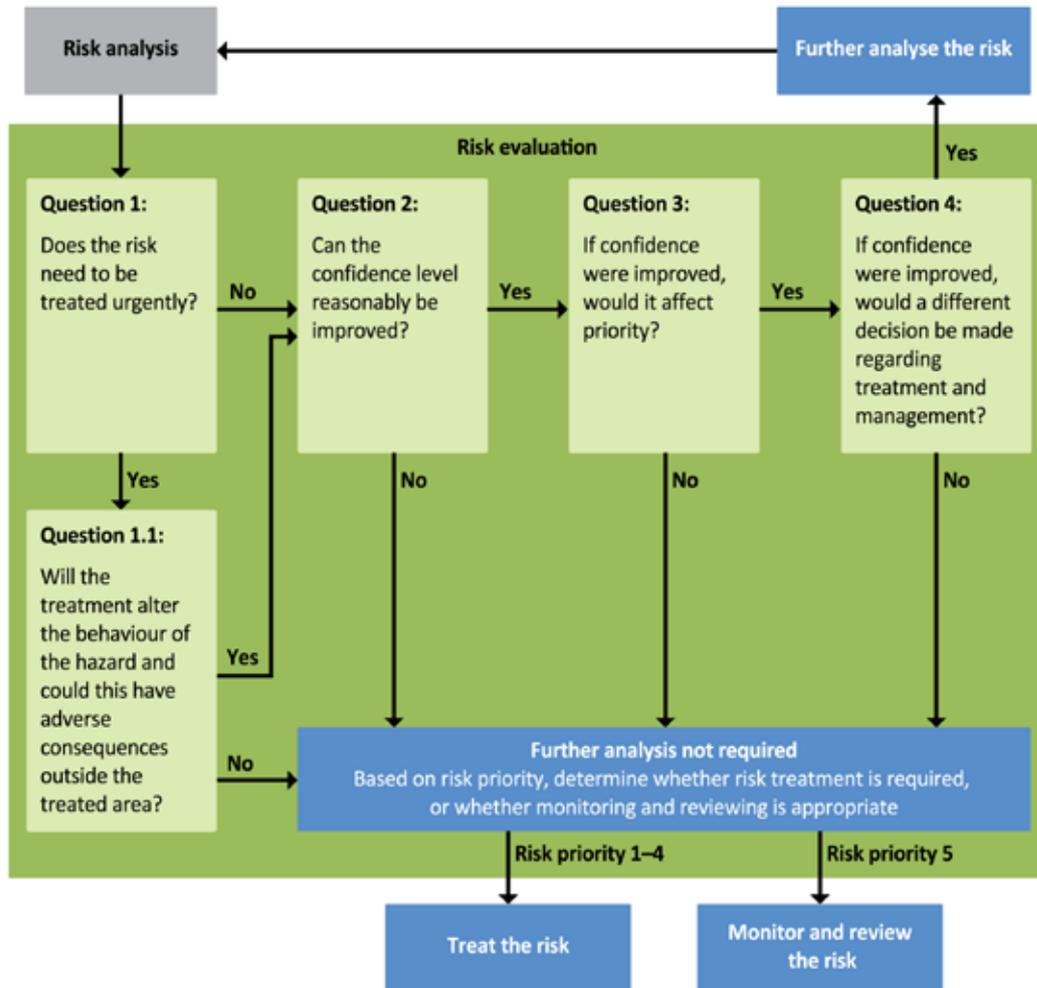
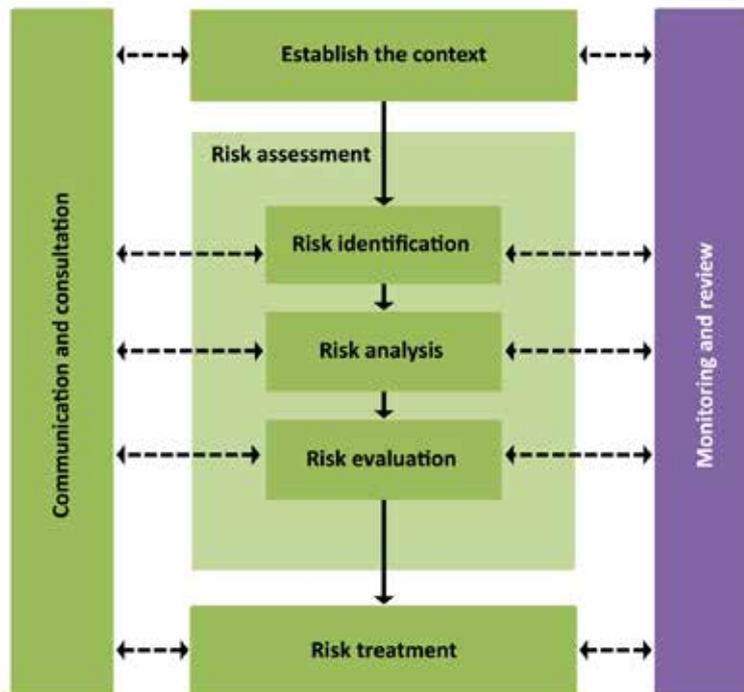


Figure 14: A flowchart used to help determine whether further risk analysis is required

8 MONITORING AND REVIEW



The nature of emergency-related risk changes over time. This includes shifting of priorities, perception and culture.

The monitoring and review process should be documented as part of reporting the risk register and risk management plan, and include:

- ensuring the identified controls are operating effectively and adequately, and have not changed over time
- ensuring the best and most up-to-date available information is used as evidence for the likelihood, consequence and confidence levels
- incorporating information from emergency events that may have occurred since the last risk assessment
- accounting for changes in the context of the risk assessment
- identifying and accounting for emerging risks.

Throughout the emergency risk management process, the project team will have monitored the process listed above, and will have completed a review when planning the treatment process. Once treatments are in place, however, it is critical to ensure that they remain effective, relevant and suited to the original intent. Various aspects of the environment can affect any of these things, and monitoring will need to consider changes in the context, anything that affects the risk assessment, and any changes that will impact on the continuing effectiveness of the treatments (although, now that they are in place, these treatments are considered to be 'existing controls').

8.1 Changes in the context

Over time, changes in aspects of the area or community of interest will occur. These can be considered in several ways, including using the consequence categories, or the 'environments', as described in the recovery framework. The important issue is that the project team uses a methodology to access a variety of indicators.

As an example, Table 15 indicates what may be considered when using the evaluation criteria and consequence categories to monitor the context. For example, if a dollar amount has been used in the consequence criteria to measure the difference between 'major' and 'moderate', this will need to be revisited over time. Note that these are examples of some you may use, but the list is not exhaustive.

8.2 Changes in the risk assessment

Changes in the risk assessment can occur over time as information develops that allows you to better understand the nature of the sources of risk, the nature of an emergency event's impact on a community and its objectives, or the way that the consequences might be measured.

8.2.1 Sources of risk

Research into the nature of the hazard, how it behaves, and how it is triggered and completes its cycle will allow you to better understand the assessment. It will also increase confidence in the assessment.

Table 15: Indicators for monitoring change in the context

| Criteria | Indicators of change in the context |
|-----------------------|---|
| People | Has there been a major change in the: <ul style="list-style-type: none"> • number of people in the area • median age of people in the area • known aspects of vulnerability (e.g health and wellbeing, isolation) • threats to injury or illness (e.g. airborne pollution, exposure to insect-borne disease vectors)? |
| Economic | Has there been a major change in the: <ul style="list-style-type: none"> • size and scale of economic activity in the area • type of major employment • size and type of industries in the area • economic policy that affects the area? |
| Environment | Has there been a major change in: <ul style="list-style-type: none"> • environmental or industrial policy that affects the area (this may be at state, federal or international level) • boundaries of protected areas, parks or fisheries? |
| Public administration | Has there been a major change in the: <ul style="list-style-type: none"> • governance structures in the area (e.g. jurisdictional boundaries) • way in which public governance is administered in the area (e.g. structural change within administration bodies)? |
| Social setting | Has there been a major change in: <ul style="list-style-type: none"> • the cultural mix in the area (e.g. different ethnic groups, different employment or skill groups, fly-in/fly-out employment) • culturally important practices or objects? |

8.2.2 The community and its objectives

Scientific and social research will add greater clarity to the impact of an emergency event on a community or area of interest. It will also more clearly illustrate the health and behaviour of people, networks and economies at the onset, during and after an emergency or disaster. It will also increase the confidence in the assessment.

8.2.3 Measuring consequences and analysing risk

Increased understanding in the areas mentioned in Sections 8.2.1 and 8.2.2 may affect the measurement of severity of consequence.

Changing community and social values are other potential areas of change. For example, over time, the Australian population has generally become less tolerant of risk, and more

litigious. At the local level, the value placed on a particular wetland, community structure or social event may change over time.

