Managing biological emergencies: a new approach

by Grant Rawlin, Principal Veterinary Officer, National Offices of Animal and Plant Health, Canberra, ACT and Roger Jones, Director TEM, Mount Macedon Victoria

Introduction

The term 'emergency' is most often used in the community to relate to the risk of natural or technological events like floods, cyclones, fires and air crashes. But there is another recognised source of risk—biological risk. Biological emergencies are in some ways more complex than those from traditional sources.

What is a biological emergency? In this paper we define 'biological emergency' by a set of attributes:

- a biological emergency occurs infrequently to a biological system and is usually caused by a biological entity
- a biological emergency has the potential to spread actively outside the immediately affected area
- often little is known of the biological agent so managers are working in an uncertain environment
- a biological emergency has the likelihood to spread not only spatially but contextually. An adverse biological event impacts not only on the immediate environment but has social, community, trade and international relations aspects. These may be out of proportion with the actual physical event
- biological emergencies tend to be 'slow on-set' events (compared to a fire or flood) and often make an increasing demand on resources over weeks or months rather than days
- emergency managers in biological emergencies require advanced tracking techniques to follow the emergency. The tracking relies heavily on collected intelligence from testing schemes as the presence and spread of the problem is often not immediately apparent. This is sometimes referred to as an epidemiological approach to the issue.

Examples of the type of biological emergencies considered in this paper are: pest invasions in various environments, disease outbreaks in humans, plants and animals, and food poisoning outbreaks.

Profiles of biological emergencies

To illustrate the claim that biological emergencies can be more complex than those from traditional sources, we will look at the linkages and areas of influence of a variety of real-world biological emergencies which have occurred both in Australia and in our region. We can best do this in a series of brief and simplified case-studies presented in a standardised 'report-card' format (see pages 42 and 43).

We have not attempted an exhaustive narrative of these occurrences, but have simplified them in order to emphasise the following points:

- biological emergencies tend to have an expanding field of effects beyond the immediately perceived area of impact
- biological emergency management involves a variety of organisations
- the managers of situations or enterprises that may be a potential source of biological risk are not necessarily the managers of a resultant biological emergency
- often organisations with responsibility for biological emergency management also have the ability to influence risk management of the issues.

Biological emergency management today

In Australia, biological emergencies are handled by a variety of Commonwealth and State/Territory government groups depending on their areas of responsibility. For the purposes of this paper the areas of responsibility are considered to extend only to national and state level. There are other private and government organisations that are involved in the process of preparedness and response at other levels.

In the case of some biological emergencies there is clear responsibility and a practised response, but in other areas this is not so.

Potentially epidemic diseases in the human species are handled primarily by communicable disease structures of Commonwealth and State health departments. Potentially epidemic diseases in other animal species and plants are handled primarily by the veterinary and plant health services of State and Commonwealth agriculture or primary industry departments. Within these structures there are established relationships and coordination mechanisms that are in normal operation or can be activated in an emergency. These systems are focused on that specific type of biological emergency. For example, in the case of animal diseases there is an interstate coordination system focused on the Consultative Committee on Emergency Animal Diseases that allows Chief Veterinary Officers to communicate on a national basis. A variety of operations manuals and response structures are contained in AUSVETPLAN (the national Australian Veterinary Emergency Plan) and many functions of training and development are carried out by a government/industry organisation known as Animal Health Australia. Similarly the system has a single responsible ministerial committee.

But if the disease is in wild animals or plants the issue of responsibility is clouded by the responsibilities of wildlife agencies or environment agencies (SCARM 1997). In the case of a response to new environmental pests, the responsible authority is determined largely on the basis of the environment in which the pest is found. A marine pest may be primarily the responsibility of a fisheries department, an environmental protection authority or a transport department, while a freshwater aquatic pest may fall to a National Parks authority or water authority. This issue was the subject of intense development in the marine environment during and after the detection and control of the incursion of the black striped mussel in Darwin in 1999 but it is less developed in other environments (SCC/SCFA 2000).

