MANAGING COMMUNITY RISKS

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Risk and society go hand-in-hand. The modern world is continually changing in relation to the recognition, production and distribution of 'social goods' (opportunities, services and products) and 'social bads' (threats, hazards and vulnerabilities). In disaster planning it is necessary to identify options that provide strategies about how to avoid, lower the severity of, or prepare to deal effectively with, potential losses or disruption arising from hazardous events. However, our current process for distinguishing and dealing with social bads is not systematic: some bads are singled out for particular attention while others are ignored; and decisions about remedial options tend to be made on the advice of 'risk experts' who focus on some issues while dismissing others. These actions reduce the element of choice, which is a critical component in effective disaster planning and other significant risk decision activities.

To make society safer requires recognition of all likely hazards and an effective strategy to treat them. To ensure that all elements of hazards are taken into account and that decisions about their treatment are accepted by as many as possible, a participatory approach to policy decision and implementation is necessary. The risk management process offers such a solution. More specifically, risk management is an appropriate mechanism for integrating emergency management: since the steps that need to be taken in response to anticipated threats or to the impact of a disaster may be carried out by different people at different times, it is appropriate that a uniform method of approach be applied. Moreover, since these actions are dependent on an informed community, risk communication is an important element of emergency management.

This paper explores the theory and practice of risk management and comprehensive emergency management. By following developments in these two areas, greater understanding can be gained about their importance in the management of large-scale social crises and uncertainties. The paper addresses the following four major areas:

1. *The changing nature of the global hazardscape*
2. *What is risk management and how it differs from other risk appraisal methods*
3. *Recent developments in emergency management*
4. *How risk management relates to emergency management*

1 CHANGING GLOBAL HAZARDSCAPES

The number of natural and technological disasters, and their associated economic costs continue to rise. A comparison of the decade 1986-1996 with the 1960s reveals a quadrupling in the number of major natural disasters. After allowing for inflation, economic losses were eight times higher, while insured losses increased fifteen-fold. A reduction in this trend is not anticipated. Figures compiled in 1997 by a leading reinsurance firm, Munich Re, indicate that the world experienced 594 natural disasters during 1996. A similar number of disasters were recorded by Munich Re in the previous two years (597 in 1994; and 579 in 1995). In 1996:

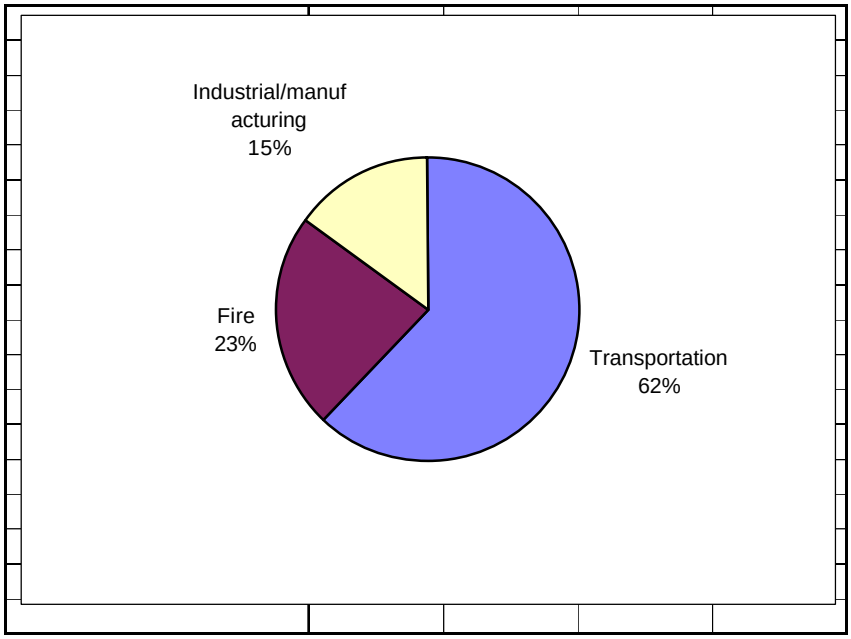
- The total world losses exceeded $US 60 billion
- Of this total only $US 9 billion was insured
- 12,000 fatalities were directly attributed to natural disaster impact
- Asia was the most severely affected continent, accounting for 31% of loss events, 80% of casualties and 61% of economic losses

- The USA suffered the most insured losses with 81% of the total
- Windstorms and floods accounted for 62% of all natural disasters, 85% of casualties, 90% of economic losses and 90% of insured losses.

On the technological hazard front, the situation appears to be a little brighter. As a rule, major technological disasters seem to occur less frequently than their natural counterparts. Yet, when they do, they also have far-reaching, albeit different, implications. Technological disasters particularly affect the economic life or credibility of business enterprises. They cause lost productivity and usually reflect failures of administrative responsibility and control. They threaten public confidence. Moreover, with technological hazards, in particular, there is growing concern over their cumulative impacts upon the environment and public health. These effects draw businesses into broader debates about risk, which the enterprises rarely succeed in winning.

In the five-year period 1989 to 1993, an average of 110 serious technological impacts were reported each year. Three categories of technological accidents stand out: mass passenger transport accidents, structural fires, and industrial/manufacturing accidents (Figure 1).

Figure 1: Major Categories of Technologically-Related Disasters, 1989 - 1993



Source: Britton (1997a). Adapted from Hewitt (1997). Note: figures have been rounded out and minor categories eliminated.

Almost two-thirds of the total major technological emergencies relate to mass passenger transport accidents. Of these, almost a quarter resulted from commercial plane accidents. From August 1996 to August 1997, for example, 20 jetliner crashes occurred throughout the world, amounting to $US 647 million in hull losses. Mass transit accidents tend to occur throughout the world, although a specific cause may be regional (for example, loss of life from ferry capsizes tends to occur mostly in Asia). By comparison, major property damage and/or deaths from structural fire is, in the main, a 'developing' nation problem, Asia predominating. In 'developed' nations, structural fires have been declining systematically as a specific hazard agent. In New Zealand, for instance, a 14.2% decrease in the overall number of fires was recorded during the 1991-1996 period. A clearer picture can be discerned from the 1993-1996 period, where a 68% decrease in the number of structural fires has been recorded. However, the number of deaths from structural fires increased in 1997.

1.1 Creating Vulnerability

The figures for both natural and technological hazard impacts lead one to reflect on the vulnerability of our way of life, especially with respect to increasing urbanisation and its concentration of people, services and economic activity. Cities are more complex to organise and service: urbanisation creates reliance on specialist technological services. When these services fail large numbers of people are affected.

The United Nations estimates that in 1950, about 30% of the world's population - then about 2.5 billion - lived in cities. Now, about 45% of the world's 5.7 billion people live in cities. This number is predicted to increase to more than 60% of an estimated total population of 8.3 billion by the year 2025. The number of cities with more than 1 million inhabitants has grown from 83 in 1950 to 325 today. The growth in urbanisation has been a particular feature of the developing world, especially Asia. Moreover, large population centres are spreading into, or consolidating themselves in highly exposed areas, such as, on floodplains; along coasts exposed to storm surge, tropical cyclones, other severe storm paths, and tsunami inundation; and areas exposed to landslide, rockslide, earthquake, wildfire and avalanche. At the same time, cities, as physical entities, exacerbate the hazards of nature in several ways, including:

- Increasing the exposure to flooding, as most of a city's area is sealed with concrete and asphalt, leaving much of the rainwater running above ground
- An increased loss potential from extreme hailstorms because of the concentration of both commercial and residential property
- An increasingly frequent occurrence of lightning strikes because of towering buildings with masts
- Intensification of storm systems due to thermal convection above warm cities.

1.2 'New Species of Trouble' ?

Future disaster agents are likely to be different from those of the past. This is inevitable and logical. Both the built and the physical environment is continually changing, and these trends result in changes that raise the likelihood of more and different types of hazards. This does not mean that all the natural and technological hazards we experience now, or which affected society in the past have been solved. What it does mean is that we will be subjected to additional sources of threats and impacts.