8.3 Changes in treatments and controls

The effectiveness and efficiency of some controls will change, and many will deteriorate over time. For example:

- behavioural controls (e.g. regulations, planning schemes, education programs) can be forgotten or neglected
- structural controls can deteriorate (e.g. levees, alarm systems)
- all controls, including technological ones, can be overtaken by progress, changed sophistication in construct or purpose, and reduced relevance in their context or environment.

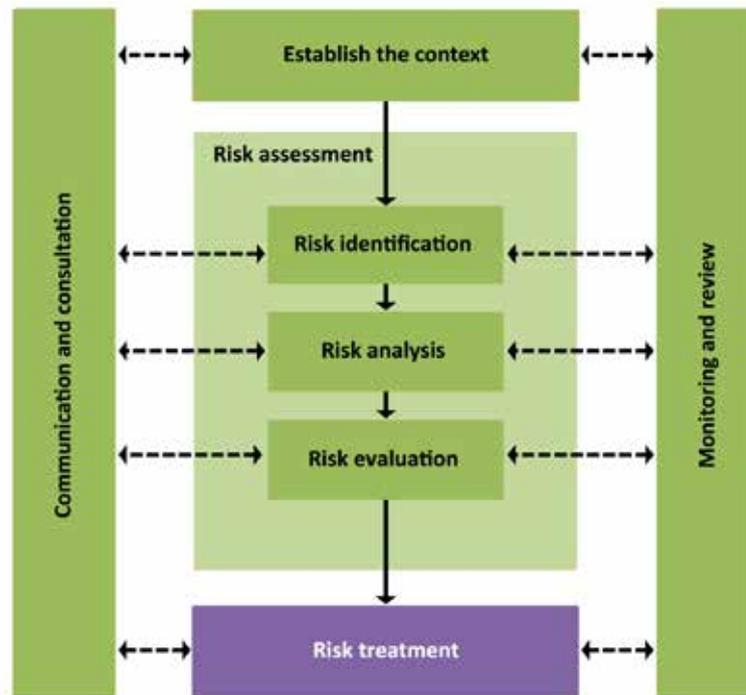
Table 3 in Section 6.2 is useful to inform the monitoring and review of implemented treatments and controls.

Practice hints – monitoring and review

26. Know the difference between monitoring and review

Monitoring is the continual checking, supervising, critical observation or determining the status to identify change. Review is the activity undertaken to determine the suitability, adequacy and effectiveness of the subject matter to achieve established objectives. Both monitoring and review can be applied to a risk management framework, the risk management process, risks and controls.

9 RISK TREATMENT



Risk treatment is the part of risk management where risk is modified by selecting appropriate options and implementing them to meet community objectives.

Throughout the project, the project team will have been mindful that, at the end of the process, it will need to make decisions about how to expend limited resources to deal with, and effectively manage, emergency-related risk on behalf of the public in a way that is appropriate to the time, place and culture of the community of interest. Decisions about risk treatments are where this outcome manifests itself.

9.1 The project team

This is a logical time to consider the make-up of the team that will design and implement the risk treatments. After the thorough risk analysis and making recommendations about the importance and urgency of risks to be managed, a team with a slightly modified skill set may be required to complete the next phase. For example, even though the same agencies and organisations may continue to be represented, different individuals may be

involved. In some instances, additional organisations or individuals representing community views may also be involved.

9.2 Developing a risk treatment plan for decision makers

Risk treatment can be described as:

[The] process to modify risk.

Risk treatment can involve:

- *Avoiding the risk by deciding not to start or continue with the activity that gives rise to the risk;*
- *Taking or increasing risk in order to pursue an opportunity;*
- *Removing the risk source*
- *Changing the likelihood;*
- *Changing the consequences; sharing the risk with another party or parties (including contracts and risk financing); and*
- *Retaining the risk by informed decision. (Standards Australia 2009)*

When the risk assessment is completed, decisions on the risk treatment need to be made as part of the broader risk management process. Compared with risk assessment, risk treatment is a related but distinct process and needs to be incorporated into the risk management framework. This section provides an indicative approach to risk treatment. (AGD 2015)

After the risk treatment phase is finished, the team will have produced:

- a consolidated guide to the criteria that will inform the selection of treatments or suites of treatments for the risks that are to be treated
- an approach to generating options for risk treatments
- one or more options for each risk that is to be treated
- a plan for implementing and monitoring treatments
- a priority order for implementing risk treatments

- a record of the process used to ensure that stakeholders, including residents, are aware of the risks, the risk treatments to be implemented, the methodology and timeframes for implementation, and, hopefully, their engagement in the development and implementation of the treatments
- a record of the allocation and acceptance of responsibility for implementing the treatments
- a documented analysis of the projected impact of treatment implementation, including extent of benefit, risks introduced, costs to be incurred, any residual risk and assurance that can be given.

Although the *National Emergency Risk Assessment Guidelines* (NERAG) provides guidance about the priority and need to treat risks, decision makers are responsible for treatment planning using their own relevant decision-making framework. This is explained in great detail in NERAG, Section 2.3, 'Risk management framework' (AGD 2015).

Figure 15 is a flowchart describing the treatment planning process. Sections 9.2.1–9.2.7 provide more detail about some aspects of the process.

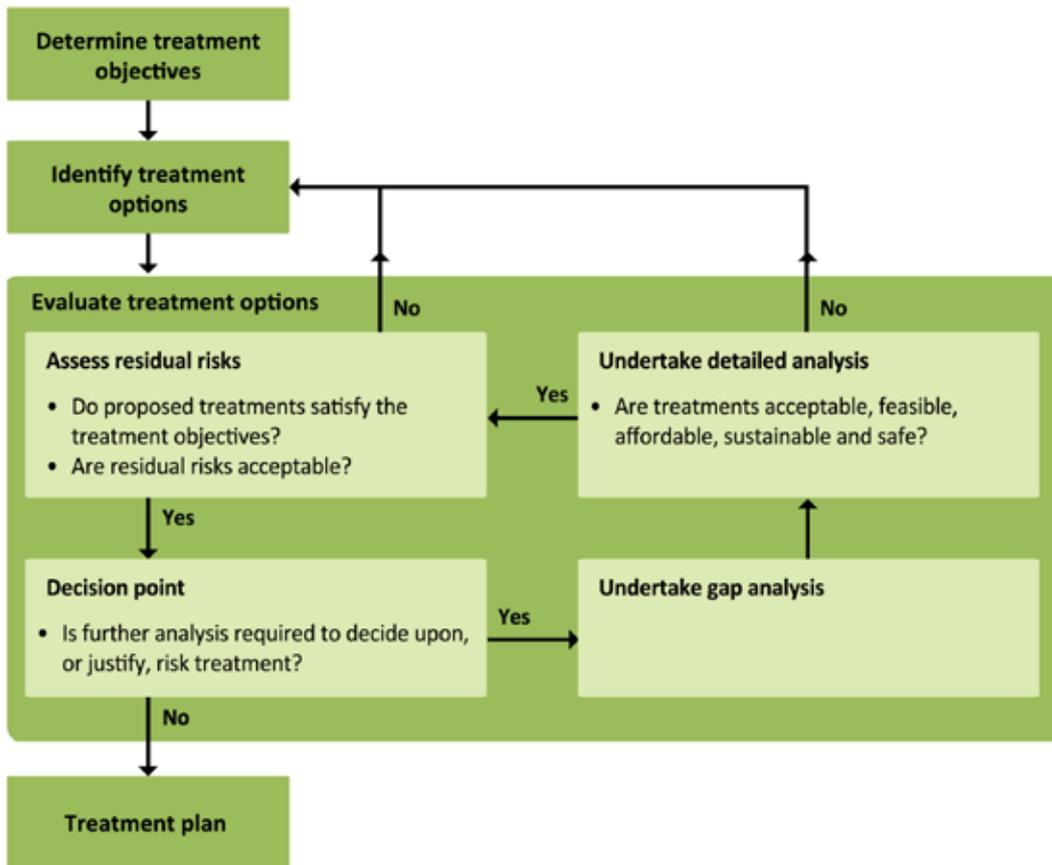


Figure 15: Treatment planning process

9.2.1 Selection criteria

As with risk criteria, the criteria by which risk treatments and suites of treatments are selected should be determined before generating and considering treatment options. These criteria should reflect the values expressed in the risk criteria and consequence tables, but should be expressed in ways that are appropriate to decision making about risk treatment. The *Emergency risk management applications guide* (Applications Guide) documents a selection of criteria (AEMI 2004); these have been slightly adapted and are included in Table 16.

You should choose the treatment selection criteria and determine a priority order, because not all risk treatments will satisfy all selection criteria.