In the case of food poisoning health authorities have clear responsibility under the various health acts but other organisations also have roles. For example, at the Commonwealth level, the Department of Health and Aged Care, the Australia/New Zealand Food Authority and Agriculture Fisheries and Forestry, Australia all have stakes in policy,

coordination and response to food safety issues.

The existing management models, such as AUSVETPLAN in animal health, are often based on event management and have connections with the larger emergency management community through State, Territory and local-level event-management plans (generally known as DISPLANs or emergency response plans). The present AUSVETPLAN arrangements for example are largely response-oriented. They deal principally with response organisation and procedures, planning, training and exercising (in other words primarily with response and preparedness for it).

As the AUSVETPLAN Summary Document makes clear, the animal health emergency management plans and many similar systems were developed in the early 1980s and often assumed the ready availability of combat and support resources within the direct policy direction and control of a single government authority. In the case of AUSVETPLAN, the designated authorities were the various agriculture and primary industry departments and the response itself and many resources essential to it were often under direct control of a Chief Veterinary Officer. Since that time there have been significant changes in the way in which these operational resources are handled. As a result many of the preparedness and response resources are held outside the direct influence of the Chief Veterinary officers or have been out-sourced to the private sector.

Increasingly, given the spread of resources across both the public and private sectors, rapid access to needed resources for emergency response purposes and the application of those resources requires high-level policy intervention and interdepartmental, multi-agency and even multi-sectoral coordination. Each particular area of biological emergency operations has its individualities, but this trend for more complex higher coordination appears to be common across disciplines.

The changing face of modern emergency management

Superficially, the general emergency management arrangements in Australia would appear not to suffer the diffusion of responsibilities apparent in the management of biological emergencies as discussed in the preceding section. At national level, a Department of Defence agency, Emergency Management Australia, is 'the Federal agency responsible for reducing the impact of natural and human-caused disasters on the Australian community' (EMA 2000a).

Each State and Territory has, under legislation or in a Cabinet-approved arrangement, a formal emergency management or counter-disaster organisation, a State or Territory emergency response management plan and arrangements and a management structure extending down to regional and local government levels. A National Emergency Management Committee consisting of the heads of the relevant Federal, State and Territory organisations provides a regular forum for the discussion of emergency management matters and issues, and is supported by a number of regularly-convened sub-committees (EMA 1998a).

However, the form of 'emergency' towards which these management structures are directed is 'an ***event***, actual or imminent, which endangers or threatens to endanger life, property or the environment and which requires a significant and coordinated response' (EMA 1998b, emphasis added). While the nationally-agreed emergency management concepts and principles embrace 'comprehensive and integrated emergency management', encompassing prevention, preparedness, response and recovery (EMA 1998c), it is clear that the primary focus of the national emergency management structure is on the preparedness for and response to emergencies as *events*. The arrangements generally designate specific agencies at State and Territory level as 'control' or 'lead combat' agencies for the management of particular types of emergency, with police authorities generally responsible for coordinating the provision of the resources such 'control' or 'lead combat' agencies might require.

The prevention or mitigation of hazards as the sources of such events has received increasing attention within the emergency management system in recent years, but progress has been somewhat limited as emergency management authorities have little direct jurisdiction in this area. Similarly, while emergency management arrangements are seen to encompass recovery ('measures which support emergency-affected individuals and communities in the reconstruction of the physical infrastructure and restoration of emotional, economic and physical well-being', EMA 2000b), in reality they are generally limited to the relief and early restoration phases of the longer-term community recovery processes (Haas et al 1977, Comfort 1988).

To add further complexity to the general emergency management scene, the potential sources of risk are also seen to be diversifying. Traditionally, the risk of emergencies and disasters has been seen to emanate primarily from 'natural hazards' (largely of geophysical or meteorological origin) and 'man-made hazards' (industrial hazards and war), and to result in a threat to life and property. Accordingly, it has been a relatively simple matter to designate an appropriate 'control' or 'lead combat' agency to deal with each type of hazard and hazard-outcome (often, as in Australia, with the police given responsibility for coordinating the efforts and resources of supporting agencies).

