



The Australian Journal of **Emergency Management**














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Front cover: *Main image – important forest habitat destroyed by fire (photo: T Norton)*
Other images – destruction of important habitats can threaten rare nectar feeding birds and small mammals; bushfires threatening important natural features, human life and property (photos: J Williams)

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The aim of this publication is the exchange of information and views across the Australian emergency management community, therefore, the views expressed in this journal should not be taken to be the views of Emergency Management Australia.

This journal incorporates a review process. Three levels of review—refereeing, editorial board review and editing—are conducted. Material submitted for publication should be on disk and reach the Editor by the following dates: Summer – October 15th; Autumn – January 15th; Winter – April 15th; Spring – July 15th. The editorial committee reserves the right to determine the suitability of all material submitted and where necessary to edit submissions.

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Editorial

Ecological emergencies in Australia: issues and challenges for environmental and emergency management agencies

Environmental change, and many emergencies and hazards often have their roots in basic features of the Australian environment—droughts, flooding rains and wildfires—and a failure of humans to recognise and accommodate these features. Climatic variability, especially in precipitation, is one enormously important feature. The legacy of the evolutionary history of the Australian continent is another feature, since Australia is the only rich country considered 'mega-diverse' in biological diversity. Another feature is a European history of extraordinarily poor environment management. Of note is the impact of humans on ecosystems and their biota, and on important biophysical and ecological processes—the foundations of natural systems. In the absence of management reform, as environmental change continues we can expect these features to manifest and produce more ecological surprises and situations that threaten the persistence of key ecological systems. At threat is the remaining natural heritage of Australia, as well as human life and property.

This expectation, not to mention the increase in the number and significance of ecological impacts and crises during the past two decades, raises many questions: What are the relationships and connections between environmental/ecological management and emergency management in Australia? Can these connections be employed to improve environmental management, especially the management of ecological emergencies? Can emergency management operations be improved to avoid unnecessary impacts on the natural environment? How can greater interaction and cooperation be fostered between these two fields?

The five papers relating to this topic are presented to consider some of these questions in more detail from a range of

ecological perspectives. The term 'environmental emergencies' (and environmental risk) has been avoided as this is generally taken to refer primarily to pollution episodes (e.g. chemical or oil spills, fires at factories) and mostly to situations where *humans* or their property are the primary concerns. For the purposes of this forum 'ecological emergencies' are defined as sudden-onset events where the subject is non-human, such as biological diversity, an ecosystem, a species, or a river system. In an ecological emergency, humans or human property may also be threatened, but the threat may be only to non-human entities.

The papers represent one of the outcomes of a national workshop: *Planning for Ecological Emergencies* that was held at the Australian Emergency Management Institute, Mt Macedon, Victoria during 9–11 September 1998. We are very grateful to the Institute for their support to conduct this meeting.

By Stephen Dovers, Tony Norton and John Handmer

Dr Stephen Dovers is a Research Fellow at the Australian National University, ACT; Tony Norton is NRS Professor of Spatial Information Science at RMIT University, Victoria; and John Handmer is Professor of Geography at Middlesex University, Enfield, United Kingdom.

Apology

I wish to point out that the lead article in the last issue of the journal by Roger Douglas of the School of Law and Legal Studies at Latrobe University on 'Administrative Law and Response to Emergencies' did not contain the required references. This was an oversight in the transferring of material to the desktop publishing stage. To be able to access the complete and correct article we have modified the electronic copy of the journal and it can be located at www.ema.gov.au/pcations.htm

I wish to apologise for any inconvenience and embarrassment caused through this error.

'Ecological emergencies' and resource and environmental management

The purpose of this and the other articles is to discuss what constitutes an 'ecological emergency', and to consider some of the key linkages between environmental/ecological management and emergency management in Australia. To do this, the article provides some ecological and environmental management context as background to the discussion. We argue that both fields have much to offer each other in terms of insight to improve the quality of planning and management. Moreover, emergency management agencies have a vital role to play in regard to the management of ecological emergencies in Australia. The connections between the two fields need to be identified and developed to maximise opportunities for improved management.

Environmental change, and many emergencies and hazards, have at least some of their roots in basic features of the Australian environment, such as droughts, flooding rains and wildfires. Climatic variability, especially in precipitation, is one enormously important and well-recognised feature. Of ecological importance are generally nutrient poor soils, and long periods of evolutionary isolation (van Oosterzee 1995). These and other factors have resulted in a rather unique suite of ecosystems and species, with patterns of frequency and abundance of plants and animals, and linkages to the non-living environment, that are peculiarly Australian. Australia is the only rich country considered 'mega-diverse' in biological diversity (biodiversity), and a rare case where one political jurisdiction covers and entire continent (Common and Norton 1992, Dovers and Williams, in press). Yet rates of loss and degradation of species and ecosystems have been high since European settlement, due to habitat alteration (esp. land clearance and land use change), predation and competitive interference by introduced weeds and pests, and competition with and displacement by domestic stock (SEAC 1996). Some native species have increased due to human-induced changes, but the bulk

by Stephen Dovers, Centre for Resource and Environmental Studies, The Australian National University; and Tony Norton, Department of Land Information, RMIT University

have diminished—especially those of limited or specialised distribution or those located in parts of the landscape also attractive to human use. Of significant concern is the impact of humans on important ecological processes—the foundations of natural systems. These ecological processes include nutrient cycles, climate processes, hydrological cycles and pollination. This concern shifts attention from traditional 'nature conservation' and single threatened species concerns, to a more fundamental level of system health.

Resource and environmental policy and management in Australia

Australia's modern history of environmental management began soon after European occupation, with regulations dealing with water quality and timber harvesting prior to 1800.¹ Through the 19th century, policy and management activity dealing with issues such as water and forests, and a little with urban environmental quality, was evident. More elaborate systems of policy, management and regulation were not put in place until this century. Frawley (1994) characterises the trend as from 'exploitative pioneering', through 'wise use' of natural resources for national development, to 'environmentalism'. Currently, all three are still recognisable. In the past few decades, we have moved from a concentration on fairly simple nature conservation and end-of-pipe pollution control, to an attempt at much more integrated approaches. This began in earnest with the 1983 National Conservation Strategy, but was more fully discussed and developed during the 1990s under the title 'Ecologically Sustainable Development' or ESD. More recent approaches have some core features, including:

- the linking of ecological, social and

economic dimensions of problems, and the (proposed) treatment of these in an integrated fashion (i.e. environmental issues cannot be treated as a discrete, separate policy and management area). Especially important has been the close linking of environment and development;

- recognition of the need to address deeper causes and wider contexts (e.g. reducing waste streams and/or resource use rather than just cleaning up afterwards; protecting biological diversity across entire landscapes, not just in reserves; or managing land and water issues across whole catchments in an integrated way);
- recognition of global dimensions and linkages with many issues, such as biodiversity or climate change;
- increased importance attached to non-market values of environmental resources, such as aesthetic and cultural, but especially of 'ecosystem services' like clean water, genetic diversity, nutrient cycles, soil protection or climate amelioration;
- the search for new policy and management approaches to supplement traditional regulatory and educational approaches.

Some basic principles of ESD, including the need for environmental-social-economic integration, the precautionary principle and community participation, have not only been avowed in policy, but have been expressed or referred to as statutory objects and guiding principles in some seventy Australian laws.² In recent years in Australia, there has been a major period of development of national (including the Commonwealth,

Notes:

1. Before this, of course, indigenous Australians managed the environment, especially through the use of fire, and indigenous knowledge and tradition is being increasingly recognised and drawn upon in resource and environmental management.

2. The precautionary principle is relevant here, stating that lack of scientific certainty should not be used as an excuse to postpone environmental protection measures, suggesting more proactive or preventative approaches.

states/territories and sometimes local government) policies and approaches, generally formulated with the involvement of stakeholders, including:

- National Strategy for Ecologically Sustainable Development;
- National Strategy for the Conservation of Australia's Biological Diversity;
- National Forest Policy Statement;
- National Greenhouse Response Strategy;
- National Rangelands Strategy;
- National Waste Minimisation Strategy;
- Oceans Policy;
- National Decade of Landcare plan; and
- Commonwealth Wetlands Policy.

These are supported by literally hundreds of subsidiary policy programs, such as the many funded through the Natural Heritage Trust, and the states and territories have a complex raft of policies and laws as well. Australian policies match major international policies and conventions, including Agenda 21, the Convention on Biological Diversity, the Framework Convention on Climate Change and the Convention on Desertification. In terms of substantive environmental issues that are topical at present, the following comprise the great bulk of the current policy agenda:

- greenhouse and climate change (international coordination of responses, impacts, and policy options especially concerning energy use and land clearance);
- conservation of biodiversity, both on and off-reserves, with emphasis on land clearing, the impact of introduced species, degradation of inland streams, and the possible implications of climate change;
- land degradation, including soil erosion, acidification and salinisation;
- resource conflicts in forests, between extractive, conservation and other values;
- water allocation conflicts, between extractive, environmental and other uses;
- use and management of the marine realm and the coastal zone;
- improving industrial 'metabolism', through more efficient production processes and waste management and minimisation;
- urban environmental protection, especially regarding city air quality.

Some major policy trends have been evident in recent years in the resource and environmental field. These have influenced policy and management styles and the sorts of policy instruments used across all these issues, and include:

- 'marketisation', being both the reduction

of state involvement through measures such as outsourcing and corporatisation, and the application of market-based policy instruments (often more in theory than practice—Eckersley 1995; Dovers & Gullett 1999);

- a move away from regulation, towards volunteerism, self-regulation, codes of practice and agreements;
- a large move towards community participation and involvement, by rural, urban, remote and indigenous communities, in environmental management and monitoring (the more inclusive mode of national policy development of the 1980s-early 90s, however, has diminished in the past few years). This community dimension is most well known through Landcare, but there are many other programs;
- increasing use of risk assessment and management approaches (but certainly little agreement as to their usefulness), and more attention to policy and decision making in the face of uncertainty;
- a strong regional focus in planning, policy implementation and program delivery;
- much greater use of sophisticated computer-based models and decision support systems to underpin policy and management;
- an emerging interest in the longer term institutional and informational underpinnings of 'adaptive, learning' policy processes and management regimes (but little evidence of their creation so far) (Dovers and Mobbs 1997).

In the final part of this paper, it is suggested that these trends closely match recent developments in emergency management.

Defining ecological emergencies

The term 'environmental emergencies' (and environmental risk) is generally taken to refer primarily to pollution episodes (e.g. chemical or oil spills, fires at factories) and mostly to situations where *humans* or their property are the primary concerns. Most discussion of 'ecological emergencies' relates to international environmental law and policy, referring to situations where countries have some responsibility to inform each other of major spills or incidents. For the purposes of this article we propose that:

'ecological emergencies' are sudden-onset events where the subject is non-human, such as biological diversity, an ecosystem, a species, or a river system. In an ecological emergency,

humans or human property may also be threatened, but the threat may be only to non-human entities.

This is not to underplay the importance of threats to humans, but to shift the focus so as to better consider what sharp events mean for natural systems, and whether and how we should be concerned about that. The definition may be centred on the system threatened, or the source or kind of threat. Oil spills in ecologically valuable areas remote from human populations are a well established example, as are water pollution events (e.g. fish kills from chemical accidents, or from exposed acid sulphate soils). Remnant vegetation and habitats (in urban or rural areas) are open to threats, such as fire or pollution episodes. Rare species are another vulnerable part of the environment, and are susceptible to, for example, an outbreak of disease or of introduced plants or animals. Inland streams and coastal estuaries are particularly vulnerable also.

A key point is that ecological emergencies are sharp manifestations resulting from underlying processes and phenomena. One part of the underlying condition will always be the variable nature of the Australian environment, and this is important to recognise, but more important from a management and policy perspective will be the additional impacts on natural systems, above the background variability, resulting from human actions and institutions.

Connections

There appears to be a number of levels of connection between environmental and emergency management, and thus bases for closer engagement between the two fields of policy and practice. We propose three categories (the following is explored further in Dovers 1998a, 1998b)

Substantive interactions

The most obvious connection between the two fields of policy and practice is 'at the coalface', or rather at the *fire front*, the chemical spill, the flood, etc.

Bushfire is probably the most well known case (and one not without conflict between environmental and emergency managers, both operationally and with respect to policy goals). Pollution episodes (spills, releases) are another, where threats to both humans and the environment coincide, and where both professions will meet, set immediate priorities and make decisions.

Other 'parts' of the environment such as inland waterways, remnant vegetation areas and estuaries are subject to sharp onset events—floods, cyclones, wind

storms, nutrient pollution and associated algal blooms—but the emergency-ecological linkages are probably less recognised. One question is: can the two sets of imperatives—human needs and natural system needs—be reconciled better *well before* emergencies or sharp onset events occur?

Common causes and problem types

At a deeper level ecological change, whether slow or rapid, and emergencies have similar causes. Generally they both arise from interactions between environmental variability, human behaviour and human institutions. Policy problems in sustainability such as biodiversity, climate change and land degradation exhibit features that make them different in both kind and degree from many other areas of public policy and administration. Some of these features are:

- broadened, deepened and highly variable scales of space and time;
- quite often irreversible and typically cumulative impacts;
- complexity and connectivity between problems;
- pervasive risk and uncertainty;
- problematic moral dimensions (rights of other species, future generations);
- causes embedded deeply in patterns of production and consumption, governance and human settlement;
- strong demands for community involvement;
- the novelty and unfamiliarity of policy and management problems.

One field of policy and management that does share many, if not most, of these attributes is emergency management. This suggests that some degree of two-way learning from experience should be possible, which would require institutional and practical linkages.

Similar policy and management trends

Given the above, there are some obvious parallels between the two fields in terms of current trends and approaches. Salter's (1998) summary of changes in emergency management could just as easily describe

many recent changes in emphasis in resource and environmental management (table 1).

In environmental management, the increase in community-based programs, attention to causes rather than symptoms, and emphasis on whole-catchment or cross-landscape approaches are equivalent to what Salter describes. So there are types of problems shared. Also, both fields are adapting to the risk management standard AS/NZS 4360:1995 (see Salter 1998 on emergency management; and there is a Standards Australia working group compiling a handbook for applying the standard to environmental management).

Recent court cases and literature revolving around application of the 'precautionary principle' are of interest to emergency management (e.g. Dovers and Handmer 1995, Deville and Harding 1997, Gullett 1997). In both areas, the opposing notions of resilience and vulnerability are being explored, and the different interpretations of these terms within risk/hazards and ecology need to be clarified. Both environmental management and emergency management are constantly adapting to a changed environment of public policy and administration involving market-led reform, competition policy, public sector cuts, and new performance expectations (Dovers and Gullett 1999, Kouzmin and Korac-Kakabadse 1999).

The connections between the two fields are both real and potential, and both positive (i.e. opportunities for coordination and cooperation) and perhaps negative (i.e. clashes in mission, possible institutional gaps). We believe that both fields have much to offer each other in terms of insight to improve the quality of planning and management. Moreover, emergency management agencies have a vital role to play in regard to the potential future management of ecological emergencies in Australia. The connections between the two fields need to be explored and exploited to maximise opportunities for improved management. However, this will require some potential barriers

(e.g. different management styles, institutional and procedural standards, or information systems) to be addressed if connections are to be created to support improved environmental, ecological and emergency management in Australia.

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From:	To:
Hazards	Vulnerability
Reactive	Proactive
Single agencies	Partnerships
Science driven	Multi-disciplinary
Response management	Risk management
Planning for communities	Planning with communities
Communicating to communities	Communicating with communities

Table 1: changes in emphasis in resource and environmental management

Book Reviews

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Third World Conference for the International Society for Traumatic Stress Studies.

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Emergency Law by Michael Eburn

The Federation Press, Sydney, 1999,
204pp, AS\$29.95

Reviewed by Hugh Selby

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Apparently there are no reported cases of anyone being sued for voluntarily providing first aid or medical services at an emergency. The law, as author Michael Eburn concludes, welcomes rescuers and wishes to protect the Good Samaritan. Nevertheless fear persists; e.g. among doctors, that if they stop at an accident and help then they will be successfully sued for their troubles. Explaining away that fear and presenting a comprehensive analysis of the law as it applies to help given in an emergency—be that first aid, medical, fire, other disaster—is the successful purpose of this book.

It's a delight to read a book which deals so clearly with important legal concepts such as consent, assault, trespass, duty of care, proximity, negligence, good faith actions, and liability exclusion clauses. The presentation is straightforward, easy to follow, and much helped by the use of examples to which readers can readily relate. Anyone working in the emergency field, be they professional or volunteer, will be able to grasp why it's safe in Australia to be a reasonable rescuer.

Of course, no one should be surprised that being a rescuer is not a ticket to be indifferent to all else. For example, the drivers of emergency vehicles take greater risks when with lights flashing and siren blaring they negotiate traffic at higher than 'normal' speed. With those higher risks comes the requirement that they exercise greater care.

Unfortunately, sometimes the rescuer becomes victim and then there is the issue of who will compensate them. The discussion of the general principles that apply to rescuer claims is very useful—particularly as it is not a mainstream topic for traditional law studies. It is reassuring that a rescuer, acting under of the pressure of emergency, is unlikely to lose their claim because they took some risks as they went to the aid of another.

Michael Eburn has done rather more than just meet the needs for reassurance by those in the field. He covers both the legislation right around Australia and court decisions both here and abroad.

That makes this book a useful reference for policy and lawmakers. At the least some attention needs to be given by government to such questions as: the extent to which assistance can be given to children over the parents' refusal; when a doctor is not 'at work' what, if any, are the requirements upon doctors to assist a person in trouble; what is the positive meaning (it has been defined negatively as 'without any indirect or improper motive') of the term 'good faith' and how does it affect the application of provisions in legislation which attempt to shut out a claim for damages against an emergency worker and their organisation; and, let's try and enter the next century and greet the Olympics with regulations in NSW that are not inconsistent and do not refer to an ambulance wagon (sic).

Water in Australia: Resources and Management by David Ingle Smith

Australia is the driest inhabited continent. It also has the most variable rainfall and runoff. This poses unique problems for the management of the nation's water resources.

Water in Australia outlines the nature of the resource, past management practices, policy, and the outlook for the future. The opening chapter addresses the issue of how much water there is, and where it is located. Subsequent chapters answer the following questions: How usable is it? Does our pattern of floods and droughts mean we have too much, or too little? How did we get where we are now? How are we doing? Where are we going?