The following fifteen points indicate what changes are already taking place and give clues about what the future might hold:

1. *Widespread systems disruption rather than direct deaths/injuries or physical damage* (e.g. 'information society' creates an over-reliance on computers, but inherent design features - such as Y2K - produce possibilities of global disruption)

2. *Emergence of new kinds of technological accidents leading to disasters* (e.g. ecological disasters through storage of hazard contaminates; widespread pollution through transit accidents of hazardous materials, such as shipping radioactive elements for reprocessing)

3. *Technological advances that reduce some hazards but add complexity to old threats* (e.g. plane travel is safer but greater reliance on synthetic interiors raises the likelihood of death by fire/asphyxiation when crash occurs)

4. *New versions of old or past dangers* (e.g. urban drought resulting from infrastructure not being able to keep up with high-rise developments and other burgeoning urban growth characteristics; urban 'flash flooding' through increased run-off)

5. *Emergence of new types of biological or chemical weapons against peacetime society* (e.g. bioterrorist attacks that can kill thousands of people, such as the 1995 Tokyo subway nerve gas

attack, or the 1984 salmonella attack in Oregon, and that require new surveillance and operational counter-measures)

6. *New and increasing kinds of biological emergencies* (e.g. new global health threats such as Ebola from W Africa; genetic engineering and biotechnology producing new organisms and synthetic drugs requiring new safety control measures; new or improved biological strains released, e.g. rabbit calicivirus disease, RCD, in Australia and New Zealand 1997, before full testing procedures are completed, and before full implications are understood)

7. *Increase in multiple or synergistic disasters* (i.e. natural disasters generating technological disasters - e.g. windstorms spreading radioactive materials in Southern Urals in the 1980s; or magnifying disaster impact - e.g. 1994 Northridge earthquake creating gas leak fires and hazardous materials spillages)

8. *Disaster agents will have more to hit and have greater impact* (e.g. increased population density, greater concentration and property value in larger urban areas, and expansion of urban boundaries)

9. *Increase in the vulnerability of populations* (e.g. increasing occupation of marginal land creates enhanced vulnerability to natural hazard impact; increase in chemically-induced hypersensitivity related to pesticides and insecticides; mixed zoning brings lower socio-economic groups into closer proximity with hazardous industrial activity)

10. *Complexity, diversity and inter-dependencies within metropolitan areas will create new problems of coping* (e.g. neglected maintenance or unduly delayed renewal of critical lifeline infrastructure; dependence on vulnerable lifeline infrastructure means damage can be longer-lasting; closure and/or damage to one lifeline can produce a domino effect on other parts of the urban environment e.g. 1998 Montreal and Auckland power outages)

11. *Disasters created by sources long distances from the point of impact (*e.g. 1986 Chernobyl nuclear reactor disaster in Russia caused widespread contamination throughout eastern and west Europe, and the United Kingdom)

12. *Hazard agents capable of causing global disasters* (e.g. global warming has been linked to possible sea-level rises and consequent inundation of low-lying landmasses; increased understanding of weather patterns reveals that El Nino- Southern Oscillation can create extreme conditions - drought and floods - throughout the world at the same time that some essential cropstrains are becoming less tolerant to climatic extremes)

13. *Lifestyle changes increase hazard propensity* (e.g. 'back-to-nature' living in peri-urban areas increases bushfire risk; social disruption more likely through a lack of basic survival skills and experience)

14. *Inter-generational effects of disasters* (e.g. radiological and toxicological hazards can be transmitted from one generation to another)

15. *Close-coupling of technological components not necessarily understood and/or incapable of adequate safety management* (e.g. 1979 Three Mile Island nuclear reactor accident).

The changing nature of global and community hazardscapes, and in particular, the ways in which our contemporary lifestyles are dependent on closely-coupled systems, means that there is now a very real need to re-consider how we manage crises and uncertainties, and whether we have adopted the most appropriate tools to assist in identifying, understanding, accepting, reducing and recovering from hazards.

The risk management process, the comprehensive emergency management approach, and the sustainable hazard mitigation approach are specific developments that, in combination, have the potential to greatly assist communities gain greater control over their environment and reduce uncertainty. These practices provide viable methods to cope with increased complexity by integrating processes through a systems approach.

2 RISK MANAGEMENT

The word 'risk' derives from the early Italian *risicare*, which means 'to dare'. In this sense, risk implies a choice rather than a fate. Activities undertaken by individuals, organisations, or governments all involve some degree of risk through choice. All activities expose people to a potential loss or gain of something they value; their health, money, career, social position, the environment, and so on. Risk therefore addresses three questions:

- The *frequency* of the loss/gain; that is, how often the loss/gain may occur?
- The *consequences* of the loss/gain; that is, how large might the loss/gain be?
- The *perception* of the loss/gain; that is, how a potential loss/gain is viewed by affected stakeholders in terms of its effect on their needs, issues, and concerns?

In practice, risk management and its key elements tend to focus on the 'loss', or fate side rather than the 'gain' or opportunity side. However, risk management, if it is practised correctly, can keep the element of choice in achieving the balance between gain and loss. Risk management is

> the process of considering the social, economic and political factors involved in risk analysis; determining the acceptability of damage and/or disruption that could result from an event; and then deciding what actions should be taken to minimise likely damage or disruption.

2.1 Risk Management as an Enhanced Interactive Process

To achieve the goal of risk management (that is, maintaining an acceptable balance between gains and losses in any chosen course of action), this process has to take into account not only the physical properties and potential effects of risk elements in terms of the probability of occurrence and the likely consequences of the losses, but also equally essential social, cultural, moral, ethical, political and legal considerations. Because there is a need to understand how a potential loss might affect and be perceived by various stakeholders, it is insufficient, and indeed can be quite misleading, for the decision-maker to consider risk solely in terms of probability and consequence.

The risk management process is part of a chain of activities used in formulating policy decisions associated with the acceptable level of public safety in relation to specific hazard/s. Like any chain, there is a continuous interlinking of key components. Each link must be employed to successfully manage programmes that deal with hazards:

Risk Assessment « Risk Communication « Risk Management

⇒ *Risk assessment* is the method used to define the likelihood of harm (probability x consequence) coming to an individual, group, or community or the occurrence of an event as a result of exposure to a substance or a situation. This assessment uses a base of scientific research and is usually quantitative.

⇒ *Risk communication* is a two-way process to arrive an acceptable level of choice by which, on the one hand, the population is informed of the risk, the assessment of what the risk entails, and how the risk might be managed; and on the other hand, meeting with the population/s-at-risk and taking into consideration their needs, issues and concerns, and seeking their feedback and input into the risk analysis, or risk estimation, process.

⇒ *Risk management* is a process that identifies the level of tolerance a group has for a specific risk. It is used to decide what to do where risk has been determined to exist. This process must be open since it has to factor in benefits, cost of control, and any statutory framework needed for managing the substance or situation.

The management of risk issues often entails priority-setting, due to limits on available resources. Hence, effective communication strategies throughout all phases of the risk decision process, and the explicit recognition that value judgements are a significant part of the risk process, are key distinguishing elements of risk management as opposed to the more technically-focused risk analysis and risk assessment. Communication among stakeholders throughout the process is a critical element. Decisions made with respect to risk issues must balance the technical aspects of risk with the social and ethical considerations that often accompany such issues.

2.2 The Risk Assessment - Risk Management Distinction

The notion of risk management was first introduced about 40 years ago, as a consequence of the performance problems pertaining to modern engineered technologies that were being increasingly utilised in production systems. Of particular concern were public safety issues when the products were sold. Hence, risk management developed as a contextualising process to the more technically-specific practice of risk assessment and the closely associated activity of risk analysis.

Risk management engages a broader scope than traditional risk assessment, which focuses on evaluating alternative probability and consequence actions and selecting among them. Since there are significant differences between risk assessment and risk management, and since many practitioners, regulators and educators still use them inter-changeably, it is useful to distinguish between the concepts.

The definitions and distinctions used below are ones that have been adopted by the USA National Research Council since the early 1990s, and most recently endorsed by the 1997 USA Presidential/Congressional Commission on Risk Assessment and Risk Management. These distinctions are explicit in the joint Australian Standard/New Zealand Standard *Risk Management Guidelines* (4360:1995), and in the Canadian National Standard, *Risk Management Guidelines for Decision-Makers*. These characterisations are also the ones adopted by the Emergency Management Policy and Establishment Unit, as it sets out to create a risk-based emergency management structure for New Zealand, and in doing so replacing the response-focused Ministry of Civil Defence.

To assist the discussion, a list a relevant terms and concepts are attached in Table 1. Table 2 provides additional explanations of key secondary terms used in Table 1.

Risk assessment might best be thought of as the process of understanding the factors that lead to the chance of something happening that will have an impact on objectives. It is the scientific analysis and characterisation of the effects of an environmental or technological hazard. It may include both quantitative and qualitative descriptors. In this way, risk assessment is the technical stage in the process of coming to an understanding of how 'risky' a hazard is. Hence, risk assessment is a set of analytical techniques for answering the question: 'How much damage or injury can be expected as a result of some event?'; and 'What is the safety margin of a particular activity, or series of inter-linked actions or processes?' It is the application of a range of formal techniques to estimate probabilities of gain and/or loss that different courses of action will result in. The risk assessor may also seek to calculate the probability of different magnitudes of loss or gain associated with alternative outcomes. In addition to determining the most likely outcomes, assessors may also devise worst case scenarios that can then be passed on to assist decision-makers determine the social acceptability of a risk. These are especially important where probability values are unobtainable or known to be unreliable, which is likely to be the case in many instances.

Table 1: Risk and Related Definitions

Risk
The chance of something happening that will have an impact upon objectives. It is measured in terms of consequences and likelihood.

Risk Acceptance
An informed decision to accept the likelihood and the consequences of a particular risk.

Risk Analysis
A systematic use of available information to determine how often specified events may occur and the magnitude of their likely consequences.

Risk Assessment
The process used to determine risk management priorities by evaluating and comparing the level of risk against pre-determined standards, target risk levels or other criteria.

Risk Communication
An interactive process of exchange of information and opinion among individuals, groups and institutions involving multiple messages about the nature, form, severity, or acceptability of risks.

Risk Identification
The process of determining what can happen, why and how.