Table 16: Criteria for assessing treatment options

| Criteria | Questions to assess the treatment option |
|------------------------------------|--|
| Cost | Is this option affordable? Is it the most cost-effective? Is it capital and/or recurrent? |
| Timing | Will the beneficial effects of this option be quickly realised? |
| Leverage | Will the application of this option lead to further risk-reducing actions by others? |
| Administrative efficiency | Can this option be easily administered, or will its application be neglected because of difficulty of administration or lack of expertise? |
| Continuity of effects | Will the effects of applying this option be continuous or merely short term? If continuous, will the treatment option be sustainable over time? |
| Compatibility | How compatible is this option with others that may be adopted? |
| Jurisdictional authority | Does this level of government have the legislated authority to apply this option? If not, can higher levels be encouraged to do so? |
| Effects on people | What will be the health and wellbeing impacts of this option? |
| Effects on the economy | What will be the economic impacts of this option? |
| Effects on the environment | What will be the environmental impacts of this option? |
| Effects on public administration | What will be the administrative impacts of this option? |
| Effects on the social setting | What will be the social impacts of this option? |
| Risk creation | Will this option itself introduce new risks? |
| Equity | Do those responsible for creating the risk pay for its reduction? When the risk is not a result of people's decisions, is the cost fairly distributed? |
| Risk reduction potential | What proportion of the losses due to this risk will this option prevent? |
| Political acceptability | Is this option likely to be endorsed by the relevant governments? |
| Public and pressure group reaction | Are there likely to be adverse reactions to implementation of this option? |
| Individual freedom | Does this option deny basic and/or existing rights? Is it legal? |

You should consolidate and document the criteria that will inform the selection of treatments or suites of treatments for the risks that are to be treated.

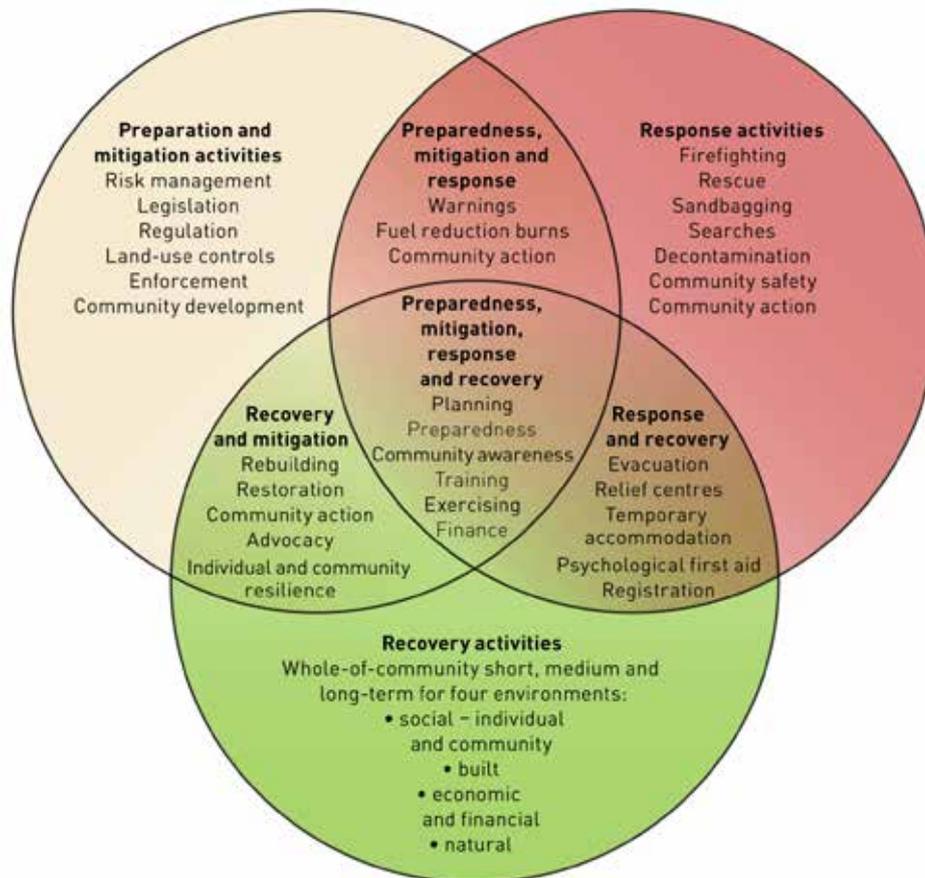
9.2.2 Generating options for risk treatments

Often, risk treatments are selected based on the previous experience of the decision makers. More effective treatments (or suites of treatments) can be gained by generating a range of options using a creative process. A variety of methods can be used for doing this, ranging from the traditional consideration of treatment outcomes outlined in AS/NZS ISO 31000:2009, to more creative approaches that challenge thinking and can result in suggestions that may at first appear outlandish. Keep in mind, though, that the implementation of some treatments will be the responsibility of private enterprises or community members.

NERAG (AGD 2015) suggests using the following actions as prompts to know when to generate risk treatment options:

- avoiding the risk
- removing a risk source
- changing the likelihood of
 - an initiating event or source of risk happening
 - a hazard impacting on elements at risk
- understanding the consequences if a source of risk negatively affects elements at risk
- sharing the risk
- retaining the risk by informed decision.

The Community Recovery Handbook (AEMI 2011b) includes the diagram shown in Figure 16, which gives examples of treatments for the preparation and mitigation, response and recovery categories.



Note: Some terminology may differ across states and territories, and nationally.

Source: AEMI (2011b).

Figure 16: Programs and activities supporting disaster prevention, preparedness, response and recovery

9.2.3 Choosing options for each risk that is to be treated

Reducing the risk in a community may be more effective if a range of bodies and organisations each implement treatments in their own policy area in a coordinated fashion. In this way, a suite of treatments that will complement each other can be designed and implemented strategically to treat the risk.

A strategic approach, requiring cross-agency and organisation coordination, will need to be planned and implemented carefully, with a clear and agreed governance and

management plan. It is usual that the structures and systems already in place can be used to manage such a suite of coordinated treatments.

The Applications Guide described this as a 'holistic approach to treatment':

It is sometimes more appropriate to develop a range of treatment options to effectively remove or reduce risks within a community. Therefore, several treatment options may need to be incorporated into a strategy that may span the responsibility of several agencies/organisations and levels of government.

Treatment options that require collective input and implementation require a strategic planning approach. The strategic plan should include goals, objectives, activities and key result areas for each agency/ organisation that contributes towards reducing or removing the risk.

Cooperative approaches require a high degree of coordination as well as effective corporate governance to continually monitor and review progress and outcomes of the strategy. Existing management structures and emergency management systems are effective means to achieving an all-agency, collaborative approach to developing safer, more sustainable communities. (AEMI 2004)

9.2.4 Prioritising the risk treatments

Once selected, the project team may recommend priorities for risk treatment implementation. Prioritising risk treatments may be a negotiated process, and will consider such issues as:

- the urgency for the risk to be addressed
- the effectiveness of the treatments to be implemented
- how easily implementation can take place
- the extent of resources required for implementation.

9.2.5 Recording the process

The project team needs to record the processes used and the outcomes reached during the risk treatment planning phase. For each risk, the following should be clearly documented:

- the methodology used to generate treatment options
- the treatment options that were seriously considered
- the treatment options that were selected and the rationale for selecting them
- the priority order for risk treatments to be implemented
- the agency, organisation or individuals responsible for implementing the treatments
- the timeframe for monitoring and review of the treatments
- the residual risk, once selected treatments are in place.

You can include this information with the risk register, or you can create a new risk treatment register that follows the same numbering and referencing system as the risk register.

9.2.6 Preparing an implementation plan

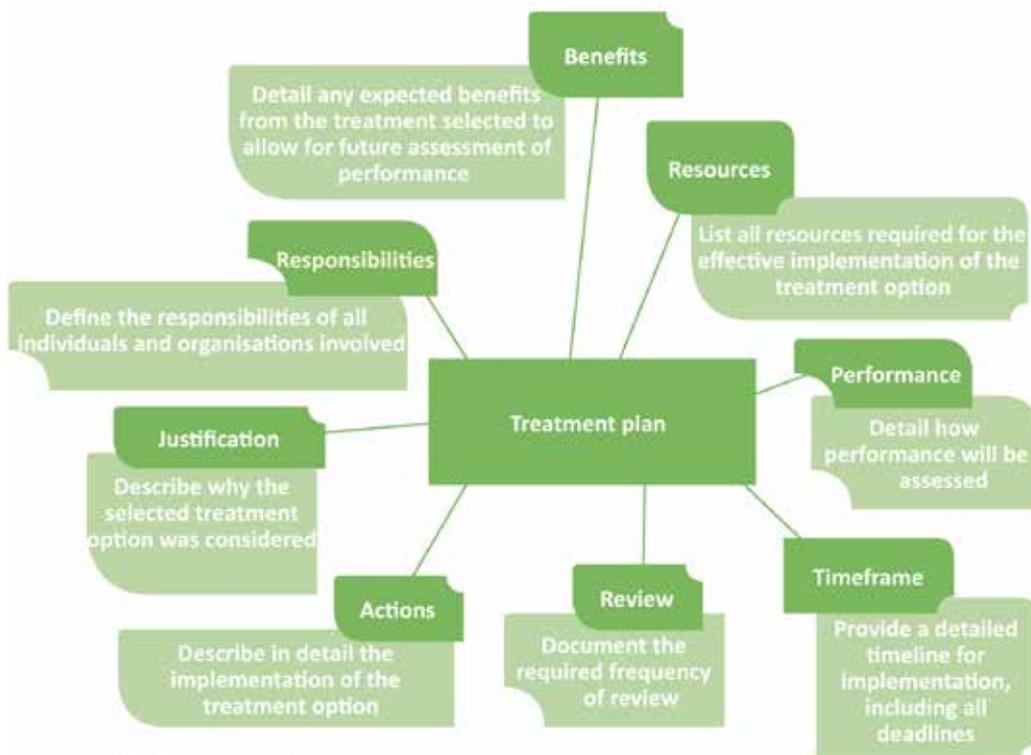
An overall strategic implementation plan should be prepared, and perhaps contain sub-plans for each treatment to be put in place. The implementation plan is meant to ensure that all stakeholders involved in the process are clear about what needs to happen and when, and who is responsible for the action. This is particularly important where several organisations are to be involved in the treatment implementation process.