For the first time, the quantity, quality, use and policy associated with water resources in Australia are described in a single text. Over a hundred figures and diagrams elucidate the text and photographs illustrate various aspects of the history and infrastructure of water in Australia. The book is approximately 400 pages and can be ordered online via the Oxford University Press web site at: www.oup.com.au, or by mail to:

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When is a fire an ecological emergency?

Introduction

Bushfires are spectacular events which have the power to catch the common imagination. Most people, whether they live in the city or country, have knowledge and opinions about bushfires. A smaller proportion of the population has direct experience of fires, including those who have defended lives and property (their own or those of others). Our perceptions of bushfires are strongly shaped by direct experiences or for the vast majority, indirect experiences portrayed through media. Extreme conflagrations (e.g. 1939, 1983 in Victoria; 1968, 1994 in NSW; 1961 in WA; 1967 in Tasmania) have had a strong influence on popular thinking and the development of formal fire management policies and practices. A common perception is that all or some fires are disasters in ecological terms. The media routinely reports that the bush is 'destroyed' by fire, especially at the time of large, intense conflagrations. One well intentioned but mistaken outcome of this is the belief that the bush must be actively rehabilitated or replanted following fires.

Some fires may precipitate an ecological crisis but it follows that not all fires cause such crises. How do we distinguish those fires that could be ecologically deleterious from those that aren't? This paper explores some of the basic concepts that may be used to answer this fundamental question. We then outline measures that may be taken to integrate such concepts into contemporary management of bushfires, from both the planning and suppression angles.

Possible deleterious effects of fires

A range of deleterious ecological effects are listed in *Table 1*. The list is indicative but may not be exhaustive and involves the perceptions of observers including the general public. Any of these effects may result from the passage of an individual fire through a landscape but we emphasize that the state and context of the landscape at the time of fire is the key to understanding whether problems will ensue.

How would a single fire precipitate any of these problems? In the case of extinction or loss of a species from a landscape,

by Ross A Bradstock, Biodiversity Survey & Research Division, NSW National Parks and Wildlife Service and A Malcolm Gill, Centre for Plant Biodiversity Research, CSIRO Plant Industry.

such a problem would occur if that fire created an adverse fire *interval* perhaps with an adverse fire *type* or *intensity* in an inappropriate *season*. The fire *regime* consists of four components: fire type, frequency, intensity and season (Gill 1975). For most ecosystems a broad range of fire regimes are possible. Individual species are able to cope with some fire regimes but not others. Inability to cope may mean extinction for a species in a landscape depending on the scale of any adverse regime.

The notion of the fire regime immediately indicates that fire effects are not merely the result of one-off events, but rather, due to recurrent disturbances with additive or other modifying effects on biological populations. Recurring fires interact with fundamental processes such as survival and reproduction in populations. The ability to survive and regain regeneration capacity after a particular fire determines the likely response to the next. Timing of subsequent fires, in biological terms is therefore crucial.

The most notable example of this are plants termed 'seeders'. Seeder species

have populations that are strongly shaped by fires. Established plants are typically killed by fires, so that recovery is dependent on germination from stores of seeds. Post-fire germinants eventually grow and become mature, thus replenishing seed stores and the regenerative capacity of the population. In extreme circumstances a fire may re-occur before maturation (i.e. during the 'juvenile period'), resulting in extinction (Gill and Bradstock 1995). The juvenile period in seeder-type plant species has been the focus of considerable research, especially as such species form a prominent component of the Australian vegetation (Gill and Bradstock 1995).

In a similar but not identical vein are animal species whose occurrence may be restricted to a particular time stage after any particular fire. A prominent example is the arboreal marsupial, Leadbeaters Possum (*Gymnobelideus leadbeateri*), a hollow-dependent dweller in tall moist eucalypt forests of southern Australia. These animals require hollows in trees for nesting, but suitable hollows are usually not available until trees reach about 190 years of age (Lindenmayer 1996). Part of the reason for this is that the dominant trees in such forests (e.g. *Eucalyptus regnans*) are seeder species. Such trees may have a juvenile period and life-span of about 20 and 400 years respectively. Trees have to reach a suitable size for hollows to form. A fire interval for tree-killing fires of 20-50 years would

Possible deleterious effects of fires

Biodiversity

extinction of species (scale an issue)
visible injury and death of 'charismatic' animals
peat fires

Other environmental effects

changed water yield and quality
increased erosion/sedimentation
loss of visual amenity
loss of recreational use
introduction of weeds/ferals etc. to local areas

Table 1: Possible outcomes of fires that may be perceived as constituting an ecological emergency.

allow the tree species to persist at a site but not the hollow dependent mammals. Note that a fire frequency of <20 years would result in elimination of both trees and mammals.

The example can be further used to highlight the gap between common perceptions of fire as a disaster and contemporary scientific knowledge. Fires in tall moist forests often include sectors of high intensity during periods of drought (e.g. in 1939). The resultant scene is one of apparent disaster, with expanses of dead trees seemingly devoid of animal life. The temptation to portray the transformation from living to dead as a disaster is understandable. Trees and animals can die but the reality is that if such a fire occurs in mature forest of an appropriate age then it is likely that the species will persist. In fact, a true disaster would occur if a fire happened not when plants were mature, but immature (i.e. lacking regeneration capacity). Similarly a high intensity fire in a mature forest containing possums will not be a disaster provided that some part of the forest containing animals is unburnt and those animals can later reach the burned area when suitable habitat is available. A disaster would occur (loss of possums from the landscape) if all sites containing possums had their habitat destroyed. This could happen if all the possums were confined to hollows in dead trees and a fire consumed all the dead trees. We have used the example of these forests to illustrate the importance of understanding the fire regime. Similar, but not identical examples, can be found in many other Australian ecosystems. Commonality of processes exists though rates and mechanisms of such processes may differ.

Peat fires perhaps offer a special case of this extinction scenario. Consumption of peat eliminates a substrate and potential habitat that may have taken thousands of years to develop. Thus organisms solely dependent on peat as habitat, or those with all their propagules in peat, will be rendered locally extinct by a single fire. The fires of 1960–61 on the Central Plateau of Tasmania are a case in point. We are told that the peat-fire edge can still be seen there today. Three species of woody plant are believed to have been made extinct locally by these fires. Gill (1996) reviewed the case which he referred to as 'arguably the most ecologically significant fire in Australian history'. Thus extensive losses of species from landscapes that may be irreversible, or only reversible over a long time-frame.

While extinction is an immediate

concern of managers charged with responsibility to conserve biodiversity, we have noted other important ecological processes and properties in *Table 1* that may be of concern to many land managers. Rates of erosion, sedimentation and water yield may, for example, be important in natural and semi-natural landscapes that are managed for water supply. Again, the nature of the fire regime and thus the 'system-state' will be a paramount concern in assessment of the impact of any real or potential fire. For example, the tall moist eucalypt forests described in the prior example serve as water-supply catchments in the hinterlands of Melbourne. Water yield from such forests declines as trees regrow and re-establish their dominance (Langford 1975). Yield gradually returns to near maximal levels as forests gain development and stature. The recovery period may be 35 years or more (Langford 1975). Repeated fires at short intervals (e.g. <20 years) at a catchment scale would be disastrous for biodiversity (see above) and water yield. Note that the yield reduction is a function of time after fire and so is linked with the intervals between fires as well.

In summary, the state of the system, namely the set of fire regimes that prevail in a landscape, pre-conditions the responses of biodiversity and ecosystem processes to any particular fire. Awareness of this fundamental principle and the concept of fire regimes is a mandatory pre-requisite for decision-making and evaluation of ecological effects of any fire.

A Framework for Decision Making

It is evident from these examples that the relevant concepts are subtle and that practical application requires insight and knowledge that may be difficult to obtain. Furthermore such concepts and background knowledge do not necessarily mesh well with conventional emergency management of bushfires. How do we incorporate such considerations into emergency management and bushfire planning in general?

Major bushfires are essentially managed as destructive events. When human lives and property are at risk this is justifiable and understandable. We have briefly illustrated above that ecological consequences of such fires cannot be viewed simplistically in this manner, despite the popular slant portrayed in the media. In ecological terms the event has to be managed within the perspective of the fire regime. How do we meld important considerations of disaster management for human protection (which focus purely

on the immediate consequences of the 'event') with more complex ecological considerations (the fire regime), particularly during suppression of major fires? Here we argue that it is possible to achieve this by the implementation of simple systems for planning and decision support. Such systems may be relevantly applied during phases of disaster management (e.g. Preparedness, Response and Recovery, Paul 1999 or 'before', 'during' and 'after').

Key elements of the preparedness phase are: use of appropriate ecological decision-support methods; compilation of knowledge of the distribution of biodiversity and fire regimes; and the annual formulation of strategies which spell out what fire regimes are currently desirable based on the state of the system.

Ecological decision support can take a number of forms. One approach is to prepare guidelines that summarise ecological knowledge about appropriate or inappropriate fire regimes in some usable form. Another approach is to implement monitoring systems, on the ground, that are targeted at critical events such as time of first flowering in plants or the development of habitat structure. Gill and Nicholls (1989) describe an ongoing approach for plants which may be used to discriminate parts of a landscape in which vegetation may be able to cope with a fire from those parts which are not in such a condition. Note that these methods can be complementary, not mutually exclusive.

To apply the above methods effectively, knowledge is required as to where species of plants and animals occur in a landscape perhaps related to an effective vegetation map. Similarly, compilation of an overview of fire regimes in a landscape is dependent on the availability of mapped records of past fires over some reasonable time frame. This highlights the importance of good records. A logical platform for assembly of fire maps and fire details is in an effective fire management plan. Plans of this kind are currently being written and implemented in conservation reserves in NSW (Conroy *et al.* 1997, Bradstock 1999). A strong ecological fire management plan should bring the key elements (i.e. knowledge of fire regimes, ecological guidelines etc.) together in a coherent way and should compel the manager to annually evaluate the ecological status quo within the landscape under his/her jurisdiction. A good plan should also highlight potential problems that may result from suppression activities, such as trail construction, earthworks and the use of fire-fighting chemicals. Areas of

particular sensitivity to these activities may be identified in advance. Thus any major fire event is anticipated and critical areas in need of protection from a major fire or suppression activities can be identified. It follows from such a process that the location of critical areas may change from year to year as circumstances change.

During a major fire (the response phase) it is crucial that planning is implemented effectively. Contemporary management of major fires is now accomplished in many parts of Australia using the Incident Control System (ICS). ICS provides an ideal framework for incorporation of ecological management considerations into fire suppression. Development of the planning strand of ICS to incorporate roles for ecological specialists is required. Such specialists would provide the inputs from the preparedness phase and help to shape strategies and tactics for suppression that result in appropriate fire regimes and avoid adverse ecological impacts of suppression activities (i.e. use of MIST—Minimal Impact Suppression Techniques, Caling 1998).

There is an urgent need to integrate mapping of fires into the response phase of emergency management. We have noted that good maps of fires (areas burnt) are integral to planning for ecological management. Often, procrastination defeats good intentions in this regard. The longer the task is left, the greater the loss in accuracy. There are obvious practical and financial reasons for incorporation of mapping into the routine operational component of ICS. Mapping should be part of the mop-up. Detailed mapping provides baseline data for fire regimes, and can now be carried out using differential global positioning systems. Aerial photographs or other imagery in association with tree-height maps can assist with the mapping of fire intensities.

The 'recovery' phase following major fires is broad-ranging. Basic questions include: What fire regimes resulted? What are the possible effects and how can these be verified through monitoring on the ground? Execution of monitoring and feedback of information into planning should result from attempts to get to grips with these questions. Issues of rehabilitation and even, in extreme circumstances, reintroduction may arise if circumstances warrant (i.e. adverse fire regimes or effects of suppression). Analysis, interpretation and monitoring are required to adequately address these

problems. Again, part of the recovery phase may be capable of being dealt with under the ICS framework. Equally, a platform for many of these activities can be laid in a competent ecological fire management plan.

A postscript to the discussion of the 'recovery phase' is the desire that members of the public have for feeding native animals in the field with introduced fruits, hay, lawn clippings etc., capturing and tending wounded animals in 'refuges'. Some authorities desire to carry out expensive 'restorative' or 'preventive' actions after, or in anticipation of, erosion using readily-available introduced grasses. All of these actions may be inappropriate, unnecessary or unsatisfactory in conservation reserves but they are actions that need to be considered in the appropriate social, geographical and land-use context.

Conclusions

Enlightened management of major fire emergencies is dependent on awareness of the importance of fire regimes as a powerful influence on ecosystems. Not all major fires or parts of fires will cause ecological disasters. Disasters will arise when components of fire regimes are adverse to the ecological values of the area. A precise knowledge of fire regimes and clearly stated objectives are required to distinguish when potentially disastrous circumstances may emerge in landscapes. Comprehensive summaries of relevant ecological knowledge, monitoring systems, and knowledge of where plants and animals live are prerequisites for assessment of fire regimes and decision-making.

An ecological fire management system should bring together these elements. Modern emergency management systems such as ICS have potential for development to incorporate ecological planning to assist with the management of major fires.

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Ecological impacts of flood mitigation and drainage in coastal lowlands

There are increasing development pressures on the south-eastern Australian coastal lowlands. The climate of these coastal floodplains provides favourable conditions for crop and pasture growth but it also causes frequent flooding and propagates the effects of land use changes into streams rapidly. Government-encouraged drainage and flood mitigation schemes have altered the hydrologic response time of coastal catchments, increasing the volume of water and the speed with which it is delivered from floodplains into streams. These, in turn, have increased sediment, nutrients and pollutant loads into coastal streams and embayments.

Almost all of Australia's coastal embayment and estuarine floodplains are underlain by brackish water sediments, called acid sulfate soils, containing naturally-occurring iron sulfide minerals. These sediments oxidise when exposed to air producing sulfuric acid. Drainage and flood mitigation schemes have promoted the partial acidification of most NSW coastal floodplains and export of acidic drainage waters into coastal streams. Thousands of tonnes of sulfuric acid are exported annually into coastal streams. The ecological consequences of soil acidification and export can be severe. Introduced crops and pastures which are not acid-tolerant die or are stunted leaving exposed, bare, acid scalds which are strongly acidified, right to the surface. Acidic waters exported into streams cause massive fish deaths, fish diseases and dramatic changes in aquatic communities. Estuarine reaches can be rendered sterile for months at a time. Aquaculture and estuarine fishing are adversely affected and aquaculture, particularly oysters can be severely impacted. Lasting impacts on biodiversity have yet to be documented. These constitute persistent, recurring ecological emergencies, driven by climate, but whose causes may be buried in time. They are difficult to treat once initiated. Emergency procedures such as drainage or

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breaching of levees could have long-lasting ecological impacts.

Government responses have varied. Conflicts between farmers and fishers in NSW led to the formation of the multi-agency Acid Sulfate Soil Management Advisory Committee, ASSMAC. The effectiveness of the plethora of existing legislation in protecting coastal ecosystems in acid sulfate soil areas is questioned and an urgent review of the Drainage Act of 1903 is suggested. Institutional impediments to better floodplain management are identified. Recent trends in environmental management and planning towards self-regulation, 'marketisation', regionalisation and agency downsizing may have adverse impacts on coastal areas and should be examined. Finally, changes in attitudes and approaches of governments, agencies and landholders, which are producing environmental benefits, offer considerable promise in rectifying the ecological impacts of flood mitigation and drainage.

Coastal lowland development, drainage and flood mitigation in eastern Australia

Coastal lowlands throughout the world are under increasing development pressures as evidenced by continued clearing of mangroves and draining of wetlands. In Australia, eastern coastal floodplains were the first areas to be developed for agriculture use because of their generally favourable soil, water and temperature regimes (King 1948). These favourable factors and few environmental constraints to production (Nix 1994) have led

governments of all persuasions to actively encourage coastal floodplain development and protection through drainage acts and flood mitigation schemes.

There is also continuing urban expansion in coastal catchments. About 80% percent of Australians live in the coastal zone, and about 66% of these are concentrated around large urban centres on estuaries and inlets. In the period 1971 to 1991 the population of the non-metropolitan coastal zone grew by 95%, from 2.1 to 4.1 million people, compared with a 32% growth for all of Australia. About 25% to 30 % of the coast is subject to increasing development, most of this concentrated in the south eastern section of the country (State of the Environment, Australia 1996). Rapid coastal growth is expected to continue over the next five decades (National Population Council 1992).

Coastal lowlands are subject to frequent flooding and governments have sought to mitigate flood impacts through drainage, stream redesign, levies and floodgates. These activities have been extremely effective in controlling excess water and promoting productivity and development, but have produced unexpectedly severe water quality and ecological problems.

Almost all of Australia's coastal embayment and estuarine floodplains are underlain by brackish water sediments containing naturally-occurring iron sulfide minerals. These sulfides pose no problems provided the sediments remain beneath the watertable. When the watertable falls below the sulfide layer, either naturally through evapotranspiration or by drainage works augmented by levies and floodgates, sulfides oxidise producing sulfuric acid. Because of this, these sediments, which occur throughout the world, are known as acid sulfate soils (Dent 1986). Acid produced in the soil water attacks soil minerals dissolving aluminium, iron, silica, manganese and other species and forming a toxic brew harmful to both terrestrial and aquatic species. Rain causes the export of acidic groundwater into streams. Both

the generation and export of acid water is altered by drainage and flood mitigation. Major ecological impacts result from this export (Brown *et al.* 1983, Easton 1989, Callinan *et al.* 1993, Sammut *et al.* 1995, Sammut *et al.* 1996). Their cause is buried in the past, yet episodic ecological emergencies can continue for decades or centuries. Once started they are difficult to treat because of the large costs and complex social, institutional, legal and political factors.

This paper explores the interactions between hydrology, drainage and flood mitigation, acid sulfate soils and their ecological impacts in south-eastern Australia, and examines government response to the ecological emergencies generated and the institutional impediments to addressing them.