Risk Management
The process of considering the social, economic and political factors involved in risk analysis; determining stakeholder acceptability of damage that could result from an event; and determining what actions should be taken to minimise likely damage or disruption.

Risk Reduction
A selective application of appropriate techniques and management principles to reduce either likelihood of an occurrence or its consequences, or both.

Risk Perception
The significance assigned to risks by stakeholders. This perception is derived from the stakeholders' expressed needs, issues, and concerns.

Risk Transfer
Shifting the responsibility or burden for loss to another party through legislation, contract, insurance or other means. Risk Transfer can also refer to shifting a physical risk or part thereof elsewhere.

Source: Britton (1997c) Adapted from Britton & Oliver 1995; AS/NZS 43360: 1995; Davies 1996; CAN/CSA-Q850-97

Table 2: Associated Risk Terms

Consequence
The outcome of an event or situation expressed qualitatively or quantitatively, being a loss, injury, disadvantage or gain.

Cost
Of activities, both direct and indirect, involving any negative impact, including money, time, labour, disruption, goodwill, political and intangible losses.

Element at risk
Anything valued by the community which may be exposed to a hazard.

Environment
Surroundings in which an organisation or community operates, including air, water and natural resources, flora, humans and their inter-action. (Surroundings in this context extends from within an organisation to the global system).

Event
An incident or situation, which occurs in a particular place during a particular interval of time.

Frequency
A measure of likelihood expressed as the number of occurrences of an event in a given time. See also ***Likelihood*** *and* ***Probability****.*

Hazard
A source of potential harm or a situation with a potential to cause widespread disruption and/or loss.

Likelihood
Used as a qualitative description of probability and frequency

Probability
The likelihood of a specific outcome, measured by the ratio of specific outcomes to the total number of possible outcomes. Probability is expressed as a number between 0 and 1, with 0 indicating an impossible outcome and 1 indicating an outcome is certain.

Resilience
A measure of the ability of systems to maintain relationships between elements in the presence of disturbances.

Vulnerability
The characteristics of a person or social group in terms of their capacity to anticipate, cope with, resist, and recover from the impact of a hazard. It involves a combination of factors that determine the degree to which someone's life and livelihood is put at risk by a discrete and identifiable event in nature or in society.

Source: Britton (1997c) Adapted from Britton & Oliver 1995; AS/NZS 43360: 1995; Davies 1996; CAN/CSA-Q850-97

Since it employs a series of *risk analysis* tools to estimate the likelihood and level of damage from a specific event or exposure, risk assessment is often presumed to be free of value judgements. Risk analysis originally meant an estimation of the relative likelihood and magnitude of alternatives where the outcome of a course of action is uncertain. More recently, it has become a generic term that encompasses processes involving hazard identification, risk assessment and risk evaluation. Hence, risk analysis is that part of the risk assessment process that many characterise as objective. It must be recognised, however, that objective measurements of risk, as with all intellectual endeavours, will always involve subjective considerations. The very choice of what questions to ask and issues to consider, as well as the methods to be employed, involves judgment, especially in the face of large uncertainties. This choice is subjective and in part based on the analyst's judgment of what may be the most significant factors. In large part, judgment is determined by the type of training the analyst received: an engineer or economist is trained for different purposes than, for example, a town planner or a policy analyst, all of whom have significant and legitimate inputs into risk assessment procedures.

By comparison, *risk management* describes the actions taken to alter the consequences or likelihood of a risk occurring so that it is more acceptable to the affected population. Risk management refers to the activities of identifying and evaluating alternative options and selecting among them. In doing so, risk management acknowledges the value judgement component: risk managers are supposed to deal with broad social, economic, ethical, and political issues in choosing from among a set of decision options by using the results of risk assessments.

In this respect, the process of reaching agreement about what an acceptable level of risk might be for a particular hazardous activity that could affect a specific group or community, will likely result in risk trade-offs. The risk management process involves analysis of risk-benefit, risk-risk evaluations, or cost-benefit analyses. However, to achieve acceptability in a risk management context, these analytical tools, which have conventionally been the exclusive domain of technical specialists, require broader social input.

Formal doctrines of risk management (that is, those based on the narrow perspective that 'risk = probability x consequence' alone) are usually based on two presuppositions. The first assumption is that a risk is acceptable only if it is outweighed by demonstrably greater aggregate benefits. Associated with this is continuous striving to reduce the level of risk to a point where it is held to be 'tolerable', or 'as low as reasonably possible' (the ALARP principle).

The second assumption is to meet some other criterion of social acceptability. However, neither assumption is capable of answering questions about what is 'tolerable' or what is 'reasonable'. Hence, fundamental questions that risk management introduces include:

- Who is to bear what level of risk?
- Who is to benefit from risk-taking?
- Who is to decide?
- Who should monitor?
- Who is to pay ?

This list is only the beginning. Other issues include:

- Where is the line to be drawn between risks to be managed by the state and those to be managed by individuals, social groups and corporations?
- What information is needed for 'rational' risk management and how should it be analysed, and using what 'justice' model?
- What actions make what difference to risk outcomes?
- Who evaluates success or failure in risk management and how?

These questions make the above-mentioned distinction between risk assessment as understanding, and risk management as action an important differentiation. On the one hand, the risk assessment process insulates scientific activity from political pressure, and maintains the analytic distinction between the magnitude of a risk and the cost of coping with it. On the other hand, the risk management process helps to make the understanding of risk more acceptable by exposing the technical analysis to wider social and political scrutiny. This distinction recognises that analytical activities are not sufficient to provide the understanding that will lead to changed attitudes toward risk acceptability. Altering the level of tolerance needs additional, non-technical, information such as the social consequences of not having the risky activity/element available (risk averse) or of being able to have it (risk taking).

Thus, while risk management and risk assessment are very different, they should be regarded as two sides of the same coin, since one builds on the other. Different training, skill-sets and different perspectives are required to undertake these complementary task-sets; and hence different methods of application are needed. Since it is as much social and political as it is technical, risk management can only be achieved through a combination of multi-disciplinary and lay input.

2.3 Tolerating the Risk: Perception, Communication and Acceptability

A significant component of the risk management approach builds on the fact that value judgements are an important part of the process. In particular, there is the acknowledgement that risk is not an 'object out there'; it is a social construct. Hence, risk perception, risk communication, and what constitutes acceptable levels of risk are major ingredients.

Risk perception is concerned with psychological and social factors affecting selection of some risks for concern and the unself-conscious minimising of others. The approach examines individuals' abilities to make accurate estimates of probability, and the disparities between their stated attitudes to different probabilities and actual behaviour. Perceptions of risk are culturally determined, however, and hence will vary widely between groups of people.

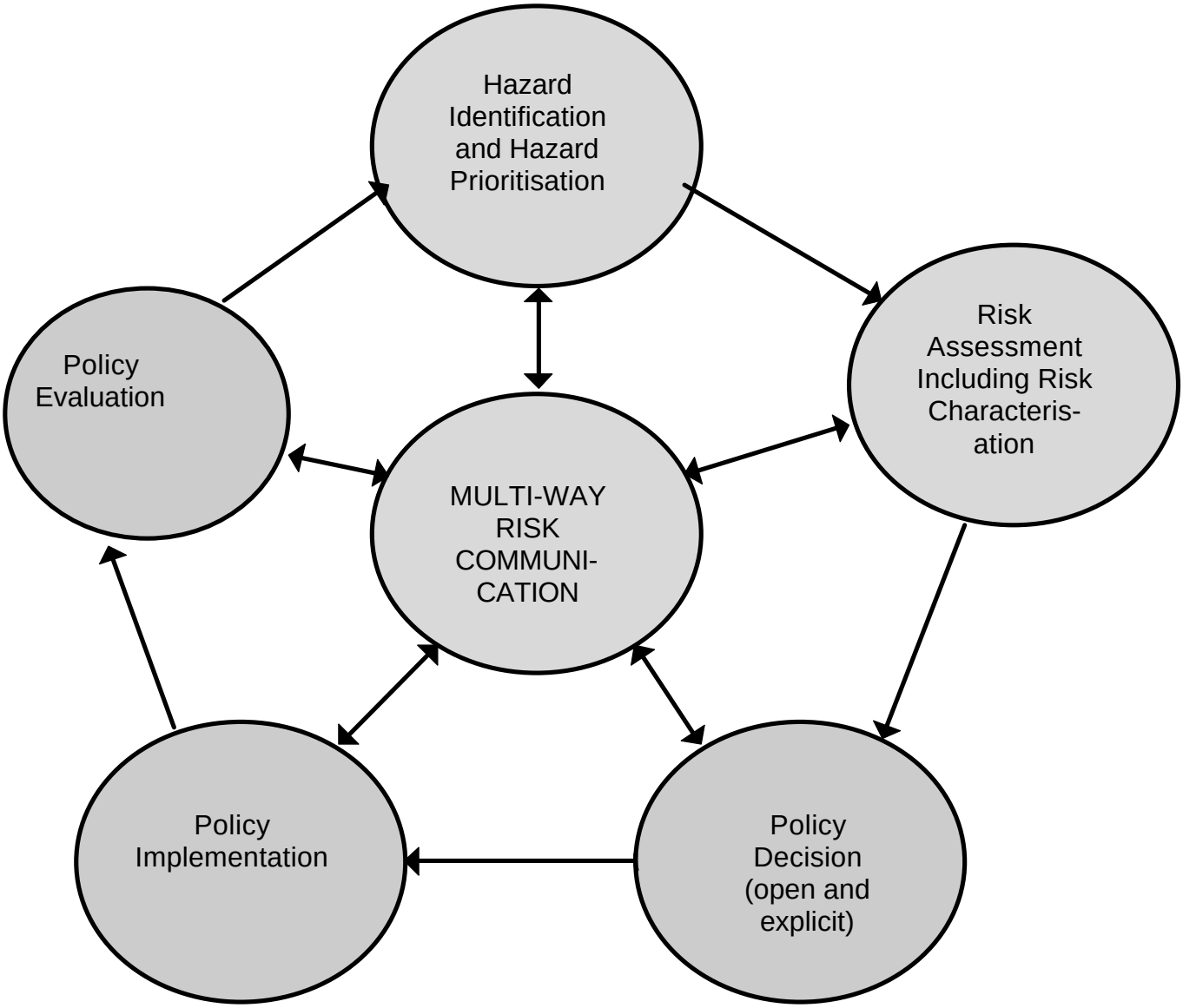
This last factor emphasises the importance of risk communication. Risk communication is just that: conveying information about risk. Such communication can range from simple warning labels, to product data sheets, to hazardous site databases, through to elaborate public awareness programmes that outline how families can conduct household contingency plans for likely disaster impact. For a long time, risk communication was generally one-way, with 'risk experts' trying to impose their judgements on the public. However, results from this approach were hardly stunning. Today, the view is that the process of communicating risk needs to be considered as informing all interested parties. This includes the public. To ensure this is achieved, the following considerations need to be part of the risk communication process:

- Identify potential stakeholders; that is, the groups that are going to be affected
- Identify the issues; that is, verify through dialogue with stakeholders the issues and identified scenarios that concern them
- Perform a stakeholder analysis; that is, develop a stakeholder profile, what specific needs, issues, and concerns do they have and why
- Begin to develop the risk communication strategy; that is, how will the issues be dealt with; what communication processes, messages and tools are required.

The risk management decision process should be open and transparent to build trust between the decision-maker and other stakeholders. If stakeholders trust the process, the conclusions and decisions stand a much better chance of being accepted. Discovering what is, and is not trusted, by stakeholders is a significant benefit of the stakeholder analysis.

Communication between experts and laypersons can be difficult for a number of reasons. Experts and laypersons have vastly different levels of knowledge related to specific issues, but the important point is that experts and laypersons tend to focus on different aspects of the issue. The interests and concerns of the two are different, including the fact that there are often large uncertainties associated with estimating future frequencies or consequences that technical experts sometimes overlook or fail to acknowledge. For these reason, and because of the inherent mistrust associated with things that are not well understood, there is often conflict between laypersons and technical experts throughout the decision process. If the communication of risk is seen as a central issue in effective risk management, many issues and potential problems can be resolved (Figure 4).

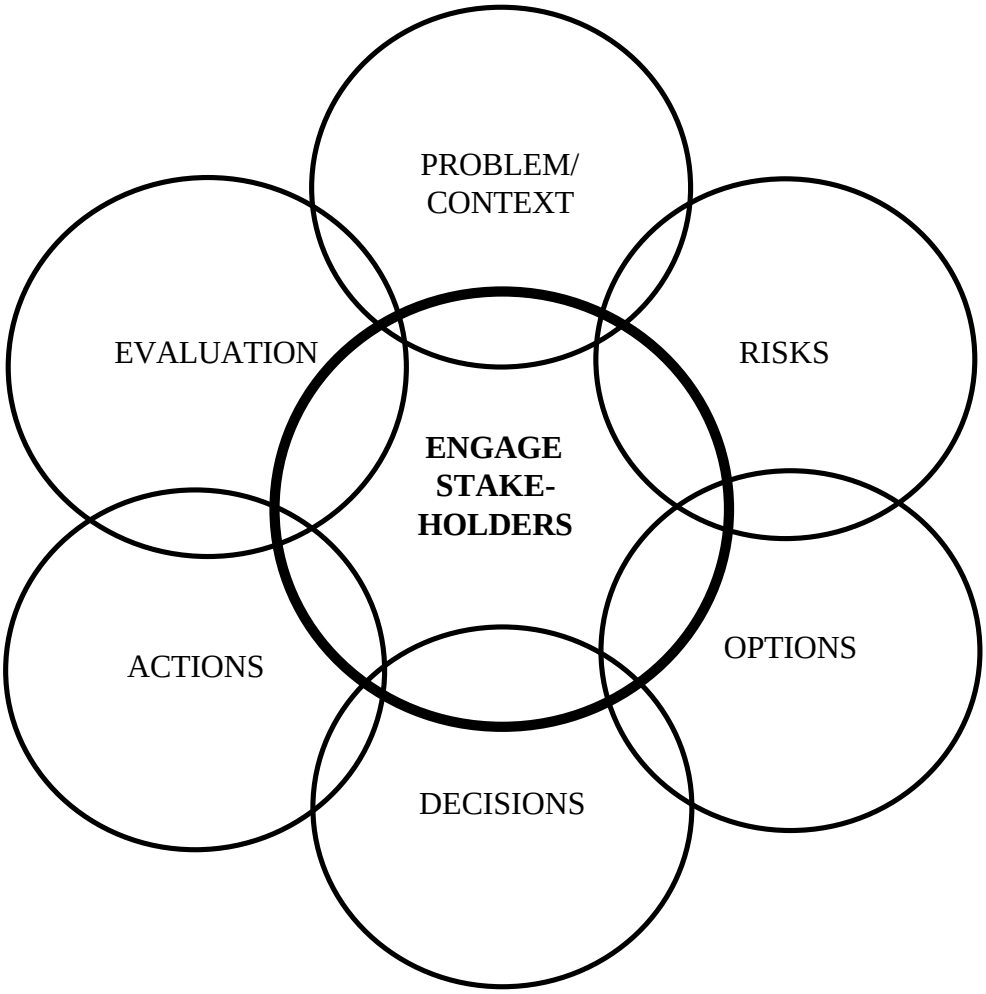
Figure 4: The Risk Management Cycle



(Source: Hood and Jones, 1996, p.7)

The framework for risk management has to be conducted in collaboration with stakeholders, that is those who will, or are likely, to be affected either directly by the hazard in question and/or by the decision outcome that is reached about the level of tolerance or acceptance. Finally, since the likelihood of easily eliminating a hazard that affects groups or communities is unlikely to be achieved the first time round, the risk management process is by necessity iterative; that is, it is a continual and repetitive cycle. Using iterations, when new information is available that changes the need for, or the nature, of risk, the process repeats. These two factors are captured in Figure 5.

Figure 5: Framework for Risk Management



Source: Presidential/Congressional Commission on Risk Assessment and Risk Management (1997, p3)

2.4 Risk Management Guidelines

The elements described above have been brought together in two recently published Standards Association guidelines. The first, published in 1995, is the joint Standards Australia and New Zealand *Risk Management Guideline* (AS/NZS 4360:1995). Two important developments are emphasised in this guideline. The first is that risk can be both positive as well as negative in its implications. That is, risk is an *opportunity* just as much as it is a danger. In stating this, AS/NZS 4360:1995 reminds us that risk is a *choice*, and is not an inherent characteristic of an action, product or outcome.

It reminds decision-makers as well as those who may be directly affected by the actions of others that there are means of altering a probable outcome. It also reminds people that there are costs involved in doing nothing as well as in doing something. More importantly, however, AS/NZS 4360:1995 works hard to ensure that risk management is not regarded as a negative process which would stifle innovation, since risk is essential to progress.

The second important contribution made by AS/NZS 4360:1995 is that risk can only be understood if it is put into proper *context*. That is, risk and the perception of risk does not take place in isolation. There are external and internal issues which can have a significant influence on risks and their management. The guideline states that the context of risk management can be separated into three components: the strategic context; the organisational context; and the risk management context. Implicit in all three contexts is the notion of risk communication. The strategic context, for example,

should involve the identification of strengths, weakness, opportunities and threats associated with a risk. Stakeholders are identified and the means of communicating with them are established.

The second publication that merits attention is the Canadian Standards Association document called *Risk Management Guidelines for Decision-Makers* (CAN/CSA-Q850-97). The most important contribution this guideline makes is that it explicitly places risk communication at the heart of all other risk considerations. CAN/CSA-Q850-97 pays great attention to incorporating risk perception and risk communication into all aspects of the decision process. Communication among stakeholders throughout the process is a critical element of risk management; and any decisions made must balance the technical aspects of risk with the wider social, political and moral considerations. CAN/CSA-Q850-97 emphasises that analysis and consultation must be developed together.