Individual plans should also be prepared for each treatment. NERAG specifies that such plans should include (AGD 2015):

- details on why particular treatments were selected
- anticipated benefits from treatment actions
- proposed actions
- resource requirements

- responsibilities
- timing and schedule
- performance measures
- residual risks and the recommended management approach
- reporting and monitoring requirements.

This is further exemplified in Figure 17.



Source: SEMC (2014)

Figure 17: Components of a treatment plan

9.2.7 Documenting risk treatment

During the risk treatment designing and planning stage, the project team will have considered many issues, which should be recorded. This information can not only inform the work at hand, but will be extremely useful for any future project or action that relates to the source of the risk, or to the aspect of the community that is affected by the risk.

The supporting documentation for the treatment register should include at least a summary of the:

- extent of the benefit
- risks introduced
- costs incurred
- assurances that can be given
- nature and extent of any residual risk.

Residual risk is the risk that remains once all treatments are implemented. It is part of recognising that not all risk will be eliminated – as with any complex problem, even the best solution is not likely to be perfect. Also, in a complex and dynamic environment, some of the residual risk may not yet be identified.

Practice hints – implementing risk treatments

27. Involve stakeholders

The treatment phase is where your work will be noticed by the public and organisations. It is useful to ensure wide consultation and engagement throughout this phase so that any treatments implemented are as well suited as possible for their context and any resistance can be meaningfully dealt with before implementation. Such resistance may result in improved or modified planned treatments. Some may even be rejected.

28. Be creative when generating treatment options

A creative approach for generating treatments can challenge traditional thinking and can result in suggestions that at first appear unrealistic. With a little further enquiry and modification, it may be possible to turn these possibilities into effective and novel solutions.

29. Revisit the context

Throughout the risk management process, it is helpful to revisit the extensive work that was undertaken while establishing the context. It will ensure that the treatments that are put in place are aligned to the original understandings of stakeholder values and the scope of the project.

30. Track the treatments

You may have found that using alpha-numeric labels during the risk analysis process was invaluable. Continuing that same system through the treatment development and implementation process will be helpful in tracking the journey, and for reporting which action(s) was taken for each problem.

APPENDIX A EMERGENCY RISK MANAGEMENT AND ITS ASSOCIATED GUIDES

Risk management as an endeavour and practice was formally recognised in an Australian and New Zealand Standard (AS/NZS) in 1995, *AS/NZS 4360:1995 Risk management – principles and guidelines*. The standard placed emphasis on managing risk rather than managing the hazards that give rise to risk. This formalised some of the thinking at the time about using resources efficiently to achieve a predetermined outcome. The emergency management sector recognised the value of this approach and set about contextualising it. In 2000, Emergency Management Australia first published the *Australian Emergency Manual Series Manual 5, Emergency risk management – applications guide* (Applications Guide). A second edition was published in 2004.

The Applications Guide supported the continued evolution of emergency management, and provided a common framework for emergency management to consider and act on risk. Before risk management's influence on emergency management, 'comprehensive' emergency management enabled thinking about approaches beyond response and relief. Comprehensive emergency management sat in the notions of prevention, preparedness, response and recovery.

Emergency risk management provided a language for the emergency management sector that was common to the economy and society, more generally. Building on top of, and not replacing, comprehensive emergency management, emergency risk management's conceptual framework was also flexible enough to cope with a wide range of contexts.

In 2009, the International Standards Organization (ISO) created an international standard based on *AS/NZS 4360:2004 Risk management*. The international standard *ISO 31000:2009 Risk management – principles and guidelines* extends the risk management process to include principles for risk management, and specifies a framework for embedding risk management into standard governance and business practices. The international standard was contextualised in 2010 in the form of the *National Emergency Risk Assessment Guidelines* (NERAG) (AGD 2015), following a decision of the Australian Emergency Management Committee.

The situation that emergency management finds itself in now is that the international standard, supported by NERAG, provides a flexible and scalable structured approach to allocating limited resources to improve Australia's disaster resilience.

APPENDIX B ENGAGEMENT TECHNIQUES FROM THE COMMUNITY ENGAGEMENT FRAMEWORK

It is critical for the ongoing credibility of the risk assessment, and trust in the agencies and individuals undertaking communication and consultation, that communication and consultation are undertaken with integrity and sensitivity to the people and the processes involved. Communication and consultation processes for a risk assessment should be identified and planned. This requires an understanding of the context and the purpose of the engagement.

The *Community Engagement Framework* (AEMI 2012) provides useful guidance for planning communication and consultation processes for a risk assessment. This framework has been adapted in the *National Emergency Risk Assessment Guidelines* (NERAG) to inform engagement with the many stakeholders involved in the risk assessment process, including the community.

Engagement should be based on three principles:

- understand the stakeholders, including their capacity, strengths and priorities
- recognise the complexity and the potential connections inherent in the diversity of the stakeholders
- partner with stakeholders to support existing networks and resources.

The framework is circular to show that one engagement approach is not necessarily better than any other, and that different approaches are legitimate depending on the purpose and context of a particular situation (see Figure 6 in Section 3.1.2). Good engagement practice relies on choosing the right approach or combination of approaches for engagement in different situations.

Information

Goal: Share information with and between stakeholders to come to a mutual understanding. Everyone is informed and able to take responsibility for decisions and actions.

Outcomes:

- Communication is relevant, accurate, targeted, credible and consistent.
- Communication is two-way.

- Information is accessible to audiences in diverse situations, addresses a variety of communication needs and is provided through a range of channels.
- Mechanisms are established to ensure coordinated communication with organisations and individuals.
- Key messages are repeated.

Participation

Goal: Build connected networks and relationships, ownership and trust through active involvement.

Outcomes:

- Stakeholders have an opportunity to be actively involved in decisions or actions that potentially affect or interest them.
- Multiple entry points or pathways are available to participate.
- Stakeholders have the opportunity to provide input about how they want to participate.
- Participation is possible for all stakeholders.

Consultation

Goal: Share information, questions or positions to obtain ideas, feedback, knowledge or an understanding of objectives and expectations.

Outcomes:

- Sufficient time is allowed for stakeholders to consider an issue or question, and provide input. For those conducting the risk management process, there is enough time for stakeholders to consider this feedback.
- The consultation process is as broad as possible while appropriate to the scope of the issue.
- Opportunities are created so that many voices can be heard.

- Information received from stakeholders is recorded, stored and used appropriately.
- Stakeholders are informed as to how their input is considered and influences outcomes.

Collaboration

Goal: Partner to support action, including developing alternatives and identifying a preferred solution.

Outcomes:

- Opportunities are created for stakeholders to take action in areas that could affect their lives.
- Relationships are developed where agencies and organisations work collectively with the community, and each contribute their share.
- Needs and interests of all stakeholders are recognised and communicated, including decision makers or agencies.
- All stakeholders who are potentially affected by or interested in a particular issue are identified, and their involvement facilitated.

Empowerment

Goal: Stakeholders have the capacity to understand risk, and accept responsibility and implement initiatives.

Outcomes:

- Knowledge is shared between stakeholders and those conducting the risk management process.
- Stakeholders lead and own the process.
- Joint action and inclusion leads to empowered individuals, communities and other stakeholders.
- Opportunities for deliberation are an integral part of the process.

APPENDIX C SAMPLE OBJECTIVE AND SCOPING STATEMENT

The following text is a sample objective and scoping statement from *2012 Tasmanian state natural disaster risk assessment* (DPEM 2011). For the full text, see the source document.