The recognition of biological and socio-political hazards as sources of risk, however, and the identification of more complex types of emergencies and disasters which can result from interactions between various types of hazards (Parker and Tapsell 1995) gives rise to events which may not be as readily susceptible to a DISPLAN-type response management arrangement as a flood, fire or cyclone impact or a release of hazardous materials. A biological emergency such as an epidemic disease in the human species overlaid on a major drought or flood event can present a far more complex management problem than any one of those events occurring singly.

Indeed, some hazards may result in little direct threat to life and property, but impact severely on the social and economic well-being of a community (as in the 2-week failure of gas supply in Victoria in 1998) or cause significant and continuing trade disruption (a typical end-result of an emergency animal disease outbreak). Such events may make little if any direct demand on the emergency services (police, fire, ambulance etc.) which have traditionally been seen as 'responders to emergency'.

Seeking a conceptual basis for dealing with such complex issues, the emergency management community has recently shifted its focus from *hazards* to more general concepts of *risk*, examining the interaction of hazards as 'sources of risk' with those vulnerabilities which can be identified as 'elements at risk'. It is clear, for example, that a cyclone is a 'source of risk' but only has the potential to create an emergency or disaster if it should impact the 'elements at risk' in a vulnerable community in its path.

This shift in focus has been advantageous, as it helps to demonstrate that reducing the 'susceptibilities to risk' or vulnerabilities in a community can be just

Case studies in 'Report Card' format

#1 – Foot and mouth disease, South Korea, 2000

The agent

This is an animal disease caused by an highly infectious virus not present in Australia. It causes death in a low proportion of infected sheep, cattle, goats and pigs but it causes very marked decreases in production in all these species. In April, 2000 there was an emergency involving this disease in South Korea. (Pro-med web-site April, 2000)

Immediate effects

Loss of production in ruminants. Loss of farming industry income to the nation.

Secondary effects

Cost of control of the disease. For example, in Korea the authorities restricted animal movements, destroyed high risk and affected animals, disinfected premises and vaccinated almost 1 million cloven footed animals.

Tertiary effects

Banning of many livestock products from export markets.

Impact on the Community

Disruption of employment and trade as well as social dislocation especially in rural areas

Who would manage this kind of emergency in Australia?

State, Commonwealth and Industry animal health emergency structures

Who manages the risk in Australia?

State and Commonwealth agriculture and primary industry departments and industry bodies.

Point for Attention

This disease directly only affects some species of animals but has enormous social and trade effects even if quickly controlled.

#2 – E.coli O157contamination of food, Hamburger Disease in USA, 1993

The agent

The bacteria E.coli is a normal part of animal and human gut flora. The subtype O157 can cause severe disease. A batch of processed hamburger meat that was supplied to a large restaurant chain carried the bacteria. Illness was detected in over 500 people, over 100 were hospitalised, and 4 died (USDA, 1993).

Immediate effects

Sickness in people leading to death in several cases.

Secondary effects

Large scale tracking and removal of product from shops.

Tertiary effects

Links were made to live cattle producers and meatworks practices that then had to be reviewed. This involved Australia as well as the USA because Australia is a major producer of beef for the US market.

Impact on the Community

Loss of faith in food supply system.
Socio-economic effects to industries associated with meat production.

Who would manage this kind of emergency in Australia?

Primarily Health emergency structures but also agriculture emergency structures.

Who manages the risk in Australia?

Health departments, agriculture and primary industry departments, industry bodies.

Point for Attention

A modern food safety emergency can be very large because of manufacturing and distribution practices. Due to the chain of food production, the emergency response can spread from human orientated investigations to processing technology and to agriculture. This can occur in animal and plant products as well as water supplies.

#3 – Nipah virus, Malaysia 1998

The agent

A newly discovered virus that caused an outbreak of disease in pigs and also a fatal encephalitis in humans in Malaysia in 1998 (Ling 1999).

Immediate effects

Deaths and loss of production in pigs in several farms, 100 human deaths from over 300 cases of human encephalitis.

Secondary effects

Loss of local farming industry income. Cost of control of the disease – among other measures this involved the slaughter of about 1 million pigs

Tertiary effects

Trade bans were instituted by many countries.