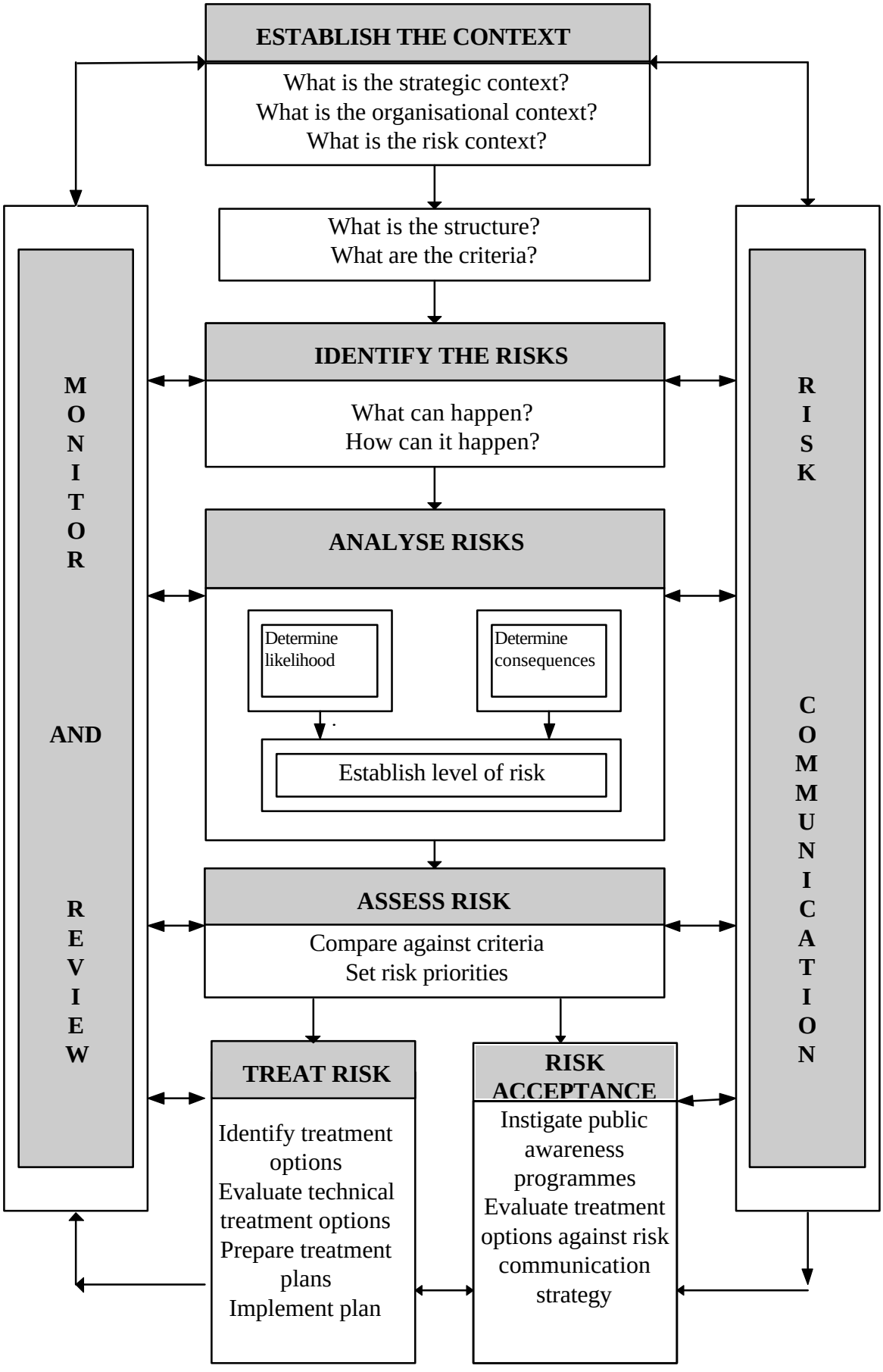
Both guidelines state that each stage of the process should be documented and that documentation should be auditable. Each stage of the documentation should include objectives, information sources, assumptions and decisions. Both guidelines remind their readers that risks are not static elements, and recommend mechanisms to ensure ongoing reviews of risks. This component will ensure that the implementation and the risk management policy remain relevant, even as circumstances inevitably change. The guidelines also strongly suggest that the risk management process itself should be monitored and reviewed on a regular basis.

Both guidelines are generic, focusing on setting out action steps rather than dealing with specific risk issues such as financial risk, engineering risk, natural hazard threats, health and safety issues, and the like. The guidelines provide a systematic method for working through complex risk issues and provides the decision-maker with the information necessary to make decisions with confidence or, alternatively, to allow an administrator to check if a risk-decision process has been followed through appropriately. Documents dealing with specific risks and/or risk environments can be developed by using the generic frameworks. In Figure 6 elements of both guidelines have been incorporated into an overall risk management model. The key characteristics are outlined below. The first two ensure flexibility and responsiveness; the latter characteristics describe the process:

- *Monitor and review*: Monitor and review the risk management process and changes which might affect it.
- *Risk Communication*: Acknowledge presence of multiple potential stakeholders. Identify key stakeholders. Identify the issues and commence consultation process. Begin stakeholder analysis and refine through dialogue. Establish representation group of technical and stakeholder groups. Assess stakeholder acceptance of risk including implications of treating or not treating risk/s. Establish stakeholder acceptability criteria. Develop risk communication strategy.
- *Establish the context*: This step establishes the strategic, organisational and risk management contexts in which the rest of the process will take place. Criteria against which risk will be assessed are established and the structure of the analysis is defined
- *Identify risks*: Identify what, why and how things can arise as the basis for further analysis
- *Analyse risks*: Determine the existing controls and analyse risk in terms of likelihood and consequence in the context of those controls. The analysis should consider:
    - how likely is an event to happen
    - what are the potential consequences and their magnitude

  Combine these elements to produce an estimated level of risk
- *Assess and prioritise risks*: Compare estimated levels of risk against the pre-established criteria. Risks are then ranked to identify management priorities. If the levels of risk established are low, then risks may fall into an acceptable category and treatment may not be required.
- *Treat risks*: Accept and monitor low-priority risks. For other risks develop and implement a specific management plan which includes consideration of funding.
- *Risk Acceptance*: Develop public awareness programmes based on risk communication process. Evaluate implementation process against stakeholder criteria.

Figure 6: The Risk Management Process



(Source: Britton, 1998. Based on AS/NZS 4360, 1995; CAN/CSA-Q850-97)

3 DEVELOPMENTS IN EMERGENCY MANAGEMENT

In the most general terms, emergency management is the practice of identifying, anticipating, and responding to negative risks associated with major disruptive and dislocating events (often referred to as 'disasters'), and reducing to socially acceptable levels their occurrence and/or the magnitude and duration of their social impact. In effect, emergency management is the discipline and profession of applying science, technology, planning and management to deal with extreme events that can injure or kill large numbers of people, do extensive damage to property, and disrupt community life. In this context, the emergency manager's task is to use a variety of resources, techniques, and skills to reduce the probability and impact of extreme events before they happen, to bring about recovery and routine as soon as possible following impact, and to encourage measures that will enhance the overall resilience of communities to future disruptive episodes.

There are six general principles governing emergency management. If the principles are upheld, through the development of rational and deliberate contingency preparations, and if they are recognised by the public and by policy-makers as being essential to the overall well-being of the nation and its component parts, then the delivery of best practice outcomes can be achieved:

- *Co-ordination*: Irrespective of ownership, resources that will be necessary when large-scale emergencies occur will be required to be brought together for the purpose of resolving the emergency issues
- *Prioritisation*: There needs to be agreement between all parties about the priority of issues and the allocation of resources to resolve those issues
- *Integration*: Specific planning arrangements need to be linked to each other so they are complementary for the purpose of emergency management
- *Partnership*: All parties, public and private, paid and voluntary, need to recognise that they have joint ownership with respect to emergency management, irrespective of resource ownership, responsibility or accountability
- *Efficiency*: There are limited resources available for any emergency, and they must be used expeditiously
- *Effectiveness*: Measures that are undertaken in the present must be capable of achieving appropriate results in the future.

Emergency management exists within a complex political, economic and social environment. More importantly, emergency management is conducted within an inter-organisational and inter-governmental framework that has a proclivity to produce fragmentation and to increase complexity. Recognising the difficulties these conditions pose, recent developments in emergency management have focused on creating strategies to bring essential agencies closer together through the application of linking frameworks. These frameworks enable consortia to be created that pool essential skills, resources and expertise. The linking framework that has current application is Comprehensive Emergency Management (CEM).

3.1 Comprehensive Emergency Management

CEM is a systematic way of ensuring all aspects of an organisation's, community's or nation's responsibilities and capabilities for managing mass emergencies and disasters are co-ordinated. The effectiveness of emergency preparedness is promoted when agreed-upon expectations about disaster demands and response capabilities are developed in this manner. Hence, the emphasis of CEM is pre-impact preparedness: developing proactive measures and liaisons to meet impact consequences.

The 'comprehensive' aspect of CEM covers all aspects of emergency activity; it applies to all hazards, and is conducted within a public-private partnership programme. For the sake of convenience, rather than accurately reflecting the reality, emergency-related activities can be clustered into 'phases' related by time and function to large-scale community crises. In turn, these phases match policy decisions

and outcomes within a CEM framework. These phases are generally referred to as mitigation, preparedness, response and recovery. However, in an attempt to make them more easy to recall, the term 'reduction' replaces mitigation and 'readiness' is substituted for preparedness, making the '4Rs' reduction, readiness, response and recovery (Table 3).