Hydrology of coastal catchments

Harries (1997) has recently reviewed acid drainage from mines in Australia. He used a climatically-based regional classification scheme similar to that developed by Nix (1994), to identify areas that have the highest potential risk for exporting materials into surface streams. Essentially this is determined by the trade off between rainfall, P (mm) and evapotranspiration, E (mm). Over sufficiently long time periods, of order a year, the runoff, R (in mm), from any given area is just the difference between rainfall and evapotranspiration;

$$R = P - E \quad (1)$$

There are two characteristics of rainfall that influence the overall export of materials into estuaries. The first is the ratio of runoff to precipitation, the runoff coefficient, $C = R/P$. Figure 1 shows the average runoff coefficient for NSW coastal rivers. The catchment average runoff coefficients in Figure 1 indicates where landuse changes may have, potentially, most impact. The smaller catchments such as the Brunswick, Bellinger, Bega, Hastings and Tweed have relatively high runoff coefficients and we expect that landuse changes in those catchments will have proportionally more impact on estuarine water quality and ecology than in streams where the coefficient is less than the approximately 27% average for NSW coastal catchments. The mean annual runoff coefficient for Australia as a whole is only about 8% (Smith 1998).

The second important characteristic of rainfall is its variability in time. As a consequence of their high rainfall variability, Australia and South Africa share the highest variability of annual stream-

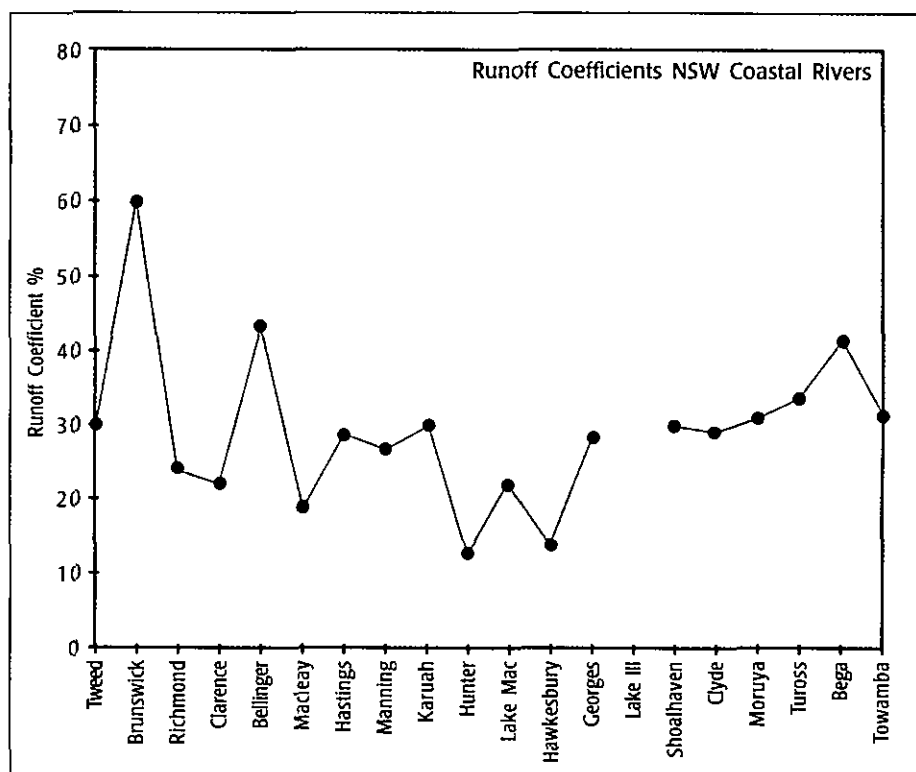


Figure 1: Annual runoff coefficients for NSW coastal catchments (Source: NSW DLWC)

flow, with a coefficient of variability of around 75% (McMahon, *et al.* 1992). Both the long term average runoff coefficients and the extreme rainfall events, as well as length of dry season, critically determine exports of water and pollutants into coastal streams.

Landuse changes and flood mitigation works can effect runoff and stream flow dramatically. Urbanisation dramatically increases the runoff coefficient to as high as high as 95%. Cropping, forestry, clearing and grazing in areas adjacent to coastal streams have the potential to change the volume, quality and rate of water entering streams through changes to cover, surface soil and stream bank conditions and evapotranspiration regimes.

The predicted impact of climate change on flooding and streamflow in coastal floodplains is widely and hotly debated. In Australia, these predictions are starting to converge, with quite different expected impacts across the country. Sea levels are now predicted to rise by about 0.25 m in the next 50 years and in the east, the climate may be drier but with more intense rains. The implications for coastal floodplains, ecosystems and their management remain to be elucidated but increased coastal flooding would appear to be a major issue (Smith 1998).

The hydrology of coastal floodplains provides favourable conditions for crop and pasture growth, but its variability also generates prolonged dry periods and

frequent flooding. This flooding propagates the effects of land use changes into streams rapidly. This export of water can lead to episodic ecological emergencies.

Flood mitigation and drainage of coastal floodplains

Before European settlement coastal floods resulted in many natural back-swamp areas remaining inundated for sometimes half the year. During early settlement, these back-swamps were valued for grazing as drought refuges. The government-encouraged development of coastal floodplains for agriculture resulted in the major re-engineering of back-swamps and coastal streams through flood mitigation and drainage works. Crops, generally, require floodwaters to be removed within five days, so that natural floodplains have quite different hydrological characteristics when drained.

Floodplain re-engineering has occurred at two scales. Flood mitigation works have been carried out at the floodplain scale and have been designed to divert upland flows rapidly through the floodplain. These systems have been designed and built by state and local government authorities and have been financed partly through federal and state flood mitigation schemes. Critical factors here are the ratio of the floodplain area to the upland area and the distribution of rainfall and runoff across the catchment. Coastal catchments with smaller floodplain to upland ratios require higher drainage densities to cope with upland flows. Figure 2 shows these ratios

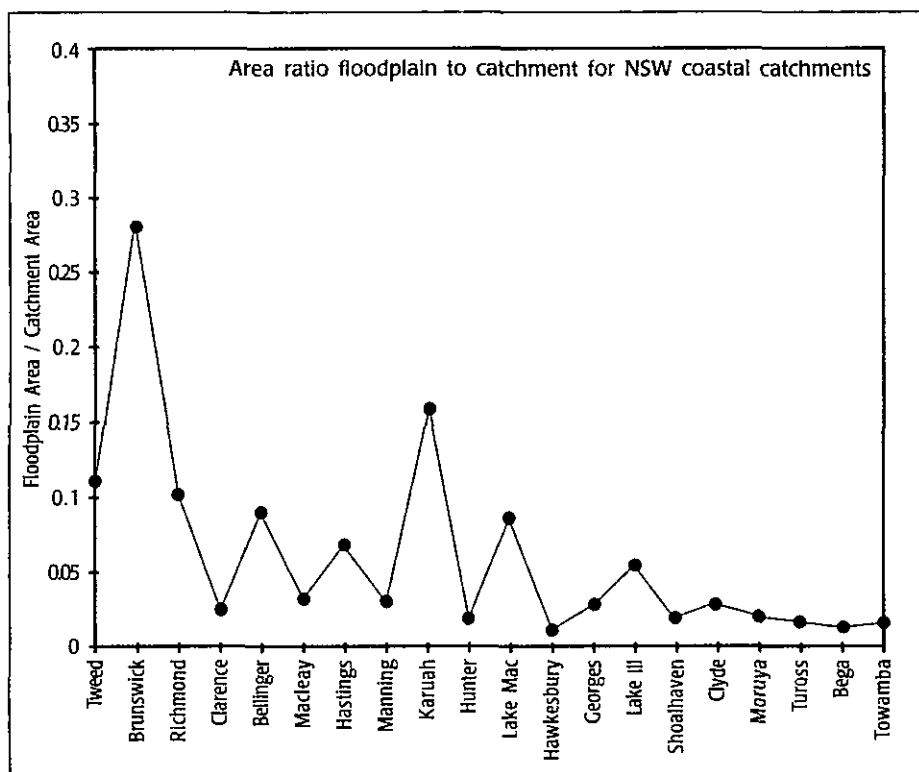


Figure 2: Ratio of floodplain area to total catchment area for coastal catchments in NSW (Source: NSW DWLQ)

for New South Wales. Rivers such as the Clarence, Hunter, Hawkesbury and Manning have substantial upstream areas which contribute both water and exported materials to the lower floodplains and estuaries.

As a result of devastating floods in the 1950s, New South Wales became a world leader in both floodplain risk mapping and flood mitigation works (Smith 1998). In the past, flood mitigation works and indeed most estuarine engineering works have overlooked the ecological consequences of drainage, installation of floodgates and levee construction. In NSW, the focus of engineering works is broadening with State Government projects such as 'Returning the Tide'.

At the more local scale, coastal floodplains in New South Wales have been drained by smaller drainage union drains. Drainage unions were set up under the Drainage Act of 1903 to empower local groups of farmers to drain floodplains cooperatively. Drainage unions are financed through rates from local beneficiaries of drainage. Currently, resources available to drainage unions have dwindled and many drainage unions have lapsed or their functions have been taken over by county councils or local governments. There is an urgent need for a review of the NSW Drainage Act.

Many local drains have been constructed by straightening, widening, deepening, de-snagging and floodgating existing meandering, floodplain streams. Drainage union drains are usually connected to a

network of smaller individual farm drains. Drainage is a technical endeavour, however, most local and farm drains have not been designed, rather they have evolved. The existing drainage network in some areas appears excessive (White *et al.* 1997).

There has been confusion on the function of farm drains, with many believing that they are necessary to lower water tables. Since many of the coastal crops use groundwater during dry times, excessive lowering of watertables may be counterproductive. In most cases, the proper function of drains is to remove surface water from fields as quickly as possible (White *et al.* 1997, Wilson *et al.* 1999). The dense network of drains in some floodplains was necessary because of the small undulations of floodplains. Laser levelling of floodplain areas now being practised in the sugarcane and tea tree industries permits better control of surface water, and enables a decrease in drainage density through the infilling of drains.

Floodgates on drains prevent tidal and partial flood ingress into drained areas and permit the drainage of land to mean low tide level. Floodgates also limit fish passage to creeks and back-swamp areas which were natural feeding and breeding areas in high water periods. Environmental audits and mapping of floodgates have been carried out by NSW Fisheries and others on the Clarence and Hastings Rivers, with other river audits planned for the near future. These audits have

shown an amazing number of structures in varying degrees of repair.

Some floodgates protect land which is below mean sea level. The wisdom of protecting such low-lying areas from what seems to be inevitable inundation seems questionable. Apart from these low-lying regions, floodgates are only needed during flood events and could otherwise remain open. Farmer groups have naturally been wary of such proposals, fearing inundation of land and salinisation of adjoining areas. The inadequacy of floodplain elevation data is an impediment to determining risks of inundation. Current elevation data gives 1 m elevation contours whereas contour intervals of at least 0.1 m are required. Cane farmers on the Tweed River, with the assistance of local government, have opened floodgates to allow tidal flushing and fish passage.

The impact of a predicted 0.25 m rise in sea level due to climate change within the next 50 years will be significant on all low-lying areas of coastal floodplains. A policy response to this expected rise has yet to be developed.

Drainage and flood mitigation impose changes. One way of determining how rapidly land use changes may be expected to propagate into surface streams is to consider the residence times, t (days), of materials in the near stream environment. This is estimated by dividing the storage volume of the particular environmental compartment, V (m^3), by the flux of material, Q (m^3/day):

$$t = V / Q \quad (2)$$

For groundwater in coastal floodplains, a key factor is the storage of material in the unsaturated zone in the soil. Here V is typically 20 mm and recharge into this zone, Q , can be 800 mm/year. Equation (2) therefore gives a residence time of only 9 days. In contrast, for arid inland areas, V can be about 1000 mm and Q approximately 10 mm/year giving a residence time of 100 years. Land use changes in coastal floodplains are transmitted much more rapidly to streams than in arid areas. The residence time for water in the floodplain with its back-swamp areas has been changed from of order 100 days under natural conditions to around 5 days under drained and flood mitigated conditions. In the past, much of that water in the undrained back-swamp areas evaporated, now it is exported into streams.

Drainage and flood mitigation schemes have shortened the residence time of coastal floodplains, increasing the volume

of water and the speed with which it is delivered from floodplains into streams. These, in turn, have increased sediment, nutrients and pollutant loads into coastal streams and embayments.

Acid sulfate soils in NSW

Australia has over 34,000 km² of iron sulfide-rich coastal acid sulfate soils under a variety of land uses (White *et al.* 1997). In Australia, recognition of their importance has lagged behind the rest of the world. The first Australian maps, showing their widespread distribution, were only published in 1995 (Naylor *et al.* 1995) together with guidelines for their management and use (Blunden and Naylor 1995). Acid sulfate soil maps in NSW are risk maps showing the probability of occurrence of acid sulfate soils. The highest risk category is where the iron sulfide layer is within 0.5 m of the soil surface (Naylor *et al.* 1995). Figure 3 shows the areas of high risk and the estimated total acid sulfate soils in coastal NSW.

The area of acid sulfate soils in Figure 3 is larger in the northern part of NSW than in the south, reflecting the change in river morphology between coastal embayments in the north and flooded river valleys in the south. The largest concentration of high risk soils occurs on the Clarence River. Research on the Tweed (Wilson 1999) and Richmond Rivers (Sammut *et al.* 1996) has found acid production rates of order 0.1 to 0.3 tonnes sulfuric acid/hectare/year together with similar amounts of dissolved iron and aluminium. Some coastal floodplains are capable of discharging 1,000 tonnes of sulfuric acid following a single storm event. Once oxidised, floodplains can continue to discharge acid water for centuries (White *et al.* 1997). Floodgates promote the formation of acid reservoirs which leak acidic waters into the downstream environment for months (Sammut *et al.* 1996). Any emergency management procedure which requires the rapid drainage of a lowland area or the breaching of a levy bank should be handled with great care since it could cause a persistent acid discharge through watertable lowering.

Ecological consequences

The ecological consequences of soil acidification and export are well documented. Introduced crops and pastures which are not acid-tolerant can show severe affects. Under extreme conditions, most plants die leaving exposed, bare, acid scalds which are strongly acidified right to the soil surface. In less extreme cases, plant productivity is greatly reduced

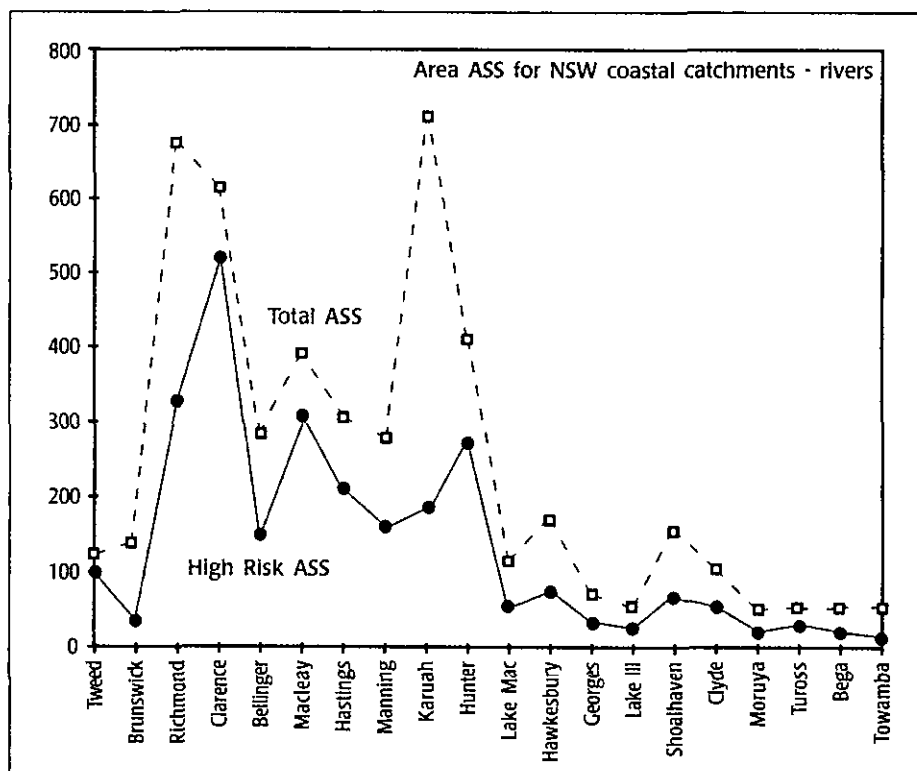


Figure 3: Area of high risk and total area of acid sulfate soils in coastal NSW

(Dent 1986). In streams the acidic waters can have dramatic impacts including: massive fish deaths (Brown *et al.* 1983, Easton 1989), fish diseases (Callinan *et al.* 1993, Sammut *et al.* 1995) and dramatic changes in aquatic communities (Sammut *et al.* 1996). Estuarine reaches can be rendered sterile for months at a time. Lasting impacts on biodiversity have yet to be documented. These in-stream events constitute persistent, episodic ecological emergencies.

Aquaculture is also severely affected. Oyster production losses in NSW of up to \$12 million have been claimed. In addition, concrete and steel infrastructure corrosion has resulted in costs of over \$4 million (White *et al.* 1997). Economic losses of fish are more difficult to estimate because of the mobility of fish and the contributions of extraneous factors such as by-catch, over-fishing and habitat destruction. Crop and grazing losses and impacts on human health are yet to be determined.

The Sydney rock oyster has been farmed for over 130 years in NSW and middens indicate they have been eaten for over 8,000 years. The NSW oyster industry is the state's most valuable fishery and one of Australia's major aquacultural producers with production worth around \$30 million. It is a significant regional employer and contributor to coastal economies. Oysters are filter-feeders who extract food from particulate and dissolved materials in water. They take between two and a half to three and a half years to reach market size. During that

time the average oysters will filter about 1ml of estuarine and river water. Oysters are mobile for only a brief period in their early life, after which they are sedentary. Their feeding habits and life-style therefore make oysters valuable indicators of water quality in our coastal zone. Figure 4 shows the 50% decline in production of Sydney rock oysters over the last twenty years (data from NSW Fisheries).