Objective

Conduct an assessment of the risks the Tasmanian community from TSUNAMI in order to direct and prioritise the community's emergency management through prevention, preparedness, response and recovery.

Scope

The assessment will address the risks from TSUNAMI to the Tasmanian community and consider possible impacts to people, infrastructure, the economy, public administration and the social setting. The TSUNAMI scenario to be considered is based on a realistic but hypothetical worst case event.

Scenario

A major fault movement (earthquake of magnitude 8.7) occurs in the Puysegur Trench off the coast of New Zealand, which causes a tsunami that impacts the Tasmanian coastline. Would rupture whole subduction zone at Puysegur. Current modelling suggests that the wave height at 100 m of water for this magnitude of event equates to a 13 000 year return period. The modelling used is based on the event occurring during the highest astro tide (HAT). This takes into account the potential for storm surge, etc. The group noted that there was a significant difference in the modelling between the level of inundation expected between a HAT event and a mean sea level event.

APPENDIX D SAMPLE COMMUNICATIONS PLAN

Table 17 is a sample communications plan.

Table 17: Sample CODE RED communication action plan

| Reference | | | | | |
|-------------------------------------|---|---|---|--|--|
| A | B | C | D | E | |
| Target audiences | Any council staff who will be relocated on CODE RED day, incl. depot staff, leisure staff, preschool/occ. care staff, CSO, HACC staff, MCH, Health Unit | Any council staff who may choose to implement their CODE RED plan and not attend work | Any council staff who plan to attend work as usual but need to travel through townships identified as high risk (e.g. travel from home in Kyneton to work in Gisborne office or vice versa) | Any council staff who plan to attend work as usual, in their usual location | |
| Method | | | | | |
| Memo with payslips | | Memo to CSOs on (date) | | | |
| Staff newsletter | To be published (date) | | | | |
| Email | Email to 'everyone' on (date) | Email/direction from manager, when appropriate | Email sent to 'everyone' on (date) Further communications to staff to be provided when details are available | Email/direction from manager, when appropriate | Email sent to 'everyone' on (date) Further communications to staff to be provided when details are available |
| Intranet | Organisational plan to be published on the intranet. To be updated as required | Organisational plan to be published on the intranet. To be updated as required | Organisational plan to be published on the intranet. To be updated as required | Organisational plan to be published on the intranet. To be updated as required | Organisational plan to be published on the intranet. To be updated as required |
| Councillor bulletin | | | | | |
| Letter or direct mail | | | | | |
| Website | PR unit to update on (date) as further details become available | | PR unit to update on (date) as further details become available | | PR unit to update on (date) as further details become available |
| Newspaper advert | | | | | |
| Fliers (to handout) | | | | | |
| Signs, posters, on-site, door | CSOs (as required) | | | | |
| Media release or briefing | | | | | |
| Email to ABC radio and Highlands FM | PR unit – when Code Red day advised | PR unit – when Code Red day advised | PR unit – when Code Red day advised | PR unit – when Code Red day advised | PR unit – when Code Red day advised |
| Community-based newsletters | | | | | |

Notes:

1. Stage 1 (October/November). Key message: These are the council's plan on a CODE RED day and this is how our services will be affected.
2. Stage 2 (when a CODE RED day is advised by the Bureau of Meteorology). Key message: Reminder – these are our plan for (date), which is expected to be a CODE RED day.

Source: Developed by Ros Handley, Public Relations Officer, Macedon Ranges Shire Council, 2009

APPENDIX E SAMPLE CONTEXT STATEMENT

The following text and Figure 18 comprise a sample context statement taken from *2012 Tasmanian state natural disaster risk assessment* (DPEM 2011). For the full text and cited references, see the source document.

Bushfire risk assessment

Context and definition

For the purpose of the TSNDRA [Tasmanian State Natural Disaster Risk Assessment], a working definition of bushfire was agreed to include any fire in vegetation, regardless of origin or cause. This was on the basis that bushfire can occur anywhere in Tasmania where there is vegetation, although its impacts are generally only significant when the fire occurs near populated or settled areas. It was felt important not to exclude bushfires of human origin from the study due to the high number of fires caused as a result of human interaction.

Bushfire has been the most costly natural disaster hazard in Tasmania's history, in both economic and human terms. Bushfire has claimed the most lives of any other natural hazard, and is said to carry an average annual cost of \$11.2 million.¹

Bushfire in Tasmania are most commonly associated with dry conditions during summer and autumn. Peak bushfire danger periods vary between seasons according to the rainfall distribution over spring to autumn. Large differences in rainfall distribution across the state affect when and where bushfires occur as well as the susceptibility of vegetation to fire. Tasmania is considered periodically vulnerable to bushfire due to the level of vegetation cover across the state, the unique population spread and the relationship between high rainfall/low evaporation on fuel loads.²

The southeastern part of Tasmania is considered more exposed to bushfire hazard than other parts of the state. As Figure 18 illustrates, Forest Fire Danger Index (FFDI) ratings of more than 100 (catastrophic) have been recorded in the southeast, which generally experiences less rainfall and drier conditions. As the figures show, the north and northwest parts of the state generally experience lower FFDI ratings.

1 BTE report 103 *Economic costs of natural disasters in Australia*.

2 *Understanding bushfires: trends in deliberate vegetation fires in Australia* (Bryant C, 2009, p. 8).

APPENDIX F SAMPLE RISK SCENARIOS

The following sections include examples of risk scenarios, from several sources.

Worst-case scenario⁴

With consideration to historical flooding events, climate change implications and current arrangements, a realistic worst-case scenario was designed for use in the flooding risk assessment workshops. The scenario was designed in consultation with SES, DPIPWE and the Bureau of Meteorology and was later validated by the risk study team. The scenario used for the assessment was described as follows:

- The flooding scenario to be considered is based on the most significant flooding event in Tasmania's history – the floods of 3–7 April 1929. Key characteristics associated with this reference event are:
 - low pressure weather systems(s) moving over Tasmania that bring moisture from the tropics and produce intense heavy rainfall in a short period of time
 - the rainfall continues for more than 3 days, and results in major flooding of multiple catchment areas around the state
 - the riverine flooding impacts more than one township, and has the potential to breach existing levee systems
 - the flooding also leads to at least one dam failure in a catchment, which produces a flash flood that inundates at least one downstream community
 - localised flash flooding is also present in more than one area
 - multiple residential dwellings and businesses are inundated.

The scenario was designed to ensure that all relevant preventative, preparatory, response and recovery controls would come into play, while retaining the characteristics of a realistic feasible flooding event.

⁴ See the source document *2012 Tasmanian state natural disaster risk assessment* (DPEM 2011) for the full description.

Health sector scenarios

Scenario 1: H1N1 swine flu, 2009–10⁵

Likely; 1:100 occurrence; ARI 3–30 years

Early in 2009, a novel strain of human influenza (H1N1 of swine origin) was initially reported in Mexico and subsequently spread across the world. Cases of pandemic (H1N1) influenza 2009 were confirmed in most other countries throughout the world by the World Health Organization (WHO).

The first United States (US) case of pandemic (H1N1) influenza was diagnosed on April 15, 2009. By April 21, the Centers for Disease Control and Prevention (CDC) were working to develop a vaccine for this new virus. On April 26, the H1N1 virus was declared a public health emergency by the US Government.

By June, 18 000 cases of H1N1 had been reported in the US. A total of 74 countries were affected by the pandemic. A vaccine against H1N1 became available later in 2009 with limited supply. Initial priority was given to vaccinating those at highest risk of complications.

The CDC estimates that, in the US, 43 million to 89 million people had H1N1 between April 2009 and April 2010. They estimate between 8870 and 18 300 H1N1-related deaths.

On August 10, 2010, WHO declared an end to the global H1N1 flu pandemic.

People:

- 37 636 cases of pandemic (H1N1) influenza reported in Australia
- 191 associated deaths Australia wide
- 17 deaths in South Australia (above normal deaths seen by the flu). Note that these numbers are likely to be an underestimate of the true figures
- the virus was mild in most people it infected
- high-risk groups, where the illness is more likely to cause complications, included patients with chronic respiratory conditions, pregnant women, obese patients

⁵ Provided by the Department of Health, South Australia.

(BMI > 30), Indigenous people, and patients with chronic cardiac, neurological and immune conditions

- children and younger people were also shown to be at increased risk of serious complications, as well as being rapid spreaders of the virus
- social distancing and isolation.

Social setting:

- Illness and reported deaths due to the public health emergency raised perceptions of risk and lead to risk-modifying behaviour in an effort to reduce the risk of contracting the illness, such as
 - prophylactic absenteeism from work
 - public gatherings
- reduced public gatherings at sporting and other events
- some workers were forced to take leave to care for young children
- some people chose to confine themselves to their homes
- social distancing and isolation.

Infrastructure:

- reduced services, maintenance and repairs due to limited people at work.