Table 3: Components of Comprehensive Emergency Management

REDUCTION (Mitigation)

Activities that reduce the degree of long-term risk to human life and property from natural and technological hazard. Reduction strategies include building codes; disaster insurance; land-use management; building use regulations; risk mapping; safety codes; tax incentives and disincentives; hazard identification, analysis and assessment; acceptability of risk studies; at-risk group identification.

READINESS (Preparedness)

Activities that develop operational capabilities for responding to an emergency. Readiness strategies include emergency operational plans; warning systems; staffing and resourcing contingencies for emergency operations centres (EOCs); emergency communications networks; emergency public information; mutual aid agreements; evacuation contingencies; resource management plans; provision for special legislation; relocation of government plans; recovery assistance packages; training programmes; exercise schedules. Readiness also include programmes that enable the general community and key sectors to develop appropriate self-help emergency preparedness and response actions. These programmes include household first-aid courses; local hazard identification; household contingency planning; emergency food, water, clothing, lighting and cooking.

RESPONSE

Activities taken immediately before, during or directly after an emergency that can save lives, minimise property damage, or improve recovery. Response strategies include emergency plan, EOC and other implementation planning activation; emergency shelter opening and management (reception, care); emergency instructions to the public; emergency medical assistance; search and rescue; impact assessment, including building safety and damage assessment.

RECOVERY

Activities that restore vital life-support systems to minimise operating standards and long-term activities that return community life to an acceptable level of 'normalcy'. Recovery strategies include debris clearance; environmental health monitoring and contamination control; counselling programmes; financial support and/or assistance; disaster unemployment assistance; temporary housing and facility restoration; health and safety information; economic impact studies; implementation of pre-disaster community reconstruction and redevelopment plans.

Source: Britton (1997b)

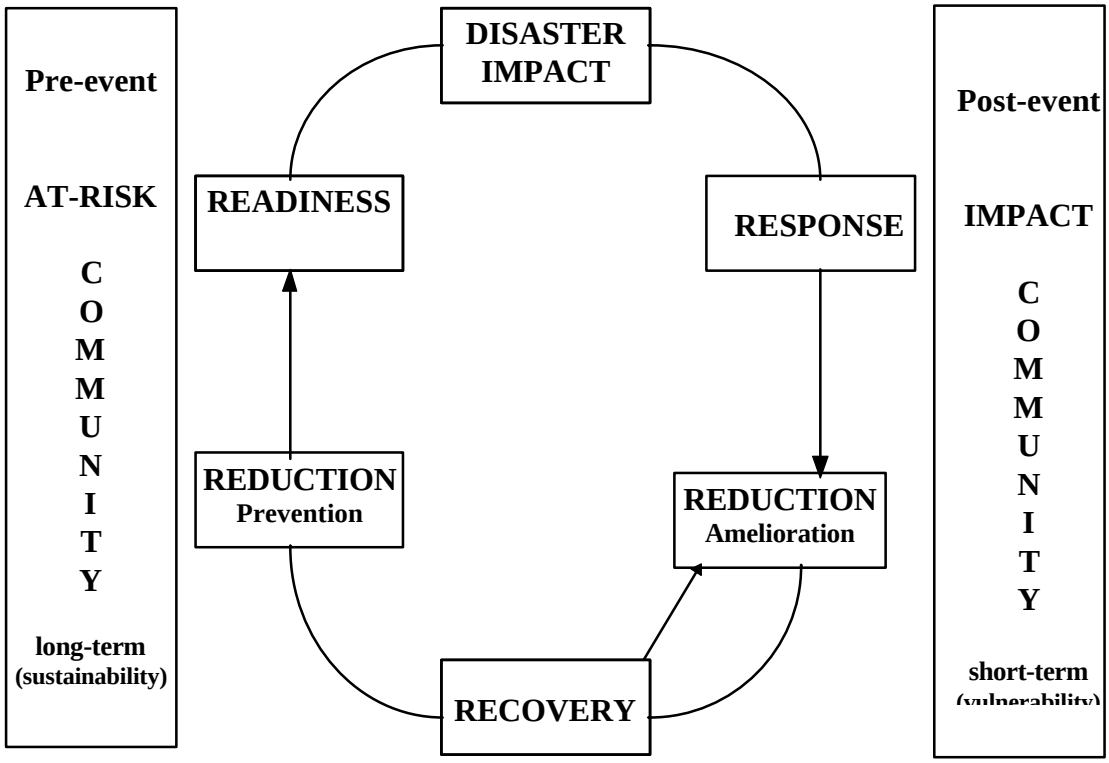
An effective CEM programme will identify agencies and individuals with useful resources to bring to bear on all aspects of emergencies. It will motivate them to apply those resources in the most productive manner, and it will co-ordinate their activities. One of the challenges facing this approach, therefore, is to find ways to facilitate relationships between emergency preparedness organisations and other organisations having disaster-relevant resources, but whose goals do not include emergency management. An effective CEM programme will address the following objectives:

- The reduction (and possible elimination) of the incidence of emergency impact wherever possible (e.g. technological hazards)
- The reduction of damage (health, property, economic consequences) caused by impacts
- The reduction of costs of emergency response and disaster recovery while at the same time increasing overall effectiveness
- The reduction of costs associated with resource wastage through non-sustainable risk reduction measures.

3.1 The Emergency Management Cycle

The goal of emergency management is to anticipate and prepare for large-scale disruptions following hazard impacts; to plan for the rapid restoration of normal routines following impact; and ensure that appropriate action is taken to reduce future community dislocation. This means that the four phases of CEM need to be co-ordinated into patterns of action so as to enable long-term strategies to be shaped and shorter-term programmes to be implemented. Figure 9, the 'emergency management cycle', shows how the '4Rs' link.

Figure 9: The Emergency Management Cycle



Source: Adapted from Britton (1994)

The emergency management cycle enlarges upon the '4Rs'. It encompasses both a pre-event (or *community-at-risk*) phase and post-event (or *impact community*) phase. In doing so, it adds a temporal dimension (short-term *v* long-term) and expands the 4Rs by a second 'reduction' phase. For convenience, the pre-event/long-term reduction activity is sub-labelled 'prevention'; and the post-event reduction actions 'amelioration. The term 'prevention' is not usually linked by practitioners to issues of community robustness, although it is highly desirable, since by doing so long-term resiliency within communities-at-risk is emphasised, and the creation of sustainable hazard mitigation practices, is highlighted:

- *Prevention* (i.e. long-term reduction) actions are designed to decrease existing levels of danger, enhance overall resilience and provide sustainable hazard mitigation measures. These actions are deliberately designed to prevent or impede the occurrence of a future disaster event and/or prevent

such an occurrence having harmful and long-lasting effects on communities. In this respect, they are proactive measures

- *Readiness* policies and programmes are usually involved with the development of response plans, identification of resources, the training of emergency services personnel, and public awareness programmes
- *Disaster impact* is the occasion when major community dislocation occurs
- *Response* policies and programmes are those that become operational once a mass emergency or disaster occurs or threatens
- *Amelioration* (i.e. short-term reduction) policies and programmes that help limit the magnitude of future impacts. They are introduced following disaster impact as a direct result of the damage or disruption caused by a specific impact. In this respect, they are reactive and are designed to restore the community to pre-impact levels
- *Recovery* policies and programmes address the immediate problems of stabilising the affected community and assuring that life-support systems are operational. These programmes also extend into the longer-term programmes for community rehabilitation and restoration.

3.2 Sustainable Hazard Mitigation

While Comprehensive Emergency Management (CEM) creates a framework for the development and maintenance of disaster-relevant activities, the concept of sustainable hazard mitigation places CEM into a wider socio-cultural, economic and political context. In this respect the concept of sustainable hazard mitigation provides a rationale as to why communities need comprehensive emergency management programmes.

Disaster occasions are not problems that can be solved in isolation. Rather, they are symptoms of problems that have been created by our forebears and contemporaries who developed our built environment and applied technologies. In turn, these arrangements reflect ways in which our environment has been perceived. Hence, how we prepared for disasters in the past, and how we prepare for them today greatly affect how the next generation will be able to prepare for disasters in the future.

An unintended consequence of many activities we currently pursue, especially actions pertaining to resource management, town planning and urban development, is the fact that these lay the groundwork for future natural and technological hazards. We extend our communities onto floodplains, for example, where future communities will be inundated; or, to build suburbs with views we carve new roads into hills that will crumble when severe weather or earthquakes produce landslides in the years ahead; or, we encroach into wooded areas where future inhabitants will not only be closer to nature but also be burnt out by next season's wildfire. We also build new industrial plants closer to the homes of future workers so as to reduce travel time within integrated communities, but also poison their children from the harmful by-products of nearby manufacturing processes.

We do these things often, without thinking through what the emergency management consequences might be. Of course, we have legislation to prevent the worst excesses. However, legislation does not overcome all these types of problems and does not alter those we have inherited. If we were able to retrospectively apply sustainable hazard mitigation principles it is likely we would not have commenced some urban initiatives that we have to live with to this day.