There are many factors that have caused the production decline in Figure 4. Some are demand-side driven, some are supply-side driven. Of the supply-side factors, one of the most important is the degradation of water quality in coastal rivers and estuaries. Significant problems occur after runoff-producing rains especially in acid sulfate soil areas. Direct impacts through shell dissolution in acid waters has been demonstrated. It has also been proposed that devastating oyster diseases, such as QX and winter mortality, may be linked to runoff from acid sulfate soils (J. Sammut, personal communication 1998). Oysters are a valuable indicator of the sustainability of coastal development.

Government responses

Conflicts between fishers and farmers became so intense that the NSW Minister for Agriculture and Fisheries set up the Acid Sulfate Soils Management Advisory Committee in 1994 to provide government with advice on the management of acid sulfate soils. Because acid sulfate soils cut across the jurisdiction of many government departments, ASSMAC has attempted

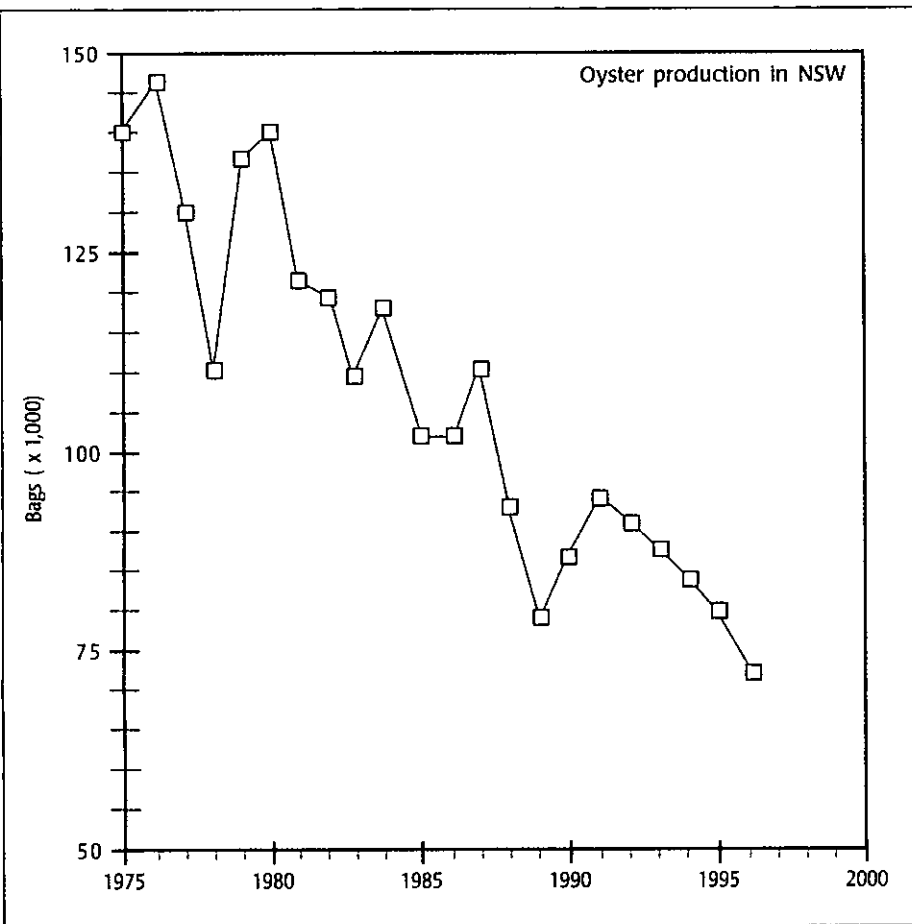


Figure 4: The decline in production of Sydney Rock Oysters in NSW since 1975. Each Bag is 100 dozen oysters (NSW Fisheries)

to provide a whole of government approach to the problem; providing information, a forum, training, guidelines and maps on acid sulfate soils. ASSMAC have used an approach based on awareness, education, research, and legislation (as a last resort). Until recently, however, this effort was under-resourced. In 1997 the NSW Government set up the ASSPRO funding program, with \$2.1 million over 3 years, to provide resources for education and training, research and remediation projects.

Harries (1997) has estimated that the cost of remediating already acidified mine dumps could be as high as \$110,000/ha. If this applies to already acidified coastal floodplains, then the cost of remediation could be tens of millions. There are no quick fixes for already acidified floodplains. In China, rice paddies are still affected by acidity from acid sulfate soils at least two hundred years after they were first developed.

ASSMAC's approach to prevent the further disturbance of acid sulfate soils and to correct existing problems has been to raise awareness of the consequences of disturbance, to provide training and education, to promote research particularly on management and rehabilitation strategies and to explore

regulations. ASSMAC has encouraged the adoption by coastal councils of Local Environment Plans, LEPs, specifically for acid sulfate soils. Hastings Shire Council was the first to approve such a strategy. Compliance with these LEPs is a significant issue. While regulation is but one management option, it would appear to be a missing option in acid sulfate soil management. The reliance on LEPs without overarching regulation would seem to be a deficiency in the range of options for mitigating the impacts of acid sulfate soils.

ASSMAC has been criticised by both land-holders and fishers and aquaculturalists as being too bureaucratic, too timid, too slow to act and ineffective. Yet in the 4 years ASSMAC has been established an array of information materials have been produced and projects have been completed. ASSMAC's tasks are politically and institutionally complex, reflecting the complexity of acid sulfate soil management, institutional arrangements and conflicting stakeholder demands. ASSMAC's output has been quickly transferred to other states, and a National Working Party on Acid Sulfate Soils (1998) has recently released a Draft National Strategy for the Management of Acid Sulfate Soils.

Successful prosecution under the Clean

Waters Act of any recent, deliberate discharge of acidity from acid sulfate soil areas through drainage would send a strong signal to the community. The NSW EPA is, at present, bringing to settlement the first successful case on discharge from drains in acid sulfate soils. Previously, the EPA had regarded acid discharge from drains in acid sulfate soil areas as diffuse, rather than point discharge and therefore outside the ambit of the Clean Waters Act.

Prosecution is seen as a last resort. Tweed Shire Council, in northern NSW, has led the way in facilitating cooperative approaches to estuarine management. It brought together land-holder, fisher, aquacultural and other representatives to agree on common goals and has provided them with expert advice. As a result, canefarmers have been using their own resources in attempts to improve water quality by re-engineering the floodplain using laser levelling to remove low spots which pond water and improve surface shedding of water. In this technique, fewer drains are needed resulting in lower acid discharges. This has resulted in a win-win situation as cane production has been improved by up to 10%. In addition, farmers are applying lime to further decrease acid production and have also opened floodgates in order to increase fish passage and tidal neutralisation of acid water. This cooperative model involving land and water users and the facilitation of local and state governments, may be appropriate for the management of all our estuaries.

Institutional impediments to floodplain management

There are a plethora of extant laws applicable to the protection of coastal estuaries, embayments and streams in NSW. The more important of these are the Rivers and Foreshores Hydraulic improvement Act of 1948, the Fisheries Act of 1994, the Clean Waters Act, the Local Government Act, the Native Vegetation Act and the Protection of the Environment Act. There are several specific State Environment Protection Plans, such as SEPP 14 Wetlands and SEPP 46, the Clearing of Native Vegetation. SEPPs are almost universally detested by broadacre land-holders, since they deprive them of freedom of decision-making over land use on their properties. Because of this ASSMAC has been loath to introduce an acid sulfate soil SEPP. A critical study of the use of these instruments and their effectiveness in protecting estuaries, and the need for overarching regulations

could be of significant benefit. The general perception amongst fishers and aquaculturalists is that there is a great reluctance on the part of government agencies to use existing legislation.

There are several determining authorities in coastal floodplain and estuarine areas who are exempt from development approvals or the EIS process. These authorities have been major participants in the modification of estuaries and floodplains. A critical examination of the number and operation of determining authorities in relation to acid sulfate soil development could prove useful.

In its examination of the management of selected coastal rivers, the NSW Health Rivers Commission has concluded that there is no single authority with sole responsibility for the health of the river systems. Indeed it has identified that there are conflicting objectives amongst those agencies currently managing rivers and estuaries. Their suggested solution has been the appointment of a River Manager with sole responsibility for the health of the river. Victoria, with a similar but broader aim, has established Catchment Management Authorities with considerable responsibilities, power and resources. In NSW, both solutions appear unacceptable, at present, since they introduce, essentially, an additional level of government.

Rapid and profound changes are occurring in the way the Australian environment is managed. Some are the result of the national thrust for Ecologically Sustainable Development, some resulting from National Competition Policy and the COAG 1995 reform process. These changes include (Dovers and Guillet 1998):

- a move away from regulation towards self-regulation, codes of practice and agreements;
- 'marketisation' of government authorities and the reduction of government involvement through outsourcing, corporatisation and the application of market-based policy instruments;
- a large shift to community participation and involvement in environmental management and monitoring;
- increasing use of risk assessment and management approaches and policy and decision making in the face of uncertainty;
- a strong regional focus in planning, policy implementation and program delivery.

The efficacy of self regulation for acid sulfate soil development deserves critical

examination. The 'marketisation' of government authorities has considerable implications for the management of estuarine environments. It has led to the downsizing of management and regulation departments with associated loss of corporate memory, and the reliance on consultancies whose products are of variable quality. Monitoring, an expensive process, is often an early casualty, and there is a danger that the considerable store of data will either be more difficult to access or will be lost. Downsizing also means that the supply of advice to local government and community groups involved in environmental management inevitably decreases. Indeed, the very necessary supply of back-up advice and information to such community groups has not been adequately resourced in the transfer of responsibilities to these groups for acid sulfate soil management.

Regionalisation does have the advantage of transferring assessment and decision making back to the affected area. This ought to move these responsibilities back to the community. Since regional bodies in NSW are appointed by state government, this possibility is weakened. Regionalisation also tends to duplicate functions and tends to diminish or even abandon activities where the centralisation of knowledge and skills is appropriate. The effect of all these changes on the management of coastal floodplains and downstream impacts is not described and would make an important and useful study.

Concluding comments

This paper has outlined the interaction of hydrology, flood mitigation and drainage of sulfidic coastal lowlands and their ecological impacts in NSW. On one hand, our attempts to control flooding have been successful in that they have allowed successful agriculture. On the other, this has promoted the oxidation of acid sulfate soils and down stream ecosystems have deteriorated. A cause buried in the past has resulted in persistent, episodic ecological emergencies due to periodic stream acidification. The decline of oyster production in NSW over the last 20 years is but one example that our estuaries and coastal catchments have problems. Any procedure which involves draining of flooded coastal lowlands or breaching of levees for emergency management, without proper treatment, runs the risk of producing a chronic acidic water discharge with serious ecological, economic and social consequences which are reversed only with difficulty.

There are a plethora of laws applicable to coastal lowland management. It would be valuable to review the role and efficacy of that body of legislation and its use in maintaining and improving estuarine health. In particular, an urgent review of the Drainage Act of 1903 is long overdue. There is also a pressing need to consider how coastal river systems might best be managed. The recent trends in environmental management in Australia to self regulation, marketisation, regionalisation and agency down sizing have very important implications for coastal floodplain management and ecology. These remain to be fully explored.

Acknowledgments

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New Books

The day the sky fell down: the story of the Stockport air disaster

Morrin, Stephen
Stephen Morrin, Stockport, England, 1998, 145pp

10 am on Sunday 4 June 1967, a British Midland Airways, Canadair C-4 Argonaut airliner packed with returning holidaymakers from Palma, Majorca, turned onto the approach to Ringway Airport, Manchester. To Captain Harry Marlow and his First Officer Chris Pollard at the controls, it seemed a perfectly normal approach. The slight drizzle and low cloud presented no kind of hazard, yet nine minutes later the aircraft lay a tangled, twisted exploding wreck in the centre of Stockport. Of the 84 passengers and crew on board, only 12 survived. What went wrong?

Safe havens from bush fires: planning a response to external fire threats for schools, hospitals and other public buildings and the community

Bush Fire Service of Western Australia
Bush Fire Service of Western Australia, Perth, 1998, 16pp

Bush fires are annual events in Western Australia, threatening communities with the risk of death, injury, destruction or damage of property. The purpose of this document is to consider the threat of bush fires to communities, and the identification and development of public buildings as a community safe haven. Public buildings which may be considered for development as a safe haven include those with large populations or features that consider the welfare of a large cross section of the community, such as schools, halls and hospitals.

America's disastrous disaster system

Hunter, J. Robert
Consumer Federation of America, Washington, D.C., 1998, 14pp

This paper asserts that the U.S. has allowed its system of preparing for and responding to natural disasters grow in a haphazard way that inconsistently deals with these events and inadequately acts to save lives and property from loss.

It examines the risks due to flood, wind, and earthquake; how we cover the costs of these risks; current problems in covering these costs; and why the current system needs to be changed. It also suggests a system that ends taxpayer subsidy of anticipated levels of damage, moves the cost of high risk to those who live in high-risk areas, and minimises death and damage due to unwise construction.

Disasters and the media: managing crisis communications

Harrison, Shirley
Macmillan, Hampshire, England, 1999, 238pp

Covers issues on: Crisis, emergency and disaster — Television news — The national crisis — The local news — The local crisis — communicating in an international emergency — Civil emergencies and the media — The Hillsborough disaster — A newspaper at the heart of the Hillsborough tragedy — A tale of two cities: Liverpool — A tale of two cities: Sheffield — The management of an organisation in crisis — Learning the lessons — Training and rehearsal — Media liaison: lessons from the front — Postscript.

Cooperating with nature: confronting natural hazards with land-use planning for sustainable communities

Burby, Raymond J
Joseph Henry Press, Washington, D.C. c1998, 356pp.

Covers issues on natural hazards and land use: an introduction — Planning and land use adjustments in historical perspective — Governing land use in hazardous areas with a patchwork system — Integrating hazard mitigation and local land use planning — Hazard assessment: the factual basis for planning and mitigation — Managing land use to build resilience — The third sector: evolving partnerships in hazard mitigation — The vision of sustainable communities — Policies for sustainable land use.



Assessing the risk associated with importing and keeping exotic vertebrates in Australia

Australia is a geographically isolated continent with a rich diversity of indigenous flora and fauna. This diversity was even greater 200 years ago before European settlement and the consequent habitat modification and ecosystem imbalance caused in part by the introduction of new species.

The development of agriculture in Australia relied on the introduction of exotic animal species, such as goats, pigs and horses, some of which subsequently established widespread wild populations and became pests. European rabbits *Oryctolagus cuniculus* were brought in with the first European settlers for food, fur and skins and have subsequently become Australia's most widespread and significant pest animal (Australian Bureau of Statistics 1996). Other exotic species which have subsequently become pests were brought in as companion animals (for example cats, *Felis catus*), for sporting purposes (for example European red foxes, *Vulpes vulpes*), or simply to make Australia seem more 'European' (for example European starlings, *Sturnus vulgaris*). Ironically, a few species were brought in to control existing pests and became pests themselves (for example cane toads, *Bufo marinus*). The result is a suite of introduced animal species—about 20 mammals, 30 birds, 20 freshwater fish, several amphibians and around 500 invertebrates—which are pests of agriculture or the environment (Australian Bureau of Statistics 1996). Hindsight provides the opportunity to prevent additions to this extensive inventory of pests and risk assessment provides a mechanism.

Risk assessment processes for importing and keeping exotic vertebrates have an important role to play in reducing the likelihood of new species establishing and causing adverse impacts in Australia. Risk assessment involves identifying hazardous events (in this case the establishment of new exotic pest species in Australia) and estimating the likelihood that such events will occur and the probable consequences if they do (Beer and Ziolkowski 1995).

By Mary Bomford, Principal Research Scientist, Bureau of Rural Sciences (BRS), Australia and Quentin Hart, Senior Professional Officer (BRS), Canberra,

This paper describes the regulation of exotic animal imports in Australia and outlines the risk assessment approach developed by Bomford (1991) that is currently used in Australia. Ways to improve this process by developing a more quantitative approach are then discussed.

The risk

There is an increasing demand for exotic species imports around the world to meet recreational, economic and conservation goals (Nilsson 1981, Lodge 1993). These species have the potential for adverse impacts on agricultural, environmental and urban systems. Future community demands and international obligations under World Trade Organisation agreements concerning free trade are likely to allow increasing numbers of species to be imported into and kept in Australia.

There is a risk that new imported species, or exotic species that are currently kept in private collections and zoos, could escape and establish wild pest populations. For example, the Somali dwarf mongoose *Helogale undulata rufula* is a small colonial carnivore that has significant potential to inflict damage on Australian wildlife if a wild population established. Yet breeding colonies of this species are kept in open enclosures in Australian zoos. Ferrets have established wild populations in New Zealand and have had highly detrimental effects on wildlife (Lever 1985). Yet ferrets can be kept without any permits or restrictions in Australia and a small wild population is believed to have established in Tasmania.

The forms of adverse impact that an established population of an escaped exotic animal could inflict include:

- reduction of agricultural productivity (competition with grazing stock for feed and water, damage to horticultural

crops, predation on stock and land degradation);

- environmental damage (competition with native species for food, water, shelter and nest sites; predation; alteration of vegetation communities through selective grazing and land degradation);
- spread of parasites or diseases;
- attack, harass or annoy people or companion animals, particularly in urban environments;
- structural damage; and
- cost and collateral impact of control measures.

Benefits and issues

Exotic species can bring many benefits to agricultural production, recreation, tourism, scientific and medical research, international conservation efforts and education.

Many of Australia's agricultural and recreational industries are based on introduced animals and there is continuing demand to import new species and genotypes. A number of zoos in Australia are involved in coordinated breeding programs for endangered species, both for release programs and to maintain the genetic integrity of zoo populations. The display of such species may also educate the public about environmental and biodiversity issues.

Key issues relating to assessing the risk of importing and keeping exotic vertebrates are:

- What is an acceptable level of risk relative to potential benefits for the import and keeping of exotic species?
- How can risk exposure be minimised and accepted risk be managed?
- What criteria can be used to assess the potential costs and benefits of importing and keeping exotic species in Australia?

Regulating exotic animal import and keeping

Legislative control over the import of exotic animals is held jointly by the peak Commonwealth environment agency, Environment Australia, and the Common-

wealth quarantine agency, the Australian Quarantine and Inspection Service (AQIS). Both organisations rely on advice on the 'pest potential' of species from a national Vertebrate Pests Committee (VPC) whose members represent relevant State and Federal government agencies. VPC is responsible for examining and reporting on arrangements necessary for the exclusion and control of mammals, birds, reptiles and amphibians, but not fish.