Economy:

- risk-modifying behaviours affected consumption and reduced labour productivity
- effects occurred in a variety of industries, not just the health sector
- increased screening for domestic and international travel
- slight reduction in tourism – accommodation, travel agents
- local hospitality and retail experienced reduced sales
- estimated loss of \$314 million to the state.

Public administration:

- increased demand on health services
- hospitals operating at capacity but still able to cope
- GP clinics fully booked
- precautions and plans activated to assist with day-to-day business.

Environment:

- fear of disease being spread across piggery farms
- fear of water contamination and waste from piggeries
- reduced sales of pork affecting the industry and farms.

Table 18 summarises the characteristics of the 2009 H1N1 swine flu.

Table 18: Summary of the 2009 H1N1 swine flu virus

| Characteristic | Description |
|-----------------------------|---|
| Incubation period | 2 days (0.5–7 days) |
| Attack rate | 11–60%, but higher in Indigenous people, healthcare workers and other groups |
| Modes of transmission | Droplet and contact, aerosol (health settings), exclude oro-faecal transmission |
| Period of communicability | 24 hours before to 5 days after onset (longer in children, shorter if on antivirals) |
| Respiratory protection zone | 1 m for droplets, whole room for aerosol-generating procedures |
| Survival of virus | Hard surfaces 48 hours, hands 30 min, disinfection (household detergents) and hand washing (soap and water for 15–20 seconds) effective |
| Serial interval | 2–4 days |
| Presenting symptoms | Respiratory with fever |
| Health impact | Case fatality rate 1–25% |
| Treatment | Antiviral and prophylaxis effective |
| Immunity | Following natural infection and vaccination |
| Absenteeism | Up to 20% |
| Duration of disruption | 7–10 months, then 6–12 months recovery |

Scenario 2: 1918–19 ‘Spanish’ flu

Unlikely; 1:1000 occurrence; ARI 301–3000 years

The Spanish flu swept across the world in three waves between 1918 and 1919. It tended to affect an area for up to 12 weeks and then would suddenly disappear, almost as quickly as it arrived, only to return several months later. In terms of the loss of human lives, the Spanish flu was unprecedented in modern times and it is almost incredible to occur to the same effects again due to immunisations and improved medicine.

More people died during the pandemic than were killed in the First World War. The illness came on suddenly and progressed rapidly to respiratory failure and in some instances death. Many people died from bacterial disease after infection with influenza (known as secondary bacterial infection).

The Spanish flu reached Australia in 1919. It began in Victoria, spread to New South Wales then to the rest of Australia. By the end of 1919 (when the Australian population was just over 5 million), around 10 000 Australians, mostly young adults, had died of influenza. As in other countries, health services in Australia were stretched during this time:

- infected 500 million people across the world
- 3 to 5% of the world’s population was killed (50 to 100 million people)
- influenza may have killed as many as 25 million people in its first 25 weeks
- 4.5% of the South Australian population died of influenza.

As it would relate to Australia today

People:

- 4.5% of the South Australian population died of influenza
- South Australian population at 30 June 2011 was 1.64 million – number of deaths would have been 73 800
- Spanish influenza targeted the young and the healthy, and was most severe among 25 to 30 year olds

- 20% of people admitted to hospital died
- social distancing and isolation
- hospitals quickly became overwhelmed by the sheer number of patients
- temporary hospitals, flu clinics were established to assist hospitals to cope
- nurses and doctors in short supply
- supplies in shortage – medical equipment, PPE
- antivirals and medication in demand
- increased palliative care required
- moral and ethical-based decision making – access to treatment.

Social setting:

- education and child care facilities closed
- mass gatherings (shopping, schools, religious venues) cancelled and closed
- compulsory to wear face masks in public
- mass burials of bodies due to numbers
- state borders guarded, stopping travel/traffic to reduce contamination
- people unable to leave or enter towns (boundaries established)
- access to daily services (food/shopping, petrol, banking) restricted
- civil disorder as supplies are short and people cannot live normal lives
- social distancing and isolation.

Infrastructure:

- industries unable to run due to limited employees
- reduction in delivery and maintenance of essential services
- public transport is stopped
- limited ability for coffins and individual burials.

Economy:

- businesses closing/industry collapse
- decreased earnings due to decreased trade and production
- import and export decreased
- international and interstate travel reduced
- estimated loss of \$1.46 billion to the state.

Public administration:

- challenges in providing governance with significantly reduced workforces and modification to normal, traditional business operations
- challenges in governing due to social distancing and isolation
- fulfilling legislative requirements with a prolonged reduced workforce.

Environment:

- increased level of waste in medical facilities
- increased landfill and incineration of waste
- issues around sales, animal husbandry and programmed culling for animals associated with the virus (swine flu – pigs, avian flu – birds).

Table 19 summaries the characteristics of the 1918–19 Spanish flu virus.

Table 19: Summary of the Spanish flu virus

| Characteristic | Description |
|-----------------------------|---|
| Incubation period | 12 hours (0.5–7 days) |
| Attack rate | 25–70% but higher in Indigenous people, healthcare workers and other groups |
| Modes of transmission | Droplet and contact, aerosol (health settings), exclude oro-faecal transmission |
| Period of communicability | 24 hours before to 5 days after onset (longer in children, shorter if on antivirals) |
| Respiratory protection zone | 1 m for droplets, whole room for aerosol-generating procedures |
| Survival of virus | Hard surfaces 48 hours, hands 30 min, disinfection (household detergents) and hand washing (soap and water for 15–20 seconds) effective |
| Serial interval | 2–4 days |
| Presenting symptoms | Respiratory with fever |
| Health impact | Case fatality rate 25% |
| Treatment | Antivirals |
| Immunity | No natural immunity; vaccination not yet produced |
| Absenteeism | Up to 50% |
| Duration of disruption | 12 months, then 12–24 months recovery |

Specific risk scenario

Table 20 shows scenarios developed for specific sudden onset natural hazards.

Table 20 Risk scenarios for bushfire and cyclone

| Hazard | Scenario | Description | Contributing agencies |
|----------|--|---|--|
| Bushfire | Credible worst case (~1:00 year event) | Severe to extreme fire dangers. Low pressure trough across the south west with dry and gusty thunderstorms. Multiple bushfire ignitions from the Murchison through to the South Coast with some areas containing high fuel loading. Fresh and gusty north-easterly winds, followed by north-westerlies and westerlies. Fires impact on people, and a wide range of community and industrial infrastructure along the Darling Range. | Bureau of Meteorology Department of Fire and Emergency Services Office of Bushfire Risk Management |
| | Credible near-worst case (~1:100 year event) | Severe fire danger during summer holiday period. Low pressure trough across the Great Southern generating fresh north-easterly and north-westerly winds. Suspected arson attack near a town. Evacuation of town is required with impacts on people, on dwellings, and on commercial and service buildings. | Department of Environment and Conservation SEMC Secretariat Research: Bushfire CRC |
| Cyclone | Credible worst case (~1:00 year event) | Category 5 STC making landfall just west of a regional town in the Pilbara close to the time of high tide. A large system with an extensive wind field – very destructive winds (gusts >164 km/h, peaking at >300 km/h) for up to 18 hours in the town vicinity. Storm surge – maximum water level of 13.5 mAHD (11.0 m > HAT) expected along coast. Heavy to flooding rain – 200–400 mm per 24 hours of rain forecast along coast. Heavy to flooding rain forecast over broad area along coastal and inlands parts. Flash flooding along coastal zone within 150 km of the town. | Bureau of Meteorology Department of Fire and Emergency Services Department of Water Water Corporation SEMC Secretariat |
| | Credible worst case (~1:150 year event) | Category 4 STC making landfall just south of a Gascoyne region town, close to time of high tide. A large system with very destructive winds (gusts >164 km/h, peaking at >275 km/h) for up to 18 hours at the townsite. Storm surge – maximum water level of 7.5 mAHD (6.5 m > HAT) expected along coast. Heavy to flooding rain – 200–400 mm per 24 hours of rain forecast along coast. Heavy to flooding rain forecast over broad area along coastal and inlands parts. Flash flooding along coastal zone within 150 km of the town. | |

CRC = Cooperative Research Centre; HAT = highest astro tide; mAHD = metres Australian height datum; SEMC = State Emergency Management Committee; STC = severe tropical cyclone

Source: SMEC (2013)

APPENDIX G EXAMPLES OF RISK STATEMENTS

This appendix list examples of risk statements taken from three publications.

From the *National Emergency Risk Assessment Guidelines*:

There is the potential that heavy rainfall will result in flash flooding that, in turn, will damage buildings.

There is the potential that a large seismic event will result in ground shaking that, in turn, will cause loss of life and injury.

There is the potential that an outbreak of foot-and-mouth disease in Australia will result in livestock being destroyed that, in turn, will affect the agricultural sector and national economy. (AGD 2015)

From the *Emergency risk management – applications guide*:

There is a risk that a bushfire within the municipal reserve will cause significant damage to the college of advanced education timber buildings.