It is in this wider context that the sustainable hazard mitigation functions of emergency management need to be understood. If it is undertaken correctly, emergency management can provide three over-arching benefits for the wider community. It can assist in the development and/or maintenance of:

- *Disaster resilience*: Reducing the probability and the impact of emergency events so as to protect community safety and continuity

- *Sustainability*: Ensuring sound decisions for present and future generations on investments in physical and social infrastructure in relation to actual and potential emergency events
- *Efficient and effective expenditure*: Day-to-day decision-making takes into account risk reduction actions, rather than having to expend resources on emergency response, reconstruction and rehabilitation.

Emergency management programmes have considerable potential to assist the overall continuity of communities by focusing on the wider issues of public safety (not only disaster response); they can help ensure that individuals, organisations, communities and the nation as a whole have measures that can help perpetuate the physical, social and cultural heritage of the nation. Emergency management can be the linchpin to other areas of public safety, rather than being regarded as an 'add-on' that is applicable only when significant hazards make things go seriously wrong. The approach is analogous to the call of enlightened health professionals who assert that a system based on preventive medicine rather than a disease-focused treatment approach would enhance the overall health status of a community.

3.3 Emergency Management and Sustainable Hazard Mitigation

To achieve this approach for emergency management two linked factors need to be added to our present way of thinking about hazards and disasters. The first prerequisite is that the application of emergency management needs to be predicated on risk management principles. There needs to be a clear process that balances the technical aspects of risk with the social and ethical considerations that often accompany such issues. The linchpin between the two is hazard management; that is, an understanding of the physical properties and the hazard profiles of the natural and technological hazards likely to cause large-scale disruption. Thus,

Risk Management → Hazard Management → Emergency Management

The risk management process can provide some important aspects of hazard management. It can, for instance, assist in the provision of analysing key components of hazards by:

- Highlighting serious hazards and their associated risks
- Exposing inter-relationships (cause and effect)
- Pointing to promising risk reduction options
- Assisting policy development and regulation
- Exploring the level of risk tolerance.
- Informing decisions about the allocation of resources for risk reduction

The second prerequisite is that a new way of thinking and addressing problems of hazard and emergency management needs to be incorporated into the way that communities think about hazards, the environment, and hazard reduction. This thinking has to go beyond simply reducing losses; it has to institutionalise actions consistent with principles of sustainability:

- *Environmental quality*: No risk reduction action should be sought that does not enhance the overall environmental quality of the locality
- *Quality of life*: No risk reduction action should be put in place that does not enhance the quality of life of the community, as the community itself defines it
- *Disaster resiliency*: The risk reduction action helps achieve the creation of a disaster resilient community; that is, the community can pay for its own disaster losses
- *Economic vitality*: No risk reduction should be sought that does not enhance the overall economic vitality of the locality
- *Inter-generation equity*: No risk reduction should be used that shifts the problem to future generations or to other groups within the community.

These principles can overcome some shortcomings in our current ways of thinking and practice. What are these shortcomings? They can be summed up as:

- Hazard reduction measures are usually hazard-specific and do not encompass the totality of a location's overall hazardscape issues
- Reduction measures do not always prevent damage, but under our current practice ideology they always postpone damage for some future generation to confront
- Current adjustments are inadequate to cope sufficiently with the complexity of the problems
- Risk reduction methods tend to be dominated by single disciplinary approaches (and understandings), rather than a multi-disciplinary approach
- The risk orientation that is applied is too narrow.

If we allowed ourselves to step outside the constraints our current practice ideologies have tied us to, a sustainable hazard mitigation approach could:

- Set societal goals for coping with hazards that are broader than conventional local risk reduction practices
- Adopt a revised paradigm that links hazard to a wider context and deals with issues holistically
- Modify our hazard mitigation efforts so they are consistent with current knowledge
- Adopt a holistic, integrated approach to the theory and practice of risk, hazard and emergency management.

Reducing losses from disasters and working toward sustainable communities can go hand-in-hand. Most actions taken to strengthen sustainability in general should have a positive effect on community resiliency to disasters. In turn, actions designed to help communities minimise disaster risk under a sustainability paradigm will strengthen overall continuity and resilience to other adverse social, economic and environmental impacts.

4 HOW RISK MANAGEMENT RELATES TO EMERGENCY MANAGEMENT

Government interventions to deal with natural or technological hazards are part of every nation's history. Two examples illustrate this. In order to reduce air pollution from the burning of coal in London, after an unsuccessful voluntary trial in 1285, King Edward issued an order forbidding the use of soft coal in kilns. In 1817, in New South Wales, after another flood had inundated the infant colony, Governor Macquarie issued an Order to be read in all churches throughout the colony on three successive Sundays about the dangers of siting homes in areas that were on natural floodplains. He had issued an earlier Order in 1816. The efforts of both King Edward and Governor Macquarie were to no avail, however.

These examples illustrate the difficulties inherent in our current practice ideology: poor land-use planning; an unconcerned/uninformed population-at-risk; a perceived lack of choices. Assuming policy-makers today are as willing as King Edward and Governor Macquarie were, the application of risk management could produce more favourable outcomes.

4.1 New Zealand's approach

In 1996, arising from a Review of Emergency Services, the New Zealand Government accepted the need for change in the country's emergency management arrangements. Nine principles would form the basis of the new arrangements. Four framework principles, and a working definition of emergency management, would complete the arrangements (Table 4).

Table 4: Emergency Management Framework Principles

Framework Principle	*Defining the Principle*	*Applying the Principle*
Emergency Management	Process of minimising the uncertainty of hazardous situations and maximising public safety by applying science, technology, planning and management. Achieved by implementing strategies and tactics centring on reduction, readiness, response and recovery.	
Risk Management	Process of (1) considering the social, economic and political factors involved in risk analysis; (2) determining acceptability of disruption that could result from an event; and (3) deciding actions to take that will minimise likely damage or disruption.	*Principle 1*: Acceptance of individual responsibility and self-reliance, including the owner of any property being responsible for reconstruction *Principle 2*: Acceptance of community responsibility and self-reliance *Principle 3*: Acceptance that routine events and emergencies are best handled at local levels where possible
CEM	A way of fitting elements of emergency management into an inclusive framework encompassing all hazards and levels of government and the private sector. Requires integration of emergency programmes and actions, to ensure all elements are incorporated into emergency planning.	*Principle 4*: Recognition of risk reduction, readiness for, and response to emergencies, and post-impact recovery as a continuum of activities *Principle 5*: Adoption of horizontally (inter-agency) and vertically (inter-governmental) integrated emergency management systems *Principle 6*: Recognition and involvement of volunteer organisations *Principle 7*: Establish community risks via an all-hazards approach
Accountability	Emergency management is core government business achieved by separating political responsibility for policy-making and funding, from professional advice and implementation. Clearly identifying and articulating operating statements about responsibilities and relationships required to implement CEM and risk management.	*Principle 8*: Declarations of emergencies at the most appropriate level of government by elected representatives
Professional Expertise	Building an accredited professional emergency management sector by developing knowledge-based education programmes and enhancing skills-based operational training needs.	*Principle 9*: Emergency management structures underpinned with appropriate technical information and expertise

It was agreed that development and maintenance of this framework is to be part of the core business of central government. Recognising the importance of partnerships, central government sought the support of local governments for the establishment of Emergency Management Groups (EMGs) at the local level as a mechanism to implement the agreed framework (an EMG is a professional body of senior executives able to commit all relevant local emergency management agencies, accountable primarily to local authorities through a governance committee comprising elected representatives). Local authorities also agreed that emergency management is a core business function.

Government decided that a new Ministry needed to be established that would be responsible for a widened emergency management task-set, and that the new Ministry would replace the existing Ministry of Civil Defence. A series of five operating principles were developed to underpin the activities of all emergency management agencies (Table 5). Taken together, the framework principles and the operating principles would offer a platform for re-assessing and, where needed, revising the way in which emergency management would be undertaken nationally and locally.

Table 5: Emergency Management Operating Principles

Efficiency	Best use of scarce resources and avoiding unnecessary duplication of functions and facilities.
Effectiveness	Use of resources that are already employed in the related normal day-to-day activity before employing additional 'emergency' resources.
Professionalism	Development of *best practice* standards pertaining to attitudes, approaches and abilities of volunteers and paid personnel that is commensurate to the needs of risk management and CEM requirements .
Governance-Management Split	Responsibility for policy-making should be separated from responsibility for advice, management and implementation of policy
Role Clarity	Agreed designated tasks and statutory authority to act, with clear management responsibility and accountability.

4.2 A Concluding Comment

What New Zealand is seeking is a way to achieve continual improvement through informed choice. Developing an emergency management programme through a risk management approach allows agencies to manage and maintain success by:

- Communicating where we are going, why we are going there, how we are doing, and when we get there.
- Allowing for proactive risk identification through hazardscape analysis
- Learning from others
- Learning from our own mistakes.