Until 1991, VPC, Environment Australia and AQIS had no framework or guidelines for assessing the risks associated with the import and keeping of potential vertebrate pest species in Australia. Risk assessments were made in a fairly subjective way and were difficult to justify if political pressure was brought to bear on a decision.

Transparent, evidence-based risk assessment processes can be used to increase decision-making objectivity and reduce the influence of social, economic and political pressures. It is essential to get the risk assessment process right prior to the import of an exotic species, because once permission is given to allow a species into the country, it is extremely difficult to reverse it.

The VPC currently lists exotic species in one of five categories based on the threat they pose to agriculture and the environment:

- **Category 1:** 'entry and keeping prohibited';
- **Category 2:** 'restricted to high security collections';
- **Category 3:** 'other collections';
- **Category 4:** 'entry and keeping unrestricted'; and
- **Category 5:** 'pests already widespread'.

Since 1994, VPC has used the risk assessment model developed by Bomford (1991) to determine whether the benefits will outweigh the risks for all species recategorisation applications. Applications are made to VPC by public and private zoos and individual keepers to downgrade category listing for species that they want to import, or species that are already in Australia but that they want to keep in a lower security collection. Linked to the recategorisation process are assessments for 'Approved Collection Status' (ACS) to allow a particular institution to keep a species.

This takes into account the security, credentials and financial viability of the proponent organisation. It also takes into account how conducive the surrounding environment is likely to be to establishment of the proposed species.

The risk assessment model

Bomford's (1991) model was developed on the premise that the import and keeping of exotic vertebrates should be subject to a balanced and rigorous assessment of risk, take account of both potential benefits and harmful impacts, and make use of ecological theory and information on the biology of the species being assessed. The component processes considered are the probability of:

- an exotic species escaping;
- the escapees establishing a wild population;
- the escapees or established population being eradicated; and
- harm associated with the three former factors outweighing the potential benefits associated with the species being imported.

Clearly, some species possess attributes that enhance their ability to escape. Security of premises and keeping restrictions can be used to manage this risk. However, no physical barriers are completely proof against: natural disasters such as floods, cyclones, fires and earthquakes; wilful removal by groups such as animal liberation or illegal traders; and/or vandalism, terrorism, civil unrest or war.

A review of the ecological literature on the factors that affect exotic animals establishing, including analyses of previous successful and unsuccessful introductions, was used to draw generalisations about factors that may increase the probability of establishment in Bomford's model. These include: escape conditions; environmental factors; species attributes associated with establishment; and, public attitudes. There has been little research to identify or quantify the relative significance of these factors or how they might interact.

Contingency plans for mounting a rapid response to the escape of exotic animals from captivity enhance the probability of early detection and eradication and reduce the probability of establishment. The existence and adequacy of such plans may be taken into account in the risk assessment process (Moller and Barret 1996). Once a population is established, eradication chances are likely to be low or non-existent due to high costs, lack of political will and, for many species, the extreme difficulty of the task (Bomford and O'Brien 1995).

There are no cases of any widespread exotic vertebrate population being eradicated on any continent. It is therefore critical that there are contingency plans and associated resources for early

detection and eradication of newly escaped individuals or small localised populations that become established.

Bomford's model weighs estimated adverse impact against estimated potential benefits. A key factor in estimating potential environmental and agricultural damage is the prediction of the probable population densities and distributions achieved by the introduced animal in Australian environments. This is an extremely difficult task, although bioclimatic and landuse matching between the species overseas range and Australian conditions may assist with this task, and is discussed more fully by Bomford and Hart (in press).

Species assessments

Since VPC accepted Bomford's model in 1994, it has been used to assess 14 mammals (11 approved for lower security categories), two reptiles (both approved for lower security categories) and 30 birds (mixture of higher, lower and unchanged security categories approved). The main grounds given by VPC members for rejecting applications was the perceived high risk that the species could establish a wild population, and the associated pest potential, particularly in relation to potential competition with native species and damage to agricultural crops.

Little consideration appeared to be given to potential benefits by VPC. Environment Australia has used the model to assess about 350 exotic bird species known to be present in Australia, to determine the level of risk they posed and hence determine appropriate security requirements for their keeping under the National Exotic Bird Registration Scheme.

An example of the use of the exotic species risk assessment process in Australia is the recent rejection of an application to import the rock hyrax *Procapra capensis*.

This rodent-like mammal is considered hard to contain and has a number of features that indicate a high risk of rapid establishment and spread and the possibility of agricultural and environmental damage including small, fast-moving and secretive; high reproductive and dispersal rates and opportunistic feeding; and potential for wide distribution and high abundance, coupled with generalist.

Quantifying the risk assessment model

Bomford's (1991) model does not use a quantitative scoring system because she considered that this could give a

misleading impression of objectivity and accuracy. Instead, the model was designed to operate as a checklist and decision guide to assist VPC decision makers by ensuring all relevant information was considered. Bomford's model has proved a valuable tool for ensuring all relevant information is taken into account in risk assessments, and also for providing a reasonable level of consistency in assessments. However the model requires a lot of data which is time consuming to collate and assess and for some species data are unavailable to assess particular criteria, particularly criteria for assessing potential benefits and harmful impacts. This can lead to subjective risk assessments. This is a common problem, and although there has been a trend towards more quantitative risk assessment models in the last decade, most biological risk assessments are at best semi-quantitative, due to incomplete information.

VPC is currently considering the feasibility of modifying Bomford's model to incorporate a more quantitative approach to make assessments simpler, less subjective and, hopefully, more reliable. One way to develop a more quantitative risk assessment process is to consider past animal introductions into Australia and compare the attributes of species that established to those that failed. The Bureau of Rural Sciences in the Commonwealth Department of Agriculture, Fisheries and Forestry is assessing the feasibility of developing such a quantitative scoring system based on past successful and unsuccessful bird and mammal introductions into Australia. Of species that established, the attributes of species that became widespread or caused damage can be compared to those that remained localised or did not become pests. Attributes strongly associated with establishment could be allocated a high 'establishment risk' score and attributes strongly associated with environmental or agricultural damage could be allocated a high 'pest damage risk' score. Less strongly associated attributes could be given lower scores. If particular combinations of attributes were strongly associated with establishment and/or damage then these combinations could be allocated additional scores.

Any new species proposed for import or keeping into Australia could have its total 'establishment risk' and 'pest damage risk' scores calculated based on its attributes. Assuming that attributes associated with past successful introductions will indicate the risk for future introductions, and that attributes

associated with current pests are also likely to be associated with future pests, then the total risk score for a species will give an indication of the probability it will establish and become a pest. A score for the bioclimatic match between a species' current distribution and Australian environments could also be included in the total 'establishment risk' score. Such a quantitative scoring system model could be validated by testing its ability to correctly predict the success or failure of past introductions of exotic animals to other countries with similar climates and land uses to Australia, or its accuracy in predicting the success of future introductions to Australia. The model could then be refined to improve its predictive capacity.

Conclusions

There is a need to assess and manage the risk that exotic animal species imported into Australia for keeping in captivity could escape and establish wild populations capable of damaging agricultural production or native species and natural environments. The ecological literature on animal invasions indicates that a range of attributes are often associated with successful establishment of exotic animals and with their potential to become pests. This information has been used to develop a largely qualitative model (Bomford 1991) of risk assessment which has been used successfully since 1994. Due to a perceived need for more quantitative and simpler risk assessments, a review of the process is now being undertaken by VPC.

There is a high degree of uncertainty in assessing the likelihood that a species could establish in a new environment. This is largely due to the variability of factors associated with successful establishment; inadequate information on the ecology, physiology and behaviour of most species; and the cost and long-term nature of research needed to obtain these data. The unpredictability of changes to species' ecology, behaviour, phenotype or genotype in new environments also contributes to uncertainty in predicting whether species will establish and become pests. Although it is desirable to develop more quantitative approaches to risk assessment, these uncertainties will limit the extent to which this is feasible. Hence there will remain a need for a wide margin for error when assessing and managing the risks that new exotic species could establish wild populations that have harmful impacts.

There is also a pressing need to develop contingency plans to respond effectively

to escapes of exotic species to prevent wild populations establishing and spreading. Because there can be no guarantee that escape can be prevented or eradication be possible, species considered to pose a high risk should be prohibited even if they represent significant potential benefit. Despite the risks posed by exotic species imports, there are also economic and social benefits that need to be considered in decisions on allowing imports. Banning imports poses the risk of encouraging illegal smuggling. Hence a scientific and evidence-based, transparent risk assessment model, which is quantified to increase objectivity and reliability where adequate information is available, is the best approach to manage these risks. This will allow the balance between free trade and risk to agriculture and the environment to be optimised.

Australia has an extremely high expenditure on exotic vertebrate pest control. By contrast, little money or resources are used to assess or manage the risk of further exotic species becoming pests. It is appropriate that adequate resources be invested in the risk assessment and management process.

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News...

8th IDNDR Pacific Regional Disaster Management Meeting

The 8th IDNDR Pacific Regional Disaster Management Meeting was held in Apia, Samoa on 6-10 September. On the first evening, the Samoan Government generously hosted a kava ceremony, opening ceremony and cocktail party officiated by the Samoan Minister for Agriculture, Forests, Fisheries, and Meteorology, and attended by the Prime Minister of Samoa.

The meeting considered many important issues relating to disaster management in the region, including the implementation of agreed disaster reduction work programmes and the transition of regional coordination of disaster management activities to the South Pacific Applied Geoscience Commission (SOPAC). Participants expressed support for the continuation of these meetings beyond the end of the International Decade, although this was to be the last one to be held under the IDNDR banner. These meetings now provide an important focus for disaster management activities in Pacific Island Countries and are a key forum for the exchange of ideas and facilitation of regional cooperation.

New Books

Fire-related aspects of the Northridge earthquake

Scawthorn C; Cowell A. and Border F. 1998, International Inc., San Francisco, Calif, EQE.

Fires following earthquakes are a potentially serious problem due to multiple, simultaneous ignitions at a time when emergency response is seriously impaired. The January 17, 1994 Northridge earthquake was the largest to occur in a U.S. city in more than 20 years, sparking about 110 earthquake-related fires. This report provides the results of research performed with the support of the National Institute of Standards and Technology. It contains information on the Northridge quake and its impacts, including seismology, building damage, the effects on water and gas supplies, and fire department response. It also includes sections on data on fires following the quake, a comprehensive analysis of distribution and ignition characteristics, information on operations at selected fires, and lessons and observations. (1 v.)

Gresford: the anatomy of a disaster

Williamson, Stanley 1998, Liverpool University Press, Liverpool, 224pp.

The first readily available account of the worst disaster of the North Wales coalfield and one of the worst in the history of the British mining industry. The disaster occurred in 1934: 256 men lost their lives, 200 women were widowed and 800 children lost their father, causing massive devastation of a small community. A great wave of public sympathy followed and a public appeal resulted in donations to disaster funds amounting to 560,000 pounds, an immense sum for those times. At a subsequent inquiry, of great significance for the future of the mining industry and its safety, the North Wales miners were represented by Sir Stafford Cripps. The disaster was also a great influence in the establishment under Lord Rockley in 1935 of a Royal Commission on Safety in Coal Mines.

Scrutiny of evidence relating to the Hillsborough Football Stadium disaster

Stuart-Smith, Murray, Sir 1998, Stationery Office, London, 222pp.

The report is divided into seven chapters, with Appendices. Chapter 1 sets out the background to the Hillsborough disaster and the sequence of events since. Chapter 2 deals with allegations about video evidence relating to the disaster. Chapter 3 discusses allegations about the inquest and the rescue operation following the disaster. Chapter 4 is about suggestions that improper pressure has been put on witnesses to the disaster. Chapter 5 and 6 deal with issues that have been put by relatives of victims and some other miscellaneous points. Chapter 7 summarises the findings.

Organizational learning under fire: theory and practice

Carley K. and Harrald J., 1997, reprinted from American Behavioral Scientist, Vol 340, no. 3, pp 310-332.

Explores the differences between organisational learning in theory and in practice as demonstrated in the actions of the organisations (e.g., Red Cross, the Federal Emergency Management Agency) responding to Hurricane Andrew. Two factors are considered in the groundwork for this analysis: 1) the interrelationship between disasters and organisational learning; and, 2) what was and was not learned from recent major disasters (Hurricane Hugo and the Loma Prieta earthquake). Then, a series of theoretical propositions concerning organisational learning is examined. Finally, the actual role of learning in disaster settings is discussed. Analysis revealed that organisational learning in theory and in practice were somewhat different. Planning was not a panacea and plans tended to be laid aside. In cases where objective performance feedback enabled organisational learning, disaster response organisations were more likely to receive subjective performance feedback from the media, which decreased their ability to learn.

Blue green algal blooms: a preventable emergency?

Reports of blue green algal blooms have increased over the last two decades. Whether this is due to an increase in public awareness and reporting, more favourable conditions for algal growth or a combination of the two is unclear. Coincident with the increased reports of blue green algal blooms has been the greater appreciation by communities of the hazards associated with these organisms. There is a genuine concern, particularly in communities that have been affected by blue green algal blooms, for an appropriate risk management framework to be implemented.

In the following discussion of these issues, I consider the question of whether blue green algal blooms are *ecological* emergencies, and suggest that theories of risk management in the emergency management context can provide a valuable tool for the conservation and management of Australia's threatened inland riverine ecosystems. For the present paper I take an anthropocentric view of an emergency, concentrating only on the impact of toxins on humans.

Algal toxins: the major hazard

The major hazard for communities in contact with high numbers of blue green algae is the capacity of this group of organisms to produce a suite of hepatotoxins, neurotoxins and endotoxins. These toxins have acute and chronic effects on humans and stock (Table 1). Toxins from blue green algae have been linked to severe human illness (Falconer *et al* 1983, Hawkins *et al*. 1985) and considerable stock losses (Baker and Humpage 1994, Codd *et al* 1994, ANZECC & ARMCANZ 1999). Managing the risk associated with blue green algal toxins is complicated by a number of factors. The amount and type of toxin produced by blue green algal bloom may vary over reasonably short time scales. While the notion that a bloom can be toxic one day but not the next is probably an exaggeration, over a scale of weeks the toxicity of the bloom may well vary (MDBC 1993). At present, tests available for toxin production are expensive, time consuming to perform and are only undertaken in a limited number of laboratories in Australia. Therefore, frequent routine monitoring

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of water bodies in remote parts of Australia for toxicity is not possible. The toxins produced are relatively stable in water, therefore, water bodies containing toxic blue green algae may remain toxic for up to several weeks before for toxins are degraded by naturally occurring bacteria (Jones 1994). Also of concern is the capacity for blue green algae, as with many other algae, to produce compounds which impart an unpleasant taste and odour to domestic water supplies.

Vulnerability

The vulnerability of a human community to blue green algal blooms is a function of the ability of the community to detect the presence of toxins in the water supply and their dependence on the impacted water. For example, the community living along the Darling River during the 1991 bloom was highly vulnerable because the only source of water for stock and domestic supplies was impacted and there was limited preparedness for the emergency. In an extensive survey of blooms in the Murray-Darling Basin, 42% of samples showed some degree of toxicity (Baker and Humpage 1994). This indicates that not all blue-green algal blooms are toxic. However, our present inability to forecast the eventual toxicity of developing blooms means that management of algal blooms has to assume the worst case scenario for toxin production. That is, it is assumed that all cells present are highly toxic, when in reality they may not be. This current gap in knowledge may greatly increase the

cost of managing algal blooms.

The affected parties to a significant blue green algal bloom may extend well beyond those that rely on contaminated water for stock and domestic supplies. Tourism and recreation industries can be severely impacted. For example, a bloom of blue green algae on Lake Hume in March 1996 resulted in reductions in tourism bookings at lakeside resorts. A major concern for irrigators along the Lower Murray is the potential damage a blue green algal bloom would have on the environmentally sustainable (clean and green) image that the horticultural industry is promoting for the region. This image is a critical aspect of the promotion of premium grade produce for the international market. The potential for significant financial losses to agricultural and tourism sectors as well as impacts on human health have to be considered in risk evaluation of blue green algal blooms.

Options for treating risk

Since the Darling River bloom in 1991 there has been significant research effort aimed at identifying the range of options for managing risk associated with algal toxins and selecting intervention options for the control of blue-green algal blooms. This effort has focused on understanding the biology of blue green algal blooms and the toxins that they produce. While our knowledge is far from complete, there is now a considerable understanding of the role of eutrophication (nutrient pollution) and river regulation (including effects of water abstraction and of impounding water behind dams and weirs) in the development of blue green algal blooms. The application of this knowledge has led to the development of a number of tools with which to manage blooms. Risk

Toxin Group	Effects
Hepatotoxins	Peptides that can cause hepatoenteritis, liver damage and may promote tumour growth
Neurotoxins	Act as neuromuscular blocking agents leading to muscle tremors, staggering, paralysis and respiratory arrest
Endotoxins	Lipopolysaccharides that can cause gastroenteritis, skin and eye irritations, skin rashes and allergic reactions

Table 1: Toxins produced by blue green algae (Adapted from MDBC 1993)

management for blue green algal blooms has evolved into a comprehensive emergency management strategy which incorporates the framework outlined by Salter (1998) of prevention, preparedness, response and recovery.

Prevention

There is a widely held perception in the community that blue green algal blooms are the result of human activities. From this perception it follows that appropriate management of human activities will prevent the occurrence of blue green algal blooms in the future. However, blue green algae are an indigenous part of the biota of Australian rivers. Blooms have been recorded from the Murray River system since the 1850's (Francis 1878, Codd *et al* 1994), well before significant river regulation or eutrophication took place. Therefore, elimination of blue green algae from Australia's inland rivers is both an unrealistic and ecologically unsatisfactory goal.