Major social disruption was caused and included periods of community panic and virtual removal of a staple food item from local markets.

Impact on the Community

Health care costs, severe social dislocation in rural areas and to city areas.

Who would manage this kind of emergency in Australia?

Human health emergency structures, animal health emergency structures.

Who manages the risk in Australia?

Health departments, agriculture and primary industry departments, industry bodies.

Point for Attention

This situation would involve both human and animal health structures and has the potential for extreme social disruption.

#4 – Chlorflurazuron contamination, Australia 1995

The agent

This chemical is a pesticide contaminant that was found in several Australian beef exports in 1995 and there were no agreed limits so a detection became a violation. (Australian Animal Health Quarterly, Issue 1 1996)

Immediate effects

None

Secondary effects

Banning of Australian beef from several important export markets for a period.

Tertiary effects

Institution of testing and systems to prove Australian beef was again 'clean' and enable trade to continue.

Impact on the Community

Socio-economic effects to industries associated with meat export.

Who managed the emergency?

Animal health emergency structures

Who manages the risk?

Agriculture and primary industry departments, industry bodies.

Point for Attention

The pesticide appears to be of no immediate human or animal health danger but caused a substantial trade emergency.

as important as modifying the hazards to which that community may be subject. The 1995 development of the new Australian/New Zealand risk management standard (SA/SNZ 1995/1999) has undoubtedly assisted in this process; in 1996 the National Emergency Management Committee directed that 'industry-specific guidelines' should be developed to apply the new standard in the emergency management field. An 'Emergency Risk Management — Applications Guide' has recently been produced, endorsed by the standards authority as an 'appropriate derivation' of the standard (EMA 2000b).

In addition, a number of recent events in Australia's region, such as the Auckland power failure, the Sydney water crisis and hailstorm and Victoria's gas supply failure have demonstrated all too clearly that, while traditional DISPLAN-type arrangements may have a role in dealing with the *event* which initiates a community emergency, these arrangements have limited relevance in dealing with the *situation* that the event creates.

Such situations may require multi-agency management with a significant level of direct political involvement, and some of the public and private sector agencies which may be involved in the management of the situation may have had little previous involvement in emergency management preparedness and response activities.

The focus of emergency management in Australia has therefore shifted from its previous hazard and event focus, to a broader concern with the management of risks to community safety and with the management of the situations which may result from hazard impact, including those situations which may result from disruption to utility, key facility and infrastructure 'lifelines' (EMA 1996). In this context, there has been increased emphasis on risk management tools and techniques and on arrangements for the higher-level management of significant community impact situations while still retaining and maintaining an appropriate response capability for responding to rapid-onset hazard events.

These developments have tended to validate the accepted Commonwealth concepts of 'comprehensive and integrated emergency management', with their emphasis upon an all-hazards, all-agencies, all-strategies (prevention/mitigation, preparedness, response and recovery) approach to the management of emergencies and disasters. However, they also make clear that giving effect to these concepts, particularly where critical resources may no longer be as readily available to response authorities, can require the effective involvement of a large number of public and private sector agencies and the community itself.

Managing risks and managing emergencies

One of the points emphasised in the earlier section on biological emergency profiles was that the managers of biological risk are not necessarily the managers of a potential resultant biological emergency, although emergency managers often have the ability to influence the approach to risk management. This leads to a need to resolve the relative responsibilities of these two sets of managers.

In regard to the management of biological risk, there is an expectation that managers of an organisation, operation or process involving an element of biological risk will adopt an appropriate risk management regime to eliminate its potential for creating a biological emergency or at least to reduce any possible impact to a regulated or acceptable level. In theory, emergencies will not occur if the risk is managed effectively—as the Australian/ New Zealand risk management standard AS/NZS 4360:1999 suggests, by some combination of ceasing the practice which creates the risk ('risk avoidance'), reducing the likelihood or consequence of the risk ('risk mitigation') or persuading someone else to bear the risk ('risk transfer'). In practice, of course, the existence of uncertainties and 'hidden or unknowable risks' (Handmer 1999) may make full removal of all risk unlikely.