There is a risk that a bushfire within the municipal reserve will cause the loss of life of some Wilderness Road residents.

There is a risk that a major outbreak of an exotic animal disease will cause the regional economy to significantly decline. (AEMI 2004)

From the *Community emergency risk management plan*, Bayside City Council:

A cliff collapse could result in a detrimental effect on the localized environment, may cause injury / fatality to users of the foreshore area and affect the local economy through loss of tourism and financial hardship to some businesses.

Disruption to gas, water, or electricity supply could result in stress and disruption to the community. This could affect all business capacity to function, affecting the local economy and living standards. Vulnerable groups will be more susceptible to loss and deterioration of health (e.g. aged, young, and specific needs groups). (Bayside City Council 2011)

APPENDIX H SAMPLE RISK REGISTER

Figure 19 is a sample of a risk register. For the full description, see the source document.

| RISK IDENTIFICATION | | | | RISK ANALYSIS | | | | RISK EVALUATION | | |
|---------------------|--|---------|-----------------------|---------------|------------|--------|---|--------------------|---------------------------|--|
| Risk No. | Risk Statement | Source | Impact Category | Consequence | Likelihood | Risk | Confidence Level | Overall Confidence | Tolerability | Supporting Comments |
| TAST501 | There is the potential for a major earthquake to occur in the Puysegur Trench off the coast of New Zealand which causes a Tsunami that impacts Tasmanian coastline, causing serious injury or illness to people and/or loss of human life, and displacement of people. | Tsunami | People | MAJOR | RARE | MEDIUM | Data - LOW Team - HIGH Agree - HIGH | LOW | TOLEABLE SUBJECT TO ALARP | 90 minutes warning time (at best) before the first wave would make difficult to evacuate all affected areas. Deaths would be greater than but less than 50; people on coastline (fishing etc) more vulnerable. Vulnerability study underway in Kingstons (infrastructure focus). |
| TAST502 | There is the potential for a major earthquake to occur in the Puysegur Trench off the coast of New Zealand which causes a Tsunami that impacts Tasmanian coastline, which would have an economic cost to the community. | Tsunami | Economy | MAJOR | RARE | MEDIUM | Data - LOW Team - HIGH Agree - HIGH | LOW | TOLEABLE SUBJECT TO ALARP | Modelling data is robust, however consequence assessment data is currently lacking. (ie difficult to assess costs and loss of life). |
| TAST503 | There is the potential for a major earthquake to occur in the Puysegur Trench off the coast of New Zealand which causes a Tsunami that impacts Tasmanian coastline, which would have negative environmental impacts. | Tsunami | Environment | MINOR | RARE | LOW | Data - LOW Team - HIGH Agree - HIGH | LOW | BROADLY ACCEPTABLE | Sewerage treatment works inundated. Fuel stores, etc impacted. Would result in pollution but not significant loss or impairment to ecosystems. Secondary hazard - fuel chemicals etc may lead to high consequences. |
| TAST504 | There is the potential for a major earthquake to occur in the Puysegur Trench off the coast of New Zealand which causes a Tsunami that impacts Tasmanian coastline, which could cause public concern and have an impact on public administration and governance. | Tsunami | Public Administration | MAJOR | RARE | MEDIUM | Data - LOW Team - HIGH Agree - HIGH | LOW | TOLEABLE SUBJECT TO ALARP | Group agreed that this level of a Tsunami would put significant strain on Tasmanian government and attract widespread attention. |
| TAST505 | There is the potential for a major earthquake to occur in the Puysegur Trench off the coast of New Zealand which causes a Tsunami that impacts Tasmanian coastline, which could impact the quality of life for many Tasmanians and damage/destroy objects of cultural or other significance. | Tsunami | Social Setting | MODERATE | RARE | LOW | Data - LOW Team - HIGH Agree - HIGH | LOW | TOLEABLE SUBJECT TO ALARP | Emotional/psychological impacts would be significant - due to high density of population near the coast, uncertainties around the tsunami threat and cataclysmic nature of the event. |
| TAST506 | There is the potential for a major earthquake to occur in the Puysegur Trench off the coast of New Zealand which causes a Tsunami that impacts Tasmanian coastline, which could cause loss or damage to critical infrastructure. | Tsunami | Infrastructure | MODERATE | RARE | LOW | Data - LOW Team - HIGH Agree - HIGH | LOW | TOLEABLE SUBJECT TO ALARP | Detailed modelling and vulnerability assessment would assist with understanding level of predicted damage (eg Sullivan's Cove, etc). |

Source: DPEM (2011).
Figure 19: Example of a risk register

APPENDIX I SAMPLE RISK TREATMENT PLAN SUMMARY

Table 21 is a risk treatment plan summary for a specific local government risk.

Table 21: Sample risk treatment plan summary for a severe storm

| Stage | Risk treatment | Responsible agency |
|--------------|--|------------------------|
| Prevention | Community education and awareness campaigns | LGA, DFES |
| | Drainage maintenance programs | LGA |
| | Kerbside rubbish collections | LGA |
| | Building Codes | LGA |
| Preparedness | Local Emergency Management Arrangements | LGA, DFES, DPAW, WAPOL |
| | Regular pruning of trees under power lines | LGA, Western Power |
| | Bureau of Meteorology weather warnings | Bureau of Meteorology |
| | Drainage maintenance | LGA |
| | Appointed community emergency services coordinator | LGA |
| | Local Government Grant Scheme | LGA, DFES |
| | SOPs and SAPs | DFES, LGA |
| | Greenwaste pick-up | LGA |
| | Training of DFES/SES | DFES |
| | Community warnings | DFES, LGA |
| Response | Murray SES unit equipped, trained for storm response | LGA, DFES |
| | Welfare Centre's Nominated | LGA |
| | Community Welfare | CPFS |
| | WESTPLAN 'Storm' | DFES |
| Recovery | Shire of Murray Local Recovery Plan | LGA |
| | WESTPLAN 'Recovery Coordination' | DPC |
| | Local emergency management arrangements | LGA |
| | Community information management | LGA |

CPFS = Department for Child Protection and Family Support; DFES = Department of Fire and Emergency Services; DPAW = Department of Parks and Wildlife; DPC = Department for Child Protection; LGA = local government agency; SAP = standard assessment procedure; SES = state emergency service; SOP = standard operating procedure; WAPOL = Western Australia Police

Source: Shire of Murray (2013).

APPENDIX J SUMMARY OF PRACTICE HINTS

As mentioned in Chapter 1, experienced practitioners have offered several practice hints to consider when undertaking the emergency-related risk management process in accordance with the *National Emergency Risk Assessment Guidelines*. These hints are summarised here.

Communication and consultation

1. Consider how to engage throughout the process

Different stakeholders will require different styles and depths of engagement throughout the process. Some will need to be deeply involved at one stage, but only need to know that the project is continuing at another. Table 2 (Section 3.1.2) illustrates this concept across a range of stakeholders.

2. Construct a communications plan

Consider who should be consulted about what, when and in what form. Appendix D shows part of a sample communications plan. Although it was constructed for a particular purpose, the structure and format can be useful.

Consequence criteria

3. Take the time to describe the context

Understanding and describing the context is critical to the remainder of the project, because it sets the foundation for the rest of your work. Do not rush this part of the project, since time invested here will bring rewards later on.

4. Involve a broad range of stakeholders

It is important to ensure that a variety of people who represent the range of responsibilities covered are involved, as well as subject matter experts and decision makers, all of whom will be impacted by the final outcomes of the risk assessment.

5. Customise the consequence descriptors

After understanding and describing the context, but before beginning the analysis, you should customise, where necessary, in the consequence descriptor tables so that they better relate to the area of your analysis. For example, in the economic consequences, express the specific gross product of the area in dollars, and do something similar for each of the consequence categories. This will also ensure that those involved in the project can more easily gauge the level of consequence.

It is important, though, to ensure that the relativities within the tables remain constant and in line with the NERAG tables.

6. Select the criteria for analysis

Some practitioners have found it useful to focus only on the impacts on people and the economy in the first instance. They have found that these give a broad indication of consequence level, and that the remaining areas of consequence, or criteria, can inform which risk treatment options may be suitable.

Some practitioners have also added consequence categories that will further inform analysis in the area. For example, a separate category for agriculture consequence could be used in some locations where it is seen as a significantly substantial and specific category of impact. This decision should be made while establishing the project context. Care should be taken, however, to ensure that by adding categories, certain consequences are not accounted for twice.

7. Estimate the consequence level

Where a scenario is likely to affect several consequence categories, it is important to have a project team understanding about how the consequence level or rating will be decided, before embarking on the risk analysis journey. The approach should be decided upon while establishing the context, and NERAG requires that the highest level should be used.