There is little doubt, however, that human activity has increased the frequency and intensity of algal blooms and that appropriately targeted management will decrease these. Consequently, prevention strategies focus on reducing the growth of blue green algae by reducing impacts of river regulation and nutrient pollution on the river system. As with all photosynthetic organisms, the two main ingredients for growth are an adequate supply of nutrient and light. In Australia's inland waters most of the 20 or so elements (nutrients) required for growth are in abundant supply. However, two nutrients, nitrogen and phosphorus are, at times, in low enough concentrations to limit the growth of blue green algae. Some blue green algae such as *Anabaena sp.* are able to utilise gaseous nitrogen (N_2) to supply the alga's nitrogen needs. The growth of these groups of blue green algae will not be limited by the availability of inorganic nitrogen since gaseous nitrogen is always abundant. Consequently, the most commonly adopted tool for the prevention of blue green algal blooms is the management of anthropogenic inputs of phosphorus to water bodies. This has been achieved by licensing and regulating point source discharges of phosphorus into rivers and lakes, for example, effluent from intensive animal industries and from sewage treatment plants. Community education programs aimed at decreasing the amounts of nutrient added to the waste stream frequently support this regulation. For example, the Albury City Council (Southern NSW) has implemented

a public education program Phos-watch that has demonstrably reduced the levels of phosphorus entering the council operated sewage treatment plant.

Diffuse sources of nutrient, such as from broad acre agriculture, are considerably harder to identify, quantify and regulate than point sources. Across Australia managing diffuse sources of nutrient is increasingly being addressed at the catchment scale through collaborative programs between the local community and government. Local involvement is a critical factor in the adoption and ultimately the success of catchment management. A significant outcome of community involvement in catchment management is an awareness and knowledge of blue green algal blooms. This makes the community less vulnerable to them when they occur.

River regulation has increased the amount of favourable habitat for blue green algae. River regulation in inland Australia has resulted in the construction of tens of thousands of dams and weirpools and the abstraction of significant volumes of water. During summer, still or slow flowing waters regularly show temperature stratification, where warm layers of water form over the cooler bottom waters. The warm, shallow surface layer provides an ideal environment for blooms to develop (Webster *et al.* 1996). A number of techniques that reduce stratification are used to inhibit the development of blue green algal blooms. These include maintaining sufficient flow in rivers to reduce stratification, particularly during periods when blue green algae are likely to develop. Water mixing devices such as pumps, paddle wheels and aeration units have been deployed to reduce stratification with various levels of success (Sherman 1998).

Preparedness

The community and government were unprepared for the 1991 Darling River blue green algal bloom. The response by governments to the bloom was to declare a state of emergency and establish a task force to deal with the immediate problems of the bloom. After the bloom had dispersed, the task force concentrated on developing a longer-term strategy for managing blue green algal blooms. An outcome of this task force was the establishment of Regional Algal Coordinating Committees (RACCs) in NSW. The RACC's were to develop algal contingency plans. Algal contingency plans consider intervention options aimed at preparedness, response and

recovery from algal blooms. The role of the RACC's includes:

- development, coordination and implementation of algal bloom contingency strategies;
- cooperation with neighbouring regions on algal management issues;
- coordination of public information programs including using the media;
- implementation of regional algal monitoring systems;
- monitoring of costs associated with algal blooms;
- coordination and implementation of training in algal identification, and monitoring and sampling in the region;
- identification of when algal warnings should be issued.

A number of Blue Green Algal Contingency Plans have since been completed. A good example is the document prepared by the Central West Regional Algal Coordinating Committee (Central West RACC, 1997). This plan clearly outlines the responsibilities of agencies, establishes communication networks, identifies alternative water supplies and provides an inventory of available water treatment methods and where to obtain them rapidly.

Are blue green algal blooms 'ecological emergencies'?

Dovers and Norton (1999) define 'ecological emergencies' ... as sudden-onset events where the subject is non-human, such as an ecosystem, a species or a river system. In an ecological emergency, humans or human property may also be threatened, but the threat may be only to non-human entities. The definition of Dovers and Norton (1999) indicates that the ecosystem has to be threatened for it to be considered an ecological emergency. In all but the most extreme cases, blue green algal blooms do not threaten the ecosystem. Blue green algae are a natural feature of Australia's inland river systems, with blooms occurring prior to European colonisation. The native biota have coevolved with blue green algae. There is no evidence that either native or introduced fish are harmed by ingestion of toxic blue green algae (Johnston *et al* 1994, Gehrke & Harris 1994). While there are conflicting reports about the toxicity of blue green algae to microinvertebrates (Matveev *et al* 1994; Boon *et al* 1994), healthy microinvertebrate populations were present in the Darling River at the height of the 1991 blue green algal bloom (Shiel & Green 1992, Boon *et al* 1994). Similarly, there were no reports of native animal or bird deaths associated with the Darling River bloom. This does not

suggest that these organisms are necessarily immune to the toxins, but rather their behaviour is such that they do not ingest the toxins. Since, in all but the most extreme cases, there is no evidence that native flora and fauna or ecosystem processes are threatened by the presence of blue green algal blooms it is reasonable to argue that blooms do not represent an ecological emergency. However, there is little doubt that the health and integrity of Australia's inland waterways are seriously threatened by the factors that contribute to blue green algal blooms—river regulation and eutrophication. These processes have impacted many of Australia's river systems, threatening many plant and animal species (Harris and Gehrke 1997). Blue green algal blooms are just one manifestation of increased eutrophication and river regulation. Others include the dramatic decline in native fisheries, considerable reductions in the area of wetlands, enhanced growth of all aquatic plants (and the associated rapid and large alterations in oxygen content of the water which can result in fish death) and erosion of river banks. While blue green algal blooms may represent a major hazard to humans, river regulation and eutrophication are the major hazard for the ecosystem.

The concept of a *sudden onset event* is an integral part of the Dovers and Norton (1999) definition of an ecological emergency. Can river regulation and eutrophication, processes that have been increasing for the best part of a century, be classified as *sudden-onset* events? We argue that in the temporal context of ecosystem evolution, anthropogenic increases in eutrophication and river regulation are sudden-onset events. Society is generally cognisant of the need to monitor and detect hazards that threaten human life or property and has generally developed appropriate equipment and monitoring programs to detect these. On the other hand, methods for detecting ecological emergencies resulting from river regulation and eutrophication, are poorly developed and often poorly funded. For example, we are still developing adequate tools for quantifying 'river health' for lowland rivers. In the absence of these tools, how will we know that an ecological emergency is taking place?

At the river basin scale, eutrophication and river regulation threaten whole populations of organisms and ecological processes (Harris *et al* 1987, ANZECC & ARMCANZ 1999). An appreciation and acceptance that these anthropogenic alterations to the riverine ecosystem

constitute an ecological emergency, and therefore require emergency management, would be a significant step in halting and perhaps reversing the decline that is currently taking place.

Conclusions

Since the 1991 Darling River bloom there has been a shifting emphasis in blue green algal management from one of hazard management to one of risk management. There has been a significant emphasis on identifying the range of options for treating risk associated with blue green algal blooms, which includes prevention, preparedness, response and recovery.

Except in the most extreme cases (and the 1991 Darling River bloom was not one of those) blue green algal blooms do not constitute an 'ecological emergency'. However, anthropogenic alterations to the riverine ecosystem of eutrophication and river regulation do threaten the riverine ecosystem. The temporal nature of this notwithstanding, these factors do constitute an ecological emergency. Theories of risk management in the emergency management context can provide a valuable tool for the conservation and management of Australia's threatened inland riverine ecosystems.

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In remembrance: post-disaster rituals and symbols

Introduction

A common feature in the aftermath of many disasters is symbolic forms of ritual expression demonstrating the impact of tragedy, particularly sudden and unexpected events, on communities. These are forms of disaster popular culture, an area which has long been of interest to researchers who are now starting to systematically collate and analyse themes in this area of disaster-related behaviour¹. Post-disaster rituals and symbols are a valid and important area of study because they have significant implications for disaster management, not only in terms of practical, logistical arrangements such as crowd control, but also in terms of managing sensitively and appropriately the range of psychological, social and political issues associated with these aspects of the immediate post-impact and longer term rehabilitative stages of disaster.

This paper examines forms of post-disaster rituals and symbols in the United Kingdom, both formal and informal, and highlights the implications for those planning, preparing for delivering services and support. The main focus is on disasters involving sudden, unexpected socio-technical events on a much smaller scale than the sorts of natural disastrous events more typical in, say, Australia and the United States. However, an interesting feature of post-disaster rituals and symbols is the similarity in form and function, and therefore much of the analysis here is also applicable to other post-disaster scenarios.

The 'Decade of Disaster'

The main forms of post-disaster ritual occur in a chronological sequence; spontaneous, unplanned expression in the first hours and days are followed by funerals, official memorial services and anniversary events. These were all features of the 'decade of disasters' in the United Kingdom in the 1980s which was charac-

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terised by a series of major incidents happening in relatively quick succession. The disasters included the fires at Bradford Football Club, Kings Cross Underground Station and Manchester Airport as well as the Clapham train crash, the Lockerbie air disaster, the capsizing of the Herald of Free Enterprise, the sinking of the Marchioness Pleasureboat and the Hillsborough Soccer Stadium Disaster (Table 1).

The decade of UK disasters in the 1980s

Interviews with some of the relatives and survivors from these disasters have been drawn on in this paper, as well as documentary material arising out of the incidents' management. These disasters received high profile media coverage, sometimes in the immediate impact phase (where television cameras happened to be present), and certainly in the first few days and weeks. Such high profile media attention was significant not only in reinforcing the sense of national tragedy as well as the local impact of each event, but also in helping to construct and

reinforce socially appropriate forms of informal popular expression, even though these were often described as spontaneous and instinctive. These patterns of post-disaster ritualisation included both religious and secular acts. The latter include contributions to disaster funds, a routine media discourse (consisting of interviews with 'heroes', attributions of blame, calls for accountability and for lessons to be learned) and, later on, coverage of inquests and inquiry procedures. Religious and quasi-religious forms of symbolism are often included in spontaneous expressions of grief, more formally organised official memorial services, anniversary events and permanent memorials. It is these that form the basis of this paper.

Spontaneous Expressions of Grief

Sociologists of religion have discussed how religious rituals and symbols are collective representations of social groups and are the means by which individual participants learn, renew and reaffirm shared meanings (Durkheim 1915). In times of social crisis such as disaster, anthropologists have analysed how funeral rituals provide a way for social groups to regain social balance and morale (Malinowski 1948). Both individual and collective rituals enable the

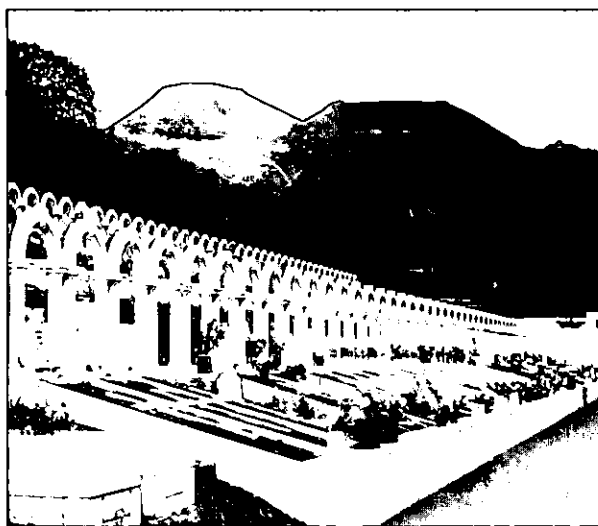
Date	Location	Incident	No. of fatalities
11.05.85	Bradford	Football stadium fire	56
22.08.85	Manchester	Aeroplane fire	54
06.03.87	Zeebrugge	Ferry sinks	193
08.11.87	Enniskillen	Terrorist bomb	11
18.11.87	Kings Cross	Underground fire	31
06.07.88	Piper Alpha	Oil rig explosion	167
21.10.88	Greece	'Jupiter' ship sinks	4
12.12.88	Clapham	Train crash	36
21.12.88	Lockerbie	Air crash	270
08.01.89	Kegworth	Air crash	47
15.04.89	Hillsborough	Overcrowded stadium	96
20.08.89	Marchioness	Riverboat sinks	51

Table 1: The decade of UK disasters in the 1980s

Notes

1. Popular culture in disasters forms the focus for study and discussion by researchers at the Annual Natural Hazards Workshop, University of Colorado, Boulder (July 1999), the American Sociological Association AGM, Chicago (August 1999), and the European Sociological Association Annual Conference, Amsterdam (August 1999).

expression of grief and can be therapeutic in helping communities come to terms with tragedy. Initial informal popular rituals often start within hours of the disaster becoming public knowledge. They include members of the public visiting a disaster site or other significant sites associated with the event, as well as places of worship. At these venues there is the laying of flowers, toys (where children are involved) or other mementos. Also candles are often lit in houses or places of worship. Two examples illustrate this. After the Aberfan Disaster in 1966 (in which 144 people were killed when a coal tip slid down onto a school) 'flowers were sent from all over the world and the Director of Parks and Cemeteries laid them out in a giant cross on the hillside, 130 feet high with arms 40 feet across' (Miller 1974).



*top: view of the public memorial – Aberfan Cemetery, August 1968
above: view of the disaster graves – Aberfan Cemetery, August 1967*

Within twenty four hours of the Hillsborough Disaster (in which 96 Liverpool soccer fans were crushed to death in an overcrowded stadium) people had started to bring flowers and other tributes to Liverpool's home ground, Anfield. As the numbers swelled, the ground was opened to accommodate the crowds:

'By five o'clock the Kop end of the ground, where home supporters always stand, had become a shrine bedecked with flowers. The visitors continued to arrive from all over the country over the seven days of official mourning, queuing for hours in silent solemnity. The field of flowers gradually grew towards the centre of the pitch, whilst the concrete steps behind the goal were transformed into a carpet of scarves, pictures and personal messages.

Scarves were also hung on the metal barriers, many of which became dedicated to the fans who had stood behind them week after week. School friends penned the names of their lost classmates on the walls outside the stadium. These messages expressed personal and communal grief as much, if not more, than any of the official ceremonies could have. For many people, visiting Anfield—Liverpool's home ground—

brought their grief to the surface' (Eyre 1989).

Although not a 'disaster' by conventional definitions of the term, the sudden death of Princess Diana in 1997 elicited a response not incomparable with the sort of emotional and symbolic ritualism seen in the aftermath of the disasters mentioned here. An appeal fund was set up and immediately attracted generous donations by the public, while personal visits to the Princess' home and floral tributes poured in. When asked why they responded in these ways, members of the public said they felt they want to *do something*, to express their sorrow and to acknowledge both their individual and the country's shared sense of grief. This again is similar to post disaster responses, even when participants may not personally know those killed or injured.

In recognition of these various forms of giving—or convergence—in the aftermath of disaster, much has been learned and applied, especially with regard to the careful planning and distribution of disaster funds (Disasters Working Party 1991). One of the continuing ironies of some giving, however, is that it does not necessarily fulfil the needs or interests of the bereaved. Apart from the disaster fund (which was itself described as the 'second disaster' due to the problems associated with its management and distribution), the large influx of toys was an impressive but inappropriate arrival into the village of Aberfan which had just lost a generation of its children (Miller 1974, Austin 1967).

As well as the signing of official books of condolence, poignant messages accompanying flowers and other gifts also reflect the depth of grief following disaster. Tributes left at key sites express a number of emotions ranging from shock, grief and personal loss to anger and sheer unbelievability. They also have symbolic significance. Walter (1998) has argued that the place where flowers and other gifts are laid are ways of mapping the sacred sites of contemporary culture. He cites examples after Princess Diana's death of flowers being left at town halls, war memorials and in supermarkets.

Personal and/or collective messages from those bereaved by other disasters may be of much comfort to the bereaved through the implicit suggestion that there are others who have some understanding of the pain. An example of this was a floral tribute at the Dryfesdale Cemetery, Scotland, on the tenth anniversary of the Lockerbie Disaster with the simple message: 'To the bereaved families of

Lockerbie and Flight 103 from the bereaved families of Dunblane'. Messages from key public figures such as the Queen or Prime Minister may also be heartening in expressing the national sense of grief and emotional solidarity with those directly bereaved.

Attendance at Religious Places

As well as disaster sites themselves becoming a focus for individual commemorative acts, religious places are also often visited more than usual after disaster. Even in generally secular societies a dramatic rise in attendance at places of worship has been noted. Sweden, for example, is regarded as a notoriously secular society, though most people have an implicit relationship with the Church of Sweden. After the Estonia Ferry Disaster in which over 800 people were drowned, many of them Swedes, very large numbers of people attended religious places (Pettersson 1996). By the evening of the first day of the disaster, at least 500 churches around the country had been opened for individual prayers, the lighting of candles and special services. Mourning services were also broadcast live on national television and radio.

Sociologists of religion have discussed the role and meaning nature of alternative, popular or 'implicit' forms of religiosity after disasters (Pettersson 1996, Gilliat 1998). They suggest that in such contexts implicit religious needs and sentiments normally latent in society become explicit and expressed. Even among the usually unchurched, then, local and regional churches and cathedrals can become the locus of solace and support in both secular and religious terms. Regular and extra organised services are often devoted to commemorating the disaster in the first few days and are a further feature of post-disaster ritual.

It is important to recognise the need to provide opportunities for traditional and non-traditional forms of expression in both religious and non-religious places and ways following disaster. On the day after the Hillsborough disaster 8000 people attended the Catholic Cathedral in Liverpool which, in a traditionally strong Catholic community, was as appropriate a symbolic site for the community as Anfield. In Dunblane, too, after the primary school shooting of 16 children and their teacher, local cathedrals were a natural reference point in this ecumenically active local community. Here again, feelings of grief and helplessness were expressed in both traditional and non-traditional ways. Symbolic

mementoes placed on the altar and in offertories included flowers and wreaths in the shape of secular symbols and teddy bears.

For those of religious persuasion, traditional religious networks and functionaries are a natural focus for support and for expressing the inevitable question 'why?' Some seek theological answers to questions such as 'why does a good God allow suffering?' (Dynes 1999, Schmuck 1999). Davis and Wall highlight how theological interpretations to some extent reflect a hangover from the past when religious explanations were given for the causes and consequences of disaster:

'In Serious thoughts occasioned by the earthquake at Lisbon' (1755), John Wesley suggested the possibility that the earthquake, which left 50,000 people dead, represented divine retribution for the sins of the Inquisitions. 'Is there indeed a God that judges the world? And is he now making inquisitions for blood? If so, it is not surprising he should begin there, where so much blood has been poured on the ground like water' (Davis & Wall 1992).