AS/NZS 4360:1999 makes clear that risk management in an organisation is not simply the responsibility of those who may be formally designated as 'risk managers' in that organisation — it should be regarded as 'an integral part of good management practice…rather than be viewed or practised as a separate program'. Thus, risk management is an executive management responsibility, and the organisation's risk management process requires 'the active ongoing support of the organisation's Chief Executive Officer'.

Given the 'mega-department' composition of the various Commonwealth and State/Territory departments with statutory responsibility for the management of biological risk in the areas of human, animal, fish and plant health, it is likely that the risk management concerns of the Chief Executive Officers and executive managements of those departments are focused primarily on the organisational risks such departments inevitably face and that the biological risks

#5 — Black Striped Mussel, Australia 1999

The agent

The black striped mussel is a small marine shellfish that causes severe fouling of boats, buoys and fixtures in the Pacific region but had not previously been seen in Australia. (Black-striped Mussel incursion Darwin - March/April 1999 - A case-study of actions undertaken in response to the Black-striped mussel infestation, 2000).

Immediate effects

Early infestation was detected in 3 marinas in Darwin in 1999. The pest had potential to severely interfere with shipping, ports and aquaculture structures. The Northern Territory government and then other Australian governments responded by poisoning the shellfish in the marinas. The pest was eradicated at a cost of approximately $2 million.

Secondary Effects

There were few overseas effects but the response lead to the realisation that Australia lacked a response system for emergency reaction to marine pest incursions. This has lead to a new system being developed (SCC/SCFA Taskforce Report, 2000).

Impact on the Community

Restriction of use of commercial and recreational vessels and marinas for several weeks.

Who managed the emergency

Whole of government approach by Northern Territory (mainly Fisheries and emergency services), CSIRO, Universities. Later many Commonwealth and other State agencies were involved – mainly primary industry and environmental agencies.

Who manages the risk

Mainly Commonwealth and State agriculture, primary industry and environment agencies.

Points for attention

This response both in the field and on a national level was complex and had no precedent in the world. Treatment protocols and coordination systems were adapted from other areas. Tracing and checking of potentially infested vessels was very complex. The elimination operation involved approximately 15 State and Commonwealth government agencies and was successful in eliminating the pest.

which may arise in the areas of their particular health responsibilities only receive significant attention with the possibility or actuality of a major event.

In relation to the management of biological emergencies, it was noted earlier that the responsibility for the development and implementation of plans and programs to manage biological emergencies is scattered across a number of Commonwealth and State/Territory government instrumentalities. To some extent the very diversity of biological risks makes this inevitable, but it also makes for some potential difficulties in determining responsibility for the management of a possible or actual major event and its potential outcomes.

In addition, given the potential impacts of a major event and the inevitable involvement of a variety of public and private sector agencies in the management of that event and its outcomes, the responsibility for ensuring the effective coordination of those agencies in dealing with the total situation cannot rest with any single agency. As discussed earlier, a specific agency will be designated in disaster and emergency response planning ('DISPLAN') arrangements as the 'control' or 'lead combat authority' for managing the response to the event itself, but primary responsibility for 'community safety' in all its aspects must ultimately rest with governments in their legislated responsibility for the wide range of programs which seek 'to protect and preserve life and property'.

As the recent national 'Emergency Management Strategic Plan 2000–2005' indicates, the achievement of the vision of 'a safer community' requires 'cooperation and goodwill across governments, communities and organisations' (NESC 1999). If the vision of a community safe from the possibility of a biological emergency is to be attained, it is evident that the first priority is to require effective measures to be established for the management of biological risk. Such measures need to be supported by appropriate plans and arrangements to deal with biological emergencies involving a partnership between governments, risk-producing organisations and the community. Both activities require government monitoring and coordination, in the interests of the communities for whose safety they are ultimately responsible and accountable.