8. Consider single-hazard risk assessment

If your project is focused on a single hazard, give careful consideration to customising the risk and consequence criteria. If adaptation is required, the basic structure of the NERAG criteria should be followed as far as possible.

9. Ensure the right people are involved

You, as part of the project team, should engage with agencies and individuals who are likely to be involved in treatment implementation throughout the project, including experts in the behaviour of the hazard. Gaining their support at the beginning of the process will lay the groundwork for accepting responsibility for implementing aspects of the risk treatments.

Risk identification

10. Use scenarios

There is a near-infinite number of possibilities for emergency events, so it is necessary to select a sample to make the process manageable and comparable. To cope with both the complexity and volume of possibilities, you will find it useful to generate three or more scenarios of increasing complexity or consequence intensity for each emergency-related risk being considered. These will allow for a reasonable range of risks to be identified for further analysis and evaluation, and may help to identify the scale of emergency at which particular emergency-related risks emerge.

Risk control levels

11. Consider a pre-existing structure

If you are working within a pre-existing risk management arrangement, it is advisable to consider methodology for analysing controls in that arrangement. It is important to maintain relativities across a risk analysis, so it is wise to use the same tools and tables consistently.

12. Document the risk control levels

The degree of effectiveness of the controls, whether there is a need for them to work in concert with others, and whether they modify the risk's consequence or likelihood may also be documented. This may be in the risk register itself or in the additional material that supports the risk register.

Risk identification and likelihood**13. Consider the controls that are in place**

Estimate the likelihood based on your understanding of the controls that are in place and their effectiveness.

14. Invoke the scope of the project

The project scope will have considered the time over which the risk is to be analysed. Consider likelihood in the context of this time period. For some risks, extended time periods will be appropriate. For example, geophysical risks such as earthquakes or volcano eruptions are very rare, and can have annual exceedance probabilities of 0.01–0.1%.

15. Ensure the right people are informing the decision

It is critical that experts relating both to the event itself, and the types and extents of consequences, participate in the process. This will ensure that thought is given to the likelihood of a natural phenomenon occurring, as well as the nature and likelihood of specific impacts being experienced. For example, if considering the likelihood of a storm impacting on a township, there should be people participating in the decision making who understand the economic circumstances, the social dynamics and the health outcomes alongside those who understand the behaviour of the storm itself.

16. Be aware of the current circumstance

Ensure that the current environment is taken into account if using some historical input to inform the decision making. Since a previous event, it is possible that the population

has changed, new industries have emerged, floor heights have been raised, building materials have improved, the density of buildings has increased and the type of vegetation has changed. In addition, building, planning and mitigation controls may have been put in place (or eroded), and the understanding of the resident population may have changed. Any of these or other changes will result in different impacts and likelihoods for future events.

17. Remember that the language matters

The international standard is careful to explain that practitioners should not think solely in a pure mathematical sense about the term 'probability'. This is why the term 'likelihood' is used. When implementing emergency risk management, it is not normally possible to make mathematical determinations in relation to any of the measures in the analysis process (and some would say it is not desirable).

The terms 'likely', 'almost certain' and 'rare' have particular and specific descriptions within the likelihood level tables. These may or may not match the everyday language of the people making the decisions. It is useful to focus on the indicators themselves, and consider these terms as labels that will inform the process. This may allay confusion.

18. Be consistent

When analysing for likelihood, choose the table (or column) that best suits your risk assessment project and stick to it. Just like considering consequence, the required outcome is one that is consistent and can therefore indicate relative likelihoods.

19. Document assumptions about likelihood

The rationale for arriving at the likelihood category should be documented, along with any assumptions used. This information can then inform the consideration of confidence levels as well as future risk analyses.

Confidence levels

20. Document assumptions about confidence levels

The rationale for arriving at the confidence level should be documented, along with any assumptions used. This information can then inform any further data collection and analysis that might occur.

21. Consider project team experience or preference

Depending on the experience or preference of the project team, assessment of the confidence levels for the entire project may be classified at 'moderate' throughout. Doing so, however, eliminates the next step in the NERAG process. If the decision is taken to choose this route, it must be:

- used as an approach throughout all risk assessments in the project
- be documented in the project materials.

Risk priority

22. Allocate priority

The project team will need to decide whether to prioritise risks as described above from '1' to '5', with potentially multiple risks at the same priority level, or whether there are arguments for further prioritisation within categories. For instance, some practitioners may wish to prioritise risks that have a consequence to life or health more highly than those that have a consequence to other risk criteria (even within the same priority level).

23. Remember that priority for further analysis or action informs treatment decisions

Prioritising for further analysis or action informs treatment decisions. It does not necessarily take the place of reasoned treatment implementation planning based on priorities and, for example, the availability of resources, community or political will, or seasonal variations.

24. Document the rationale and assumptions for the priority level

The rationale for arriving at the priority level should be documented, along with any assumptions used. This information can then inform the consideration of appropriate treatments or direction for further analysis.

25. Make decisions about further analysis or action

NERAG gives a detailed account of a suggested decision-making process about further analysis or action. Figure 14 (Section 7.2.2) describes this process.

Monitoring and review

26. Know the difference between monitoring and review

Monitoring is the continual checking, supervising, critical observation or determining the status to identify change. Review is the activity undertaken to determine the suitability, adequacy and effectiveness of the subject matter to achieve established objectives. Both monitoring and review can be applied to a risk management framework, the risk management process, risks and controls.

Implementing risk treatments

27. Involve stakeholders

The treatment phase is where your work will be noticed by the public and organisations. It is useful to ensure wide consultation and engagement throughout this phase so that any treatments implemented are as well suited as possible for their context and any resistance can be meaningfully dealt with before implementation. Such resistance may result in improved or modified planned treatments. Some may even be rejected.

28. Be creative when generating treatment options

A creative approach for generating treatments can challenge traditional thinking and can result in suggestions that at first appear unrealistic. With a little further enquiry and modification, it may be possible to turn these possibilities into effective and novel solutions.

29. Revisit the context

Throughout the risk management process, it is helpful to revisit the extensive work that was undertaken while establishing the context. It will ensure that the treatments that are put in place are aligned to the original understandings of stakeholder values and the scope of the project.

30. Track the treatments

You may have found that using alpha-numeric labels during the risk analysis process was invaluable. Continuing that same system through the treatment development and implementation process will be helpful in tracking the journey, and for reporting which action(s) was taken for each problem.

REFERENCES

- AEMI (Australian Emergency Management Institute) 2004, *Australian Emergency Manual Series Manual 5, Emergency risk management – applications guide*, Canberra: AEMI, Australian Government.
- AEMI (Australian Emergency Management Institute) 2011a, *Australian Emergency Management Handbook Series Handbook 1, Disaster health*, Canberra: AEMI, Australian Government.
- AEMI (Australian Emergency Management Institute) 2011b, *Australian Emergency Management Handbook Series, Handbook 2, Community recovery. The community recovery handbook: building a disaster resilient Australia*, Canberra: AEMI, Australian Government.
- AEMI (Australian Emergency Management Institute) 2012, *Australian Emergency Management Handbook Series Handbook 6, Community Engagement Framework*, Canberra: AEMI, Australian Government.
- AGD (Australian Government Attorney-General's Department) 2015, *Australian Emergency Management Handbook Series, Handbook 10, National Emergency Risk Assessment Guidelines*, Canberra: AGD.
- Bayside City Council 2011, *Community emergency risk management plan*, prepared by Emergency Management Consultancy Services, Victoria: Bayside City Council.
- DPEM (Tasmania Government Department of Police and Emergency Management) 2011, *2012 Tasmanian state natural disaster risk assessment*, Hobart: DPEM.
- EMA (Emergency Management Australia) 2004, *Critical infrastructure emergency risk management and assurance handbook*, Canberra: AEMI, Australian Government.
- NEMC (National Emergency Management Committee) 2011, *National Strategy for Disaster Resilience: building our nation's resilience to disasters*, Canberra: Emergency Management Australia, Australian Government.
- SEMC (Western Australian State Emergency Management Committee) 2013, *Western Australian state-level risk assessment. Seven sudden onset natural hazards: storm, earthquake, bushfire, tsunami, heatwave, cyclone and flood*, Perth: SMEC.

- SEMC (Western Australian State Emergency Management Committee) 2014, *Emergency Risk Management Guide. Prototype – transitional edition, June 2014*, Perth: SMEC.
- Shire of Murray 2013, *Emergency risk management report treat risk*, Pinjarra: Shire of Murray.
- Standards Australia 2009, *AS/NZS ISO 31000:2009 Risk management – principles and guidelines*, Sydney and Wellington: Standards Australia and Standards New Zealand.
- Victorian Government 2011, *State Emergency Risk Assessment Methodology for the State Emergency Risk Assessment Project*, based on the National Emergency Risk Assessment Guidelines (August 2011), Melbourne: Victorian Government.

Australian Emergency Management Knowledge Hub

www.emknowledge.gov.au