Uncertainty is present in all environmental problems, whether they are caused by forces of nature, by industry and science, or by urban planning practices (past or present). When uncertainties are large

and important to the outcome of problem analysis, a risk management approach can assist. Emergency management issues contain elements of uncertainty and largeness; and they are highly important issues for any community to debate and reach consensus on. The risk communication aspect of risk management in particular, will enable all sections of a community to participate in the risk decision process.

The fact that the risk communication process has the potential to achieve this means that this factor alone probably provides the greatest potential for change in emergency management, since local and national governments will be given a direct mandate on hazard management issues. It may therefore overcome one of the most frustrating aspects of emergency management - that of issue salience (that is, hazards and disasters are not regarded as everyday problems and hence are not considered issues that require immediate attention).

Similarly, the notions inherent in sustainable hazard mitigation have important implications for community continuity. If emergency management was linked to issues of sustainability in this way, it helps to provide greater focus, and a better perspective, on what the real aim of emergency management is - it is to ensure that large-scale community dislocations are kept to an absolute minimum, and not all about picking up the pieces after the damage has been done.

Both practices will become increasingly more important for communities of the future if the trends in global and national hazardscapes are to be effectively stemmed. Both practices are important for emergency management right now. This is why both are integral to the new emergency management framework being developed for New Zealand.

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References Used in the Preparation of this Paper

Adams, J. (1995) *Risk*. London ,UCL Press.

Bernstein, P L (1996) *Against the Gods: The Remarkable Story of Risk*. New York. John Wiley & Sons.

Blaikie, P, Cannon, T, Davis I & Wisner B (1994) *At Risk: Natural Hazards, People's Vulnerability and Disasters*, London, Routledge.

Britton, N R (1997a) Making progress with business continuity planning for natural disaster management. In N R Britton and J Oliver (eds) *Financial Risk Management for Natural Catastrophes*. Aon Group Australia. Griffith University Press. 235-265

Britton, N R (1997b) *Emergency Management: Conceptual Issues for Emergency Management. Study Guide 1 - Putting Parts Together: Comprehensive Emergency Management.* Diploma in Emergency Management. Palmerston North. Massey University.

Britton, N R (1997c) *Emergency Management: Conceptual Issues for Emergency Management. Study Guide 2 - Planning and Response Issues for Emergency Management: Risk Management.* Diploma in Emergency Management. Palmerston North. Massey University.

Britton, N R (1995) Emergency management: Lessons for New Zealand lifelines organisations from the 17 January 1995 Great Hanshin Earthquake. In *Wellington Earthquake Lifelines Group 1995 Report*. Wellington. Wellington Regional Council. Pages 1.93 - 1.100.

Britton, N R (1994) Emergency management and lifeline co-ordination: The Wellington City approach. *Wellington Earthquake Lifelines Group 1994 Report*. Wellington. Wellington Regional Council. 1.4 - 1.6

Britton, N R (1992) Uncommon hazards and orthodox emergency management. *International Journal of Mass Emergencies and Disasters*. 10(2). Pp.329-349.

Britton N R (1991) Hazardous industries and risky technologies: A new role for insurance? In N R Britton and Oliver J (eds) *Natural and Technological Hazards: Implications for the Insurance Industry*. Armidale. Sterling Offices. University of New England. 201-218.

Britton, N R (1990) Policy development and social crisis administration. *Asian Review of Public Administration*. 2(1). June, Pp.74-91.

Britton, N R (1986) Developing an understanding of disaster. *Australian and New Zealand Journal of Sociology*. 22(2). July. 254-271.

Britton, N R & Oliver J (1995) Insurance and urban planning: Partnering in risk resolution. In N R Britton, McDonald J and Oliver J (eds) *Insurance Viability and Loss Mitigation: Partners in Risk Resolution*. Alexander Howden Reinsurance Brokers (Australia) Limited. Brisbane. Griffith University Press. 1-20.

Britton, N R & Oliver L (1993) Changing societal hazardousness and increasing social vulnerability: Whose responsibility? In N R Britton and Oliver J (eds) *Catastrophe Insurance for Tomorrow: Planning for Future Adversities*. Sterling Offices (Australia) Limited. Brisbane. Griffith University Press. 31-50.

Britton, N R & Oliver J (1991) The meanings of hazard. In N R Britton and Oliver J (eds) *Natural and Technological Hazards: Implications for the Insurance Industry*. Armidale. Sterling Offices. University of New England. 1-11.

Burton, I Kates, R W, & White G (1993) *The Environment as Hazard*. Second edition. New York, Guilford Press.

Canadian Standards Association, (1997) *Risk Management: Guideline for Decision-Makers*. National Standard of Canada. CAN/CSA-Q850-97. Canadian Standards Association. Ontario.

Collins, J M & Ruefli, T W (1996) *Strategic Risk: A State-Defined Approach*, Massachusetts, Kluwer Academic Publishers.

Covello, V T & Merkhofer, M W (1993) *Risk Assessment Methods: Approaches for Assessing Health and Environmental Risks*, New York, Plenum Press.

Covello, V T & Mumpower J (1985) Risk analysis and risk management: A historical perspective. *Risk Analysis* 5(2): 103-120.

Cross, J (1995) The Risk Management Standard. *The Australian Journal of Emergency Management*. 10(4), Summer 1995.96: 4-7.

Davies, J C (Ed) (1996) *Comparing Environmental Risks: Tools for Setting Government Priorities*, Washington DC, Resources for the Future.

Drabek, T E & Hoetmer G J (1991) (eds) *Emergency Management: Principles and Practice for Local Government*. Washington. International City Management Association.

Dynes, R R (1994) Community emergency planning: False assumptions and inappropriate analogies. *International Journal of Mass Emergencies and Disasters*. 12(2). 141-158.

Frost, C (1994) Effective responses for proactive enterprises: Business continuity planning. *Disaster Prevention and Management* 3(1): 7-15.

Gillespie, D F, Colignon R A, Baneree M M, Murty S A, & Rogge M (1993) *Partnerships for Community Preparedness*. Program on Environment and Behavior Monograph 4. Boulder. Institute of Behavioral Science. University of Colorado.

Hewitt, K (1997) *Regions of Risk: A Geographical Introduction to Disasters*, Essex. Longman

Hood, C & Jones D K C (1996) *Accident and Design: Contemporary Debates in Risk Management*, London. UCL Press.

Institution of Civil Engineers, (1995) *Megacities: Reducing Vulnerability to Natural Disasters*, London. Thomas Telford.

International Federation of Red Cross and Red Crescent Societies, (1996) *World Disasters Report 1996*. Oxford University Press.

Kasperson, R E & Pijawka, K D(1985) Societal responses to hazards and major hazard events: Comparing natural and technological hazards. *Public Administration Review* 45 (Special Issue) January. pp 7 - 19.

Kunreuther, H & Gowda R (eds) (1990) *Integrating Insurance and Risk Management for Hazardous Wastes*, Boston. Kluwer Academic Publishers.

Lindell, M K (1997) Editor. Adoption and implementation of hazard adjustments. Special Issue. *International Journal of Mass Emergencies and Disasters*. 15(3). 325-453.

Local Government New Zealand, (1997) *Local Government and Emergency Management: A Paper to the Emergency Services Review Officials Committee*. Wellington. Local Government New Zealand.

Mileti, D S (1997) Designing disasters: Determining our future vulnerability. *Natural Hazards Observer*. 22 (1). 1-3.

Molak, V (1997) (ed.) *Fundamentals of Risk Analysis and Risk Management*. Florida. Lewis Publishers.

Munich Re, (1997) *Annual Review of Natural Catastrophes 1996*. Munich. Munchener Ruckvericherungs-Gessellscahft.

National Research Council, (1989) *Improving Risk Communication*, Washington DC. National Academy Press.

National Research Council, (1994) *Facing the Challenge: The US National Report to the IDNDR World Conference in Natural Disaster Reduction*, Washington DC. National Academy Press.

New Zealand Fire Service, (1997) *Emergency Incident Statistics, 1993-1996*. New Zealand Fire Service. Wellington. Strategic and Corporate Planning, National Office.

Perrow, C (1984) *Normal Accidents: Living with High-Risk Technologies*, New York. Basic Books

Petak, W J & Atkisson, A A (1982) *Natural Hazard Risk Assessment and Public Policy: Anticipating the Unexpected*, New York. Springer-Verlag.

Presidential/Congressional Commission on Risk Assessment and Risk Management, (1997) *Framework for Environmental Health Risk Management. Final Report*. Washington DC.

Quarantelli, E L (1996) The Future is not the Past Repeated: Projecting Disasters in the 21st Century from Current Trends. *Journal of Contingencies and Crisis Management*. 4(4) December. pp.228-240.

Ruck, B (1993) *Risk is a Construct: Perceptions of Risk Perception*, Munich. Knesebeck.

Shapiro, S (1997) Limited liability waived in air crash. *Business Insurance*. August 11. 1,26,27

Smith, K (1996) *Environmental Hazards: Assessing Risk and Reducing Disaster*, second edition, London. Routledge.

Standards Australia and Standards New Zealand, (1995) *Risk Management*. AS/NZS 4360. Sydney and Wellington.

Stern, P C & Fineberg, H V (eds) *Understanding Risk: Informing Decisions in a Democratic Society.* Washington DC. National Academy Press.