Towards a new approach to 'bio-risk management'

The 'case study' profiles demonstrate clearly why a new approach to the management of biological risk is needed, in regard to at least two major issues:

- The impact of major biological events can have effects that reach potentially into almost all aspects of national and community life. While the responsibility for dealing with the event itself may fall primarily upon the relevant scientific specialists, emergency managers and their respective support agencies, the responsibility for dealing with the possible *outcomes* of such events extends far beyond their effective remit. Proper management of such outcomes requires both authority and resources which certainly extend beyond the warrant of any single government department or instrumentality.
- Managing a full-blown emergency resulting from a biosecurity breakdown or exotic disease incursion, for example, is probably the least preferred approach to the management of biological risk—once the emergency has occurred, it may be too late to reverse its possible effects on the nation and on individual communities, in health, environmental or socio-economic terms. Managing the risk itself, through prevention and mitigation programs which will either avoid the possibility of an emergency occurring or limit its effects if one should occur, should be the 'option of choice'.

These issues are of course not peculiar to emergencies of biological origin—they can be equally relevant to emergencies associated with natural, man-made and socio-political hazards. However, the critical first step in any risk management process is to 'establish the context' ('the strategic, organisational and risk management context in which the rest of the process will take place', SA/SNZ 1995/1999), and there are some characteristics in the general biological risk context which have implications in regard to the two issues identified above.

The need to deal comprehensively with the community impacts of major events, ensuring effective policy-making and resource coordination in such situations, has resulted in the 'whole of government' approaches to the management of major emergencies adopted in recent years in States such as Queensland and Victoria. A similar 'comprehensive and integrated approach' to situation management was taken by the Commonwealth and all States and Territories in preparing to deal with possible Y2K issues, and this in itself has established a general precedent for the future management of major community impact situations on a 'whole of government' basis.

On the somewhat more narrow question of the application of risk management tools, it needs to be borne in mind that processes such as that detailed in AS/NZS 4360:1999 are essentially generic and intended to have wide application. They require interpretation for application in a particular 'industry' (as the National Emergency Management Committee directed in 1996 in relation to the application of AS/NZS 4360 in the emergency management 'industry'). It is also important to note that AS/NZS 4360 is clearly oriented towards the risk management needs of a single organisation in addressing the risks specific to that organisation, measuring risk in the classic terms of the likelihood and consequences of 'something happening'.

However, community emergency management is fundamentally multi-organisational, multi-functional and of necessity focused on the range of hazards confronting a particular community. Risk in emergency management terms is 'a concept used to describe the likelihood of harmful consequences arising from the interaction of hazards, communities and the environment' (EMA 2000b). Clearly, the responsibility for dealing with '… harmful consequences arising …' cannot be vested totally in any one organisation or any single 'emergency manager'.

There is a further issue in regard to the application of the AS/NZS 4360 process in the management of community safety risk in general, and that concerns the final 'Treat Risks' step in the process. Risk 'treatments' encompass reduction of the likelihood and/or consequence of risk, risk transfer and risk avoidance. At the end of the 'treatment' process, there may be residual risks ('retained risks') which the organisation ranks as 'acceptable'. In such instances, the Standard notes that 'plans should be put in place to manage the consequences of these risks if they should occur, including a means of financing the risk'. In managing community safety risk, however, the issue of 'acceptable risk' is one which needs to be addressed in consultation with the community, and plans to manage the consequences of residual risks borne by the community are multi-organisational emergency management plans.

This supports our contention at the beginning of this section, that the management of a full-blown community emergency of biological origin should be regarded as the least preferred approach to the management of community safety risk. Risk 'treatments' in the management of community safety risk, including risks

of biological origin, should be primarily designed to remove risk or to mitigate its effects. Emergency management plans need to be based upon the best possible estimates of the nature and scale of resultant retained or 'residual' risk, with appropriate provision for the inevitable uncertainties in managing these types of risk.

These are the outcomes currently sought in the biosecurity programs which have been initiated in many bio-risk industries and areas, and if effective they would make a major contribution to the elimination or minimisation of the effects of future emergencies. However, these programs need to have a sound basis in current risk management principles and practices, and full commitment and co-operation by government instrumentalities, the relevant industries and scientific specialists, if they are to be effective.

In addition, while biological *risk* might arise from a multitude of sources, the attributes of biological *emergencies* as identified at the beginning of this paper share certain commonalities. There is clearly a need for more inter-agency and interdisciplinary interaction to ensure that future biological risk management and biological emergency management arrangements, processes and techniques will benefit from shared experiences and understandings.