For many, however, a theological interpretation may not be desired or appropriate and this makes it particularly difficult for religious representatives to know how to respond to relatives and others who might address them in the aftermath of tragedy. Reflecting on the decision-making process regarding the form of a memorial to commemorate the Bradford fire, trustee Roger Suddards (1987) recalls:

'We saw the plaque as being also a historic record of a terrible disaster in Bradford's history. Should we ask the Provost to place it in the Cathedral? Would this offend our non-Anglican friends?...Walking round the Cathedral we were struck by the number of 'historical' as well as 'religious' monuments. We felt that our non-Anglican friends could not reasonably be offended'.

Formal memorial services

Some weeks after a disaster there is usually a planned official memorial service which, depending on its local, communal or national significance, is usually held in a cathedral or church. Official guidelines on emergency planning in the United Kingdom acknowledge the important functions served by such services and key issues for those planning and conducting such ceremonies. As Dealing With Disaster (1998) states:

'A memorial service provides an opportunity for those affected by the disaster

to share their grief with others. It often has an important national as well as local role and is likely to be covered extensively by the media. For these reasons the organisation and structure of such events need to be considered very carefully, covering such aspects as timing, invitations and conduct' (para 4.28).

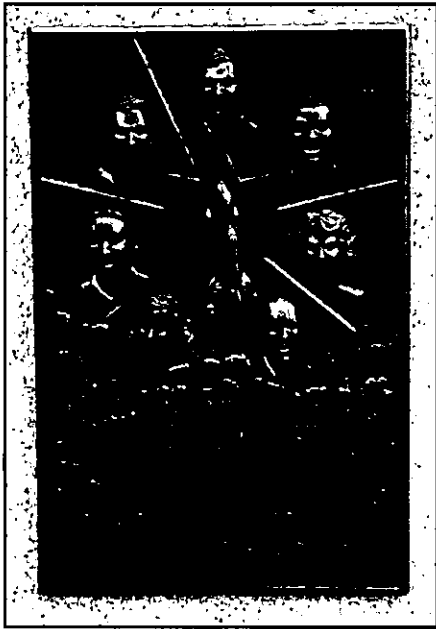
Little further guidance on planning and delivering such services is available however. Given the recentness of the event and the fact that people are still in shock these are likely to be very emotional occasions. Indeed interviews with relatives and survivors highlight the enduring impact of such events and the sensitive issues surrounding their conduct and organisation. In fact these are important events for various types of victims involved in disaster, including emergency service workers and other helpers, who may be joining together with the bereaved for the first time after the event. One survivor comments thus on the community impact and solidarity she felt:

'The church was absolutely packed and we were amazed that all these people had turned out on a cold November night to church. And there was the caretakers and the dinner ladies and neighbours, not only, you know, VIPs like the local MP and the mayor. There were so many people and it was absolutely packed' (Survivor of the sinking of the Jupiter Cruise Ship commenting on the thanksgiving service).

Although these events are often attended by key national figures such as members of the royal family and politicians, the question of which dignitaries do and do not attend can be sensitive. Many of those who attended the official memorial service following the Hillsborough Disaster were upset that a representative of the senior royals did not attend and were also dismayed by the presence of the then Prime Minister, Mrs Thatcher, whose relationship with the City both before and after the Disaster was not warm. Those planning official memorial services need to be sensitive to these community factors and plan accordingly.

As an extension of this it is important to appreciate that the organisation and order of services themselves express implicit assumptions and messages. The Disasters Working Party (set up to examine psycho-social support systems in the aftermath of the decade of disasters) emphasises the importance of considering the feelings of the bereaved and offers the following advice:

'It is extremely important to give due consideration to those who are



Memorial to the Challenger disaster (28 January, 1986) Arlington National Cemetery, Washington DC

personally affected by the disaster, as well as to any officials or dignitaries, both local and national, who wish to pay their respects... It is important that joint services are held as far as possible, so that relatives do not find themselves attending numerous services in different churches' (Part 2, p66).

In some cases the decision to invite dignitaries and to afford them privileged treatment and priorities over those most deeply affected may be upsetting for the bereaved. One relative from the Lockerbie Disaster feels memorial services are *'appalling occasions because the most important people at them are the PM and/or the royal people, the local dignitary; they are the ones who get to sit in the front pew, who get to read a lesson or something like that. So my family chose absolutely not to go in the immediate aftermath.'*

Statements such as this highlight implicit messages surrounding ownership and impact and show why careful thought is needed in planning the form, content, attendance and broadcasting of such services.

Insensitive language and proceedings, including both what is and is *not* said, can also have an impact on the bereaved. One survivor recalled a thanksgiving service after the Jupiter disaster thus:

'The vicar did not mention the four people who had died and a lot of people were upset that he hadn't mentioned them. The feeling was if we'd have died, would we not have been mentioned at someone else's thanksgiving service?'

While this interviewee acknowledged the attempt at sensitivity on behalf of the clergy, the sense of upset remained:

'Probably he didn't mention it because he didn't want to upset people, and it was a thanksgiving service for our lives, and you don't know how he put the service together...but we would have liked a mention of these four people there.'

At a neighbouring school a similar thanksgiving service *had* included prayers for the four who had died and this aspect of ceremony, with candles being lit in remembrance, had been regarded as more appropriate. Some brief preliminary consultation with the bereaved about the service content may have prevented this distress.

The Disasters Working Party states that the clergy, alongside the Director of Social Services or Social Work should be involved in planning memorial services, including decisions about when and where the event is held and who should be invited. There are obvious implications here for the training of clergy and others involved in planning and delivering such high profile events. Sadly, as with much disaster management, these are seen as sufficiently rare events and are not part of the regular training of religious and other professionals. How many mock exercises and seminars testing disaster plans include consideration of these aspects of the rehabilitative phases of disaster?

Anniversary events

Psychologists have highlighted the significance of anniversaries and the 'anniversary effect'. Because of the psychological significance given to a certain day, many survivors:

'are touched once again by the disaster. A brief but significant later point in time can powerfully evoke and activate the disaster experience' (Echterling 1998).

Sociologists too have highlighted the social significance of disaster anniversaries as marking not only physical time but also 'social time', thereby acknowledging the passing of calendar years as well as enabling collective remembrance and expression of a community memory:

'Disaster anniversaries entail an interactive process in which people share personal experiences. Public officials make declarative comments while the press and electronic media reconstruct the disaster experience by recording current thoughts and reflections. In short, the disaster anniversary is a process of collective remembering' (Forrest 1993).

The first anniversary is particularly

important after disaster but subsequent ones are also significant as high attendance and media coverage shows. On the 30th anniversary of the Aberfan Disaster more than 100 villagers attended the annual commemoration service led by five ministers from eight churches and chapels (Timewatch BBC TV, 1996). As well as anniversaries being opportunities for relatives and survivors to reunite, bereavement and grief can resurface at this time. For some these events and media coverage may even trigger the beginning of griefwork and the onset of post-traumatic stress:

'Many existing crisis counselling services have received phone calls at times of anniversaries, birthdays, holidays, resolution of court cases and publications of reports about the disaster—all occasions when the memory of the disaster is evoked' (Disasters Working Party Report, 1991 Para 3.5).

Support workers need to be aware of this. Although practical information and support is planned for in the first few weeks and months following disaster, to whom will the distressed turn should the tenth, twentieth or thirtieth anniversary be the occasion of the first feelings of flashback and other symptoms of post-traumatic response? Optional helpline support may be a way of picking up some of these at anniversary and other significant points in the longer term, including the conclusion of inquest and inquiry procedures. As well as their therapeutic



Vietnam Veterans' Memorial, Washington DC

potential, planners need to be responsive to the fact that anniversary events themselves can cause resentment. They may reinforce, for example, anger at media intrusion or divisions among or between relatives, survivors and organisers.

The Politics of Anniversaries

For those more actively involved after disasters, for example members of relatives and/or survivors' action groups, anniversaries can be used to raise the public profile of outstanding issues and injustices. Such campaigners may positively use the media to publicise their views and feelings. As an example, the Hillsborough Families Support Group used the tenth anniversary to highlight the 'unfinished business' of the Disaster including the ongoing search for justice through the prosecution of senior police officers in charge on the day (HFSG 1999).

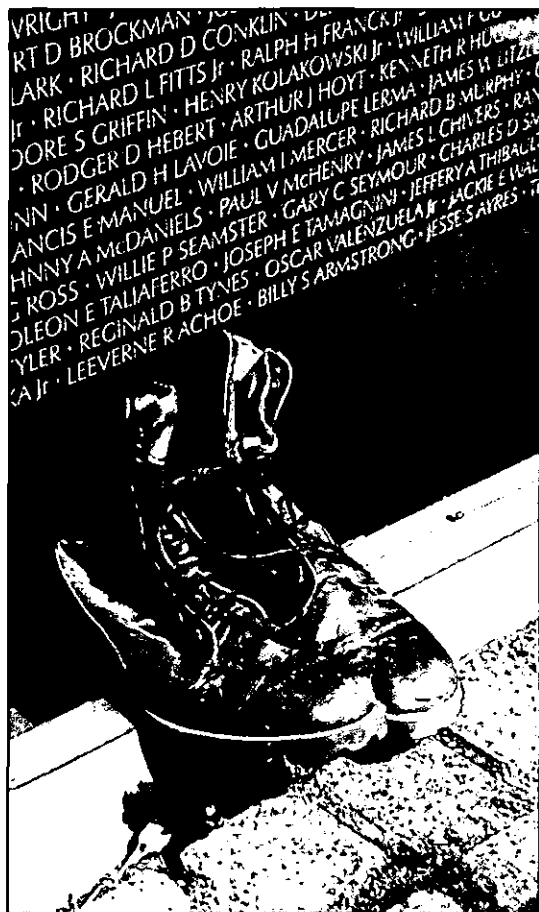
Elsewhere I have argued that the public and 'complicated' nature of death through disasters has a significant impact on grieving processes and have emphasised the inability of the bereaved to find 'closure' while fundamental questions relating to the deaths of their loved ones remain outstanding (Eyre 1998). This theme in the aftermath of humanly-caused disasters is a reflection of unsatisfactory and unsympathetic procedures in inquests, inquiries and court cases and their outcome. The persistence of unresolved issues relating to responsibility, accountability and justice can be a source of ongoing trauma for relatives and survivors. For them anniversaries are far from a rite of passage to 'moving on' but a painful reminder of the little that has been achieved after so long. Further distress is sometimes caused when these appropriate feelings of anger are dismissed as 'unresolved grief' by the media and others. Rather, grief is just one of the complex emotions experienced after disaster which needs to be understood within the broader psycho-social and legal aftermath of disasters and their unfinished business.

The Functions of Post-Disaster Rituals

It is important to be prepared for and consider the practical organisation of the various forms of post-disaster ritual discussed here, not only because they are likely to have lasting effects on participants, but also because experience has shown that they are predictable features of post-disaster behaviour. This is because they serve important psychological and social functions for individuals

and communities. It has been suggested here that in the first few days and weeks after a disaster, ritual expression can be a healthy opportunity for expressing the sense of shock, anger, disbelief, grief and other emotions associated with the disaster. For those of religious persuasion, post-disaster rituals serve explicit religious functions in terms of spiritual reflection and rites of passage, particularly funerals. More fundamentally in the early stages (namely the first few days and weeks), acts and services are important for acknowledging the reality and devastation caused by the disaster. Indeed, the involvement of the media and public/political figures functions to define and socially construct incidents as 'disasters' in sociological terms by acknowledging their national and even international impact as well as the more direct local effects.

In many cases television coverage can enable the vicarious participation of the broader community by, for example, publicising and broadcasting memorial services. Though it may be short term, social solidarity on a smaller scale can be reinforced through the communal dimensions of services etc which can integrate an event into the identity of a community (particularly where a small geographical area or a particular institution such as a school is involved). At anniversaries, rituals can further function to locate and reinforce a disaster in a community's social history and identity, marking the links between chronological time and social time (Forrest 1993). As time passes, anniversary events also provide the opportunity for relatives and survivors to reunite, rebound and update on the progress of disaster-related actions and campaigns. At the same time, however, it is important to recognise that post-disaster rituals, particularly organised events, may be psychologically and/or socially dysfunctional. As discussed, some may feel marginalised or excluded on grounds such as religion, geographical distance, inability to attend on the basis of disaster-related injury or simply due to the restricted number of places. Of course, on practical grounds, some prioritising of invitations has to take place. Usually families are given a limited number of places, but this may mean that survivors feel left out (often literally in terms of access into a cathedral



Vietnam Veterans' Memorial, Washington DC

or church) and left with uncomfortable feelings about a lack of ownership and consultation. More broadly, the dynamics within relatives' and survivors' groups, and even the relationships between the two, may reinforce the inappropriate sense of a hierarchy of grief and this, as well as different ways of grieving, may be part of the reason why self-help and support groups experience internal strife, splinters and breakaways.

As stated, in exceptional cases, anniversaries promote dysfunction by triggering the first symptoms of Post-Traumatic Stress Disorder, particularly for those who have not been able to start grieving previously. Disaster managers need to be aware of, plan for and publicise the extra psychosocial support which may be needed at such times.

In various ways, therefore, post-disaster acts and services may fulfil a number of functions ranging from increasing social solidarity to fostering or reinforcing a sense of social exclusion. It is important to remember that the organisation and impact of such events, as well as the disaster itself, is likely to affect many and varied groups of 'victims' (Taylor 1998) over a significant length of time. Hence I have also argued that a much longer term approach must be incorporated into the concept of the 'disaster cycle' and its



Korean War Memorial, Washington DC

rehabilitative phases (Eyre 1998). While it would obviously be impossible to consult with all those affected, disaster managers must recognise that those most directly involved will have an emotional interest in post-disaster rituals such as memorials and anniversary services. Where possible in the longer run, involving these interests groups in decision-making may be preferable. An example where such decision-making processes have been applied is in the area of permanent memorials.

Permanent Reminders: Disaster Memorials

Just as war sites and those killed by armed conflict are commemorated at permanent memorials², so physical reminders have been constructed as a way of remembering forever particular disasters and their legacy. Those tasked with planning and organising such memorials can learn much from previous experience here. Key questions to be addressed include: what form can and should a permanent memorial take? How will memorials be maintained longer term? Who should make these decisions?

Permanent memorials after disaster take many forms. As well as the personal graves of those who lose their lives (each in itself a commemoration of a life), collective symbols commemorating the

event and its significance are also often constructed and maintained either at or close to the disaster site. In the small community of Aberfan, South Wales, part of the appeal fund was used to construct a formal memorial in the shape of a cross bearing the names of the victims at the place where some of them were buried in a mass funeral. The series of white arches set against the sky on this hillside cemetery touches all who visit. Also, at the site where the junior school once stood, a garden of remembrance was constructed, its layout reflecting the original layout of the classrooms that had been there. Both memorials are visited regularly by members of the local community and outsiders, testimony to the continuing significance both of the event and its memory.

Suddards (1987) reflected at length on the range of issues surrounding decisions about the permanent Bradford Disaster memorial. His reflections, revealing great sensitivity and forethought, are reproduced below:

'What form should a memorial take?... For my part I would have liked some kind of a garden which could be used as a place of peace for those who suffered. But this has complications: someone has to maintain it. It might not be wanted (the thought of a hall at Aberfan, which is I understand little used, loomed in front of us) or it might be vandalised... We all felt that whatever shape our memorial took, it was important that it commemorated the generosity of people contributing to the fund. So in the end, after some fascinating discussions, we all were happy to suggest a memorial plaque... Although gardens would have been nice, nonetheless here is a plaque which will be in a safe place, a thing of beauty and

something which those who are still distressed from that tragic day may come and see in peace, quiet and privacy. We hope that it will give them comfort'.

Conclusions

In all the ways discussed above, informal and official commemorative events are more than just occasions for remembering those killed or injured and ways of expressing personal and collective grief. Although the first anniversary appears to be of particular significance (Forrest 1993), subsequent ones are too as their marking shows. Commemorative sites and services can also be political sites of consensus and conflict. It is suggested here that researchers and practitioners may learn more about the longer term psycho-social and political significance of some disasters by examining the issues and expressions surrounding disaster commemoration after five, ten or even twenty years. Organisers need to take account of the range of social, religious and political issues surrounding disaster commemorate itself which are reflected in decisions about where, when and how it takes place and who has the authority to make such decisions. In the longer term this is one justification for a community-based involving relatives and survivors in planning and designing such events wherever possible.

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2. The internet is increasingly becoming a resource for commemorating those killed by war (See, for example, www.poppyappeal.britishlegion.org.uk) and disaster (e.g. the National Network for Child Care: www.exnet.lastate.edu/Pages/families/nccc/Guidance/flood/anniversary.html) and for highlighting ways to mark anniversaries and disaster-related campaigns. (e.g. www.hfsg.org for the ongoing campaign relating to the Hillsborough Disaster).

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About the Author

Anne Eyre is employed by the Fire Service College and based at the Centre for Disaster Management, Coventry University. There she teaches on multidisciplinary degree programmes in Disaster Management specialising in the psychosocial dimensions of disaster. She is setting up a Disasters study group within the British Sociological Association which aims to bring together academics, practitioners and survivors and in line with this is organising a conference focusing on the human aspects of disasters which will take place in April 2000. Special thanks to Hazel Hancock for her help in researching this article.



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Impact of landslides in Australia to June 1999

Introduction

In the following discussion the term 'landslide' is used in a very broad sense to include rock falls and topples, flows of solid material, and slow movements of a few tens of centimetres per year. Some incidents of mine subsidence are also included in the damage estimates, although the data are incomplete. Landslides can be either the result of human activity, or else naturally occurring phenomena.

Much of the statistical information in this paper was compiled from AGSO's Australian Landslide Database but, despite sustained efforts at recording landslides, the database is certainly incomplete, and so conclusions drawn from it and any analysis are tentative.

AGSO has made the database accessible via the Worldwide Web at www.agso.gov.au/ngis/locator.html, and would welcome exchange of information on landslides to improve it and keep it current.

Landslides causing injury or death

On 30 July 1997 a landslide with a head scarp on the north western margin of the Alpine Way at Thredbo destroyed two ski lodges and trapped 19 people. Eighteen of these were eventually confirmed dead and one person was rescued alive.

by Marion Michael-Leiba
Cities Project, Australian Geological Survey
Organisation (AGSO), Canberra, ACT.