Conclusion—searching for principles to develop new approaches

Biological emergencies tend to have an expanding field of effects past the immediate problem. Sometimes there can be no apparent problem in the field at all, but still major negative effects occur to sectors of Australia's community.

There are many organisations involved in the management of biological emergencies at the various levels of government. Often field operations will require expertise from many areas of government or private industry. Biological emergency management operations may closely involve the more conventional emergency services, but this involvement is not routine and their roles are often unfamiliar.

Making policy for biological emergency response often involves expertise (and responsibilities) held in several areas of government. This makes the making of policy as reliant on coordination and communication as is the field operation. Due to their wide range of impacts, biological emergencies can make the management of their impact on the community more of a 'whole-of-government' issue than an issue for one government department alone.

Often organisations that have responsibility for emergency management in various biological areas will also have the ability to influence risk management of the issues. This is at variance with most conventional emergency organisations. Emergency management can be considered as the response capability requirement left over after risk management is addressed. There is a connection between emergency management and risk management processes which should enable better coordination of response needs with the most likely areas of concern.

This is not to say all emergencies can always be predicted—they cannot—but general areas of need may be identified. Biological emergencies are by their nature difficult to predict. Due to this unpredictability, response systems need to be flexible and act on the basis of the best information available at the time, although as noted earlier there is much potential benefit to be gained from greater inter-agency and inter-disciplinary interaction to share understandings about response system needs.

The following principles emerge for developing and applying the proposed new approaches to biological emergency management:

- facilitation for policy and operational coordination between agencies is paramount
- communication between management agencies will be needed both before and during an emergency situation
- communication with a variety of potential operation agencies is likely to be needed
- flexibility in response will be required and response plans may have to be altered in the face of changing information
- good intelligence during the emergency event is required as the problems are not usually directly observable by the responders
- government agencies responsible for the issues have the opportunity to treat emergency management as part of an overall risk management approach such as that of AS/NZS 4360:1999 and therefore influence the need and design of both emergency response systems and risk management systems.

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About the Authors:

Grant Rawlin: Principal Veterinary Officer, Office of the Chief Veterinary Officer, National Offices of Animal and Plant Health, Agriculture Fisheries and Forestry – Australia, Canberra ACT. He has worked in CSIRO as a researcher in animal virus diseases, Department of Agriculture Victoria as a field veterinarian and diagnostic pathologist. Dr Rawlin now works in Canberra on technological support of Australia's animal health policies, particularly in emergency management systems and training. He has experience in the control of biological emergency situations in animal and plant health and marine pests.

Contact address:
Mr Grant Rawlin
Principal Veterinary Officer
National Offices of Animal and Plant Health
G.P.O. Box 858
Canberra, ACT
Grant.rawlin@affa.gov.au

Roger Jones: Director TEM Consultants Pty. Ltd., Mount Macedon Victoria. He has spent 25 years in emergency management policy development, operations, education and training at national and state levels in Australia and is a former director of Emergency Management Australia's Australian Emergency Management Institute at Mount Macedon in Victoria. Among other consultancies at international, national and State levels, he recently undertook on behalf of Animal Health Australia a review of the management of the 1999 outbreak of Newcastle disease in NSW.

His contact address:
Mr Roger Jones
Director
TEM Consultants Pty Ltd
P.O. Box 142
Mount Macedon Victoria
temcons@netcon.net.au

This article has been refereed

Book Announcement

Community Risk in Mackay. A multi-hazard risk assessment

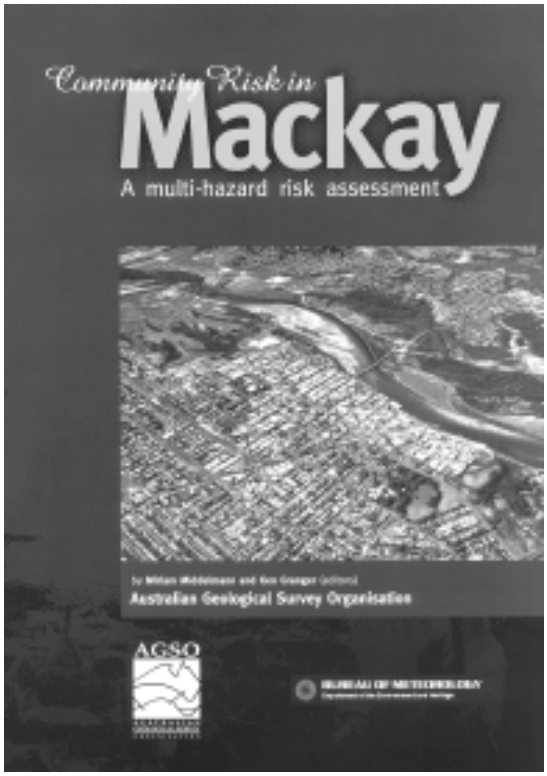
Editors: Miriam Middelmann and Ken Granger

Cities Project, Australian Geological Survey Organisation, Canberra, Australia

All Australian urban communities face risks from a range of geohazards. Mitigation of these risks will improve community safety, sustainability and prosperity. However, due to the complexity of comparing the risks from different geohazards, few multi-hazard risk assessments have been attempted. This report is the second of AGSO's Cities Project multi-hazard risk assessments, and it develops further the methodology outlined in the Cairns study (*A.J.E.M.*, 14 (2), Winter 1999).

The research assesses the risk to the Mackay community from severe winds and storm tide from tropical cyclones, flooding of the Pioneer River, and earthquakes. It makes extensive use of AGSO's Risk-GIS method, which is a fusion of the decision support capabilities of geographical information systems (GIS) and the philosophy of risk management. The analysis of risk involves assessing the levels of hazard at Mackay, developing an understanding of the vulnerability of the elements that are at risk within the community, and synthesising a range of event scenarios. A comprehensive building database is used to generate damage assessments for the various scenarios. Each suburb is ranked for its contribution to overall community vulnerability and for its exposure to the various hazards. These two rankings determine total risk for each suburb by hazard. Finally, overall community risk from the various hazards is compared.

Floods in the Pioneer River pose the greatest geohazard risk to Mackay. In the ARI = 100 year scenario (which sets the minimum floor level for new buildings), 18% of all buildings would have overfloor flooding, producing moderate or more severe damage and possibly structural failure. Numerous key facilities would be exposed to inundation. Severe wind and storm tide from tropical cyclones rank equal second in their risk to Mackay. Under an event with ARI = 1000 years (the design event for wind), almost 50% of buildings would suffer moderate or more severe damage. A storm tide scenario with a 100 year ARI (which sets the minimum floor level for new buildings) indicates that 10% of all buildings would have overfloor flooding, causing moderate or more severe damage and the possibility of structural failure. Earthquakes also pose a significant risk to Mackay. For a 475 year ARI scenario (as specified by the Australian earthquake loadings standard), about 16% of all buildings are expected to sustain damage, although about three-quarters of this damage will be slight. Electric power distribution, medical facilities and commercial businesses are especially at risk.



The Mackay community appears to accept a moderate level of risk for relatively frequent hazard events (ARI of 50 years or less). Increased community awareness regarding the possible impact of rarer, more severe hazard events could improve the public's understanding of risk, thereby making mitigation strategies easier to implement.

The report is a valuable resource for those responsible for, or interested in, the management of natural hazard risks, including concerned citizens, elected officials, professional engineers, planners and emergency managers.

The 300 page report, titled *Community Risk in Mackay. A multi-hazard risk assessment,* is published by AGSO (primary funder and research leader) in conjunction with the Bureau of Meteorology and in cooperation with Mackay City Council and the Queensland Department of Emergency Services.

The report consists of an overview in a full colour booklet with comprehensive information in the attached CD-ROM. The full report is available on Compact Disk.

The booklet and CD-ROM are available from:
The Australian Geological Survey Office (AGSO)
PO Box 378
Canberra City 2601

The overview booklet can be viewed on AGSO's web page www.agso.gov.au