The death toll exceeds that of the 1989 Newcastle earthquake. However, Thredbo is not an isolated incident.

In Australia, 47 landslides are known to have caused injury or death during the period 1842–June 1999. At least 82 people have been killed by at least 36 landslides. These figures are probably underestimates, as Australian landslides tend to pick people off in ones and twos, events which tend not to be widely reported. An additional 52 people are known to have been injured by landslides.

Almost half (about 20) of the landslides causing injury or death were rock falls/topples. In some cases rocks were inadvertently dislodged by human activities, while in others the rock fall was the result of natural causes.

Thirteen of the 47 landslides involved material falling from cliffs. The cliff event causing the most recorded casualties was the Cowaramup rock fall, Margaret River, WA, of 27 September 1996. Nine people were killed and three injured while attending a primary school surf carnival. During the period January 1996–June 1999,

six out of the 12 landslides causing injury or death involved the fall or topple of a single rock!

The most recent landslide deaths and injuries happened in 1998. In January, a man was injured by a toppling rock on Mt Stuart, Townsville, and a 12 year old boy was killed near Eden, NSW when a hole he and his brother were digging in the beach caved in and buried him.

In April 1998, two boys were injured and had to be taken to different hospitals in separate rescue helicopters when they got buried in a cave-in caused by their tunnelling into a sand cliff at Teewah Beach, north of Noosa, Queensland. In May, two train drivers were killed near Robertson, NSW, when their train capsized after hitting debris from an old railway bridge abutment collapse.

Damage to buildings

Fifty-six landslides are known to have caused damage to over 200 buildings (Michael-Leiba et al, 1997) during the period 1842–June 1999. A number of these were written off, along with the land on which they were built.

The most expensive incident was at Lawrence Vale, Launceston, Tasmania in the 1960s when two adjacent landslides in Tertiary sediments destroyed 35 houses. Land was also written off. The cost is estimated at \$4.6 million in 1999 dollars.

The two most recent incidents in which buildings were destroyed both involved debris flows. In January 1998, a debris flow, triggered by torrential rain on Magnetic Island, Queensland destroyed up to 18 units of the Magnetic Island International Resort. In August 1998, a debris flow from Mt Keira, Wollongong, NSW, destroyed a mine building part way up the mountain and a suburban house in the runout zone.

Both these instances of destruction were by fast moving landslides, but buildings have been, and are currently being, damaged or destroyed by very slow moving landslides with speeds of less than 100 mm per year.

The total direct dollar cost of damage (of which we are aware) to houses and residential land from Australian landslides since 1842 is estimated to be around \$25 million in 1999 currency. Landslide damage is not normally covered by



This small landslide on the Paluma Road, north of Townsville, killed a woman during Tropical Cyclone Justin in March 1997

insurance in Australia, so the human cost in terms of stress to affected property owners is high. One man died of a heart attack after having learnt that his house was being destroyed by a slow moving landslide.

Landslide damage to infrastructure

Hundreds of landslides are recorded as having caused damage to roads, railways or pipelines, and/or to have required stabilisation, and the data are certainly incomplete. There are too few financial data to estimate the cost in dollar terms. However, a gabion wall repair of a small road fill failure at Macquarie Pass, NSW, in February 1997 cost \$250,000 and necessitated road closure for about two weeks.

An expensive example is the Wollongong–Sydney–Brisbane railway, where costs associated with landslide damage are estimated to average \$25 million per year during the period 1989–1996. The costs prior to 1989 are not available.

Damage to agricultural land and crops

Five landslides are mentioned as having caused damage to agricultural land, and we estimate a total loss of \$1.3 million (Michael-Leiba et al, 1997). It is likely that both the number of landslides and the cost are gross underestimates.



This landslide, on Lake Morris Road near Cairns, was triggered by heavy rain in March 1999.

Loss of earnings, productivity, etc.

Losses of productivity, earnings or time caused by landslides include: people's time involved in rescue, evacuation, clearance of debris, and legal action; temporary closure of the Magnetic Island International Resort; land unable to be developed; temporary mine closures; damage to fences; and road and rail closures of up to almost three months. Occasionally, residents have suffered the inconvenience of a road being permanently closed, as in the case of Comet Street–Granadilla Drive in Cairns, where the 1990 Tropical Cyclone Joy caused

a landslide which permanently restricted the connection of these once-continuous streets to a pedestrian walkway. There are too few data to put a dollar figure on these losses.

Conclusions

Although the damage caused by an individual landslide in Australia tends to be more localised than that from a damaging earthquake, landslides have killed more than five times the number of people killed by earthquakes. Thirty-six landslides have caused fatalities, compared with two earthquakes.

Landslides are estimated to have caused at least hundreds of millions of dollars worth of damage in Australia in addition to at least 82 deaths and 52 injuries. Consequently, they are worthy of consideration when identifying geohazards in an area.

Finally, we recommend teaching about the dangers of landslides, particularly rock falls from cliffs and ledges and collapses caused by excavation. The education would be particularly valuable if aimed at primary school children. Hopefully, it may save a few lives as five out of the eight landslides which caused fatalities during the period January 1996–June 1999 involved children aged 13 and under.

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This old mine building on Mt Keira was destroyed by a debris flow during the Wollongong floods in August 1998.

Disasters as Heuristics?

A case study

Introduction

During the early 1970s the members of a local environmental group in Port Talbot, South Wales began complaining about the environmental and health record of a local petrochemicals plant. It was alleged that the plant generated dust, noise and light pollution, and 'odours'. Concern was also expressed about the use of vinyl chloride monomer, a suspected carcinogen, as a feedstock gas. The plant's explosive hazards were not a major bone of contention.

On June 1, 1974, the Nypro nylon-manufacturing plant at Flixborough on Humberside exploded killing 28 workers. The deaths and property damage to local houses were widely reported. Following this event, the Port Talbot group began to focus on the potential explosive hazards generated by the petrochemicals plant.

This paper attempts to explain the changing risk perceptions of the Baglan Action Group (BAG) following the Flixborough disaster. Two discourses are employed: Kasperson's (1992) 'social amplification of risk' model, and the social psychological theory of heuristics (Rachlin 1989). The paper commences with a brief description of the two discourses. This is followed by a history of the petrochemicals plant at Port Talbot and a description of the Flixborough disaster. Case study data is presented, and some tentative conclusions drawn.

Discourses

'The Social Amplification of Risk' model

For Kasperson, our experience of risk has two dimensions: First, actual physical harm; Secondly, the acquisition or creation by individuals or groups of 'interpretations of hazards'. The 'social amplification' model focuses on the latter dynamic. Specifically it addresses the possibility that 'psychological, social, institutional, and cultural processes... can heighten or attenuate perceptions of risk and shape risk behaviour'. The 'social amplification' model is premised on the assumption that risk is part 'objective threat' and part a product of 'culture and social experience'. Not all risks are given equal attention. Receptivity is a function of currently held beliefs and agendas (Kasperson 1992):

by Dr Simon Bennett, Lecturer in Risk Studies, Scarman Centre, University of Leicester

Some groups and individuals actively monitor the experiential world, searching for hazard events related to their agenda of concern... [they] process the information [and] locate it in their agenda of concerns... Some may change their previously held beliefs... and be motivated to take action... [S]ignals that are inconsistent with previous beliefs or that contradict the person's values are often ignored or attenuated.

Crucially, therefore, groups or individuals may amplify or attenuate risk 'signals'. As Kasperson (1992) puts it, 'Each cultural or social group selects certain risks and adds them to its strand of worry-beads... even as it selects out other risks'. Kasperson uses Rayner's 'electronic tuner' imagery to explain why some risk messages are picked up and others not. Thus according to Rayner and Kasperson people are 'pre-tuned' to pick up only certain kinds of messages. Kasperson elaborates by asserting that while 'most individuals are largely reactive... many organisations actively seek out and order risks'. The media plays an important role in amplification or attenuation processes. 'The processing of risk events by the media... profoundly shapes the societal experience with risk... Heavy media reporting appears to stimulate social mobilisation', says Kasperson. The media response is 'roughly proportional' to the physical consequences of the event, while risk perception 'appears to incorporate extent of human exposure as well as risk management performance'.

Heuristics

A heuristic is a mental shortcut that '...provides a simplifying routine... that leads to approximate solutions to... everyday problems' (Fiedler and Schmid; Hewstone 1996). In today's complex world it is sometimes difficult to come to a decision. There seems to be too much data to process in the available time. Such cognitive mechanisms as heuristics

'...help the individual to save mental resources... and enables him or her to cope with multiple affordances at the same time' (Fiedler and Schmid; Hewstone 1996). Take the problem of deciding the safety of air travel. Rather than examine all available data, one might be tempted to calculate the safety of air travel on the basis of those events that come most easily to mind. Unfortunately, given the widespread and often detailed reporting of air disasters, one might decide that air travel is dangerous. High profile air disasters offer the public an 'availability heuristic'—a means of quickly estimating the safety of air transportation. Air disasters constitute a 'simplifying routine' for the processing of information and decision-taking. As Perrow (1984) puts it, 'If there has recently been an airline crash, we focus on that event and ignore all the successful flights when we think about the probability of a crash while deciding whether to take a flight or not'. Making a decision on the basis of a limited set of data (an easily recallable event, for example) is known as 'satisficing'. Ideally, of course, one should 'optimise'—that is, spend time and effort weighing up all available data before making a judgement. In the case of air travel, for example, this would mean availing oneself of transportation safety data. Given that air travel is three times safer than rail travel and thirteen times safer than car travel, one might well decide to go by air rather than by any other form of transport. But, as described above, there is a tendency to use mental short-cuts in decision-making. To save time and effort we allow ourselves to be influenced by such memorable and vivid events as disasters or the modes of death of the rich and famous. As Rachlin (1989) explains:

You are driving along the highway and see the flashing lights of police cars and ambulances... You drive a little slower for the next hour or so. You hear that... President Reagan has rectal cancer and you make an appointment with your own doctor. In making judgements as well as decisions we tend to use the information that is most available to us... It is of course easiest and fastest to make judgements on the basis of what

Year 2000

EMA continues to work with the States, Territories, Commonwealth agencies and key utilities in planning to deal with Year 2000 service failures and meet national information needs. The focus has now moved to managing the event and, to meet this requirement, States, Territories and the Commonwealth have agreed to establish Government Response/Coordination Centres embracing emergency response, policy advice and media elements. These centres will monitor Year 2000 related events, provide information to government and, through the media, to the public, and coordinate other action as necessary.

The Commonwealth Centre to be known as the National Coordination Centre (NCC) is being established by EMA and the Office for Government Online. The NCC will gather information from the equivalent State and Territory centres, Commonwealth agencies, and key national organisations to provide a national picture of the impact of the Year 2000. Operation of the Centre will be complemented by the Commonwealth Government Year 2000 Event Management Plan.

For further information contact Barry Stanton, ph: (02) 6266 5505, or email: bstanton@ema.gov.au.

Taiwan Earthquake

Following the earthquake in Taiwan on 21 September 1999, the Australian Government sought to provide a physical rather than monetary response to the disaster relief effort. The Minister for Foreign Affairs Five highly-trained senior officers from the fire services of the Australian Capital Territory, Queensland, New South Wales, Victoria and South Australia deployed on 23 September for seven days. While in Taiwan, they were employed primarily on debriefing rescuers completing their search and rescue duties.

For further information contact Trevor Haines, ph: (02) 6266 5169, or email: thaines@ema.gov.au

Sydney Harbour Oil Spill

Following a request from the Australian Maritime Safety Authority on 4 August 1999, EMA tasked the Australian Defence Force to move two Marco Oil Skimming Vessels and supporting stores by air from Brisbane to Sydney and subsequently by road to Sydney Harbour.

For further information contact Trevor Haines, ph: (02) 6266 5169, or email: thaines@ema.gov.au
Communications in Times of Crisis

As was reported in the Autumn edition of the AJEM (Volume 14 No 1), the National Communications and Information Systems Advisory Group has developed a draft Strategic Plan aimed at resolving a number of issues surrounding communications in times of crisis. The National Emergency Management Executive Group

approved the Plan at its August meeting and work is commencing on its implementation.

A working party met in October to consider the provision of telecommunications services during disasters and, under the provisions of the Telecommunications Act 1977, the need for a National Disaster Communications Plan. Participants were drawn from States and Territories, the Australian Communications Authority, the Department of Communications, Information Technology and the Arts, the Australian Communications Industry Forum and EMA. For further information contact Barry Stanton, p: (02) 6266 5505, or email: bstanton@ema.gov.au.

National Framework for Prevention and Mitigation

In order to promote and market the National Framework for Prevention and Mitigation, the Mitigation Working Party, through EMA, is seeking a more publicly acceptable title which preferably excludes the word, 'mitigation'. While the assistance of marketing professionals and students is being sought, all comments are welcome.

For further information contact David Winterburn, ph: (02) 6266 5009, or email: dwinterburn@ema.gov.au.

Mitigation Working Party Update

Membership of the Mitigation Working Party (MWP) has been broadened to include representatives from the NSW State Emergency Planning Committee, ACT Emergency Services Bureau, Royal Australian Planning Institute, the Insurance Council of Australia, Bureau of Meteorology and the Australian Geological Survey Organisation. The Commonwealth Departments of Transport and Regional Services and Finance and Administration are also showing interest in the work of the committee.

A major outcome of the last meeting was the establishment of working groups to develop a strategic plan for the Mitigation Working Party and Terms of Reference for research into national risk assessment, the costs of disasters (with cost measured in economic, social, environmental and psychological terms); and the cost-benefit of mitigation. The latter proposal will be considered by the National Emergency Management Committee at its November 1999 Meeting.

For further information contact David Winterburn, ph: (02) 6266 5009, or email: dwinterburn@ema.gov.au.

Submission to include Flood in the Building Code of Australia

EMA recently submitted a proposal to the Australian Building Codes Board (ABCB) to have flood and storm surge included in the Building Code of Australia. The proposal aims to enhance safety from building failure during flood, ensure safe evacuation routes at times of flood and to highlight the need for designs and the use

of flood compatible building materials to reduce flood damage.

For further information contact David Winterburn, ph: (02) 6266 5009 or email: dwinterburn@ema.gov.au.

Search for Missing Snowboarders

In a last ditch effort to locate four snowboarders missing in the Mount Kosciuszko National Park in south-eastern Australia and, at the request of the New South Wales Government, in early August EMA tasked the Australian Defence Force to provide a specialist aircraft to assist with the search. The aircraft was fitted with thermal imaging equipment which was part of a surveillance trial focused on locating land-cruiser sized vehicles in northern Australia. The aircraft located some 'hot spots' on the snow surface but, consistent with the characteristics of thermal imaging, which does not penetrate water, the equipment was unsuccessful.

For further information contact Rod McKinnon, ph: (02) 6266 5328, or email: rmckinnon@ema.gov.au

East Timor Crisis

In September and October, EMA was heavily involved in the East Timor Operation. Commitments included: activation of the Commonwealth Government Reception Plan (COMRECEPLAN) for the coordination of Commonwealth agency involvement in the reception in Australia of Internally Displaced Persons (IDP); activation of the Commonwealth Government Disaster Response Plan (COMDISPLAN) for the sourcing and movement of tents, stretchers and bedding by the Australian Defence Force from Southern Australia to Darwin to enable the Northern Territory Government to establish a Temporary Accommodation Facility; and, at the request of the Australian Agency for International Development, activation of the Australian Government Overseas Disaster Assistance Plan (AUSASSISTPLAN) for the air dropping of food in East Timor.

Other Commonwealth agencies involved included the Departments of Foreign Affairs, Health and Aged Care and Immigration and Multicultural Affairs. From a Northern Territory perspective, it was truly a whole-of-Government effort.

For further information contact Rod McKinnon, ph: (02) 6266 5328, or email: rmckinnon@ema.gov.au

Disaster Prevention for the 21st Century

The Australian Disaster Conference 1999 was held on 1-3 November 1999 in Canberra. Printed copies of the proceedings are available from EMA at a cost of \$100. Contact EMA on ph: (02) 6266 5402, fax: (02) 6266 5029 or by email to: ema@ema.gov.au to order a copy of the proceedings. Copies are also available for loan through the AEMI library.

Later issues of AJEM are expected to contain a detailed report on the conference, the directions and priorities identified for the future and a selection of the presented papers.

Spatial Data in Emergency Management Workshop

A Spatial Data in Emergency Management Workshop was

held on the day following the conference, Thursday 4 November. It was planned and organised by the ACT Emergency Services Bureau and the Australian Geological Survey Organisation (AGSO), in cooperation with the Australian Disaster Conference 1999.

This workshop forms part of a series that began with the 1994 workshop *Hazard Management: Better Information for the 21st Century*, held at AEMI and sponsored by EMA and AURISA. The series aims to facilitate the effective use of spatial data across the whole spectrum of emergency management in Australia and the region.

The workshop provided a forum for discussion between practitioners, including data analysts, GIS professionals and information users, and others interested in the use of spatial data for emergency management. Other workshops are also being planned over the next two years.

For further information contact Rick McRae on ph: (02) 6207 8607 or Greg Scott on (02) 6249 9132.

New IDNDR projects funded in FY 1999/2000

- Australian Emergency Management Forum - web site including virtual chat forums (3/99), *Dr John Field, Charles Sturt Uni, Bathurst, NSW.*
- Message Sticks - Natural Hazard Warning and Action Devices for Aboriginal Communities (4/99), *Dr Allan Skertchly and Ms Kristen Skertchly, Success Management International Learning Enterprises (SMILE), Casuarina, NT.*
- Public Education and Awareness - Natural Disaster in the Republic of Palau (5/99), *Mr Hazime Telei, National Emergency Management Office (NEMO), Republic of Palau.*
- Flood Data Books - A Low Cost Alternative to Floodplain Mapping in Rural Areas (6/99), *David Fuller, Department Primary Industries Water and Environment, Hobart, Tas.*
- Effective Behaviour Change Programs for Natural Hazard Reduction in Rural Communities (7/99), *David Bridge, Deakin University, Geelong, Vic.*
- Cyclone Vulnerability/ Awareness and Preparedness in Remote and Aboriginal Communities of the Gulf of Carpentaria (9/99), *Dr David King, James Cook University (JCU), Townsville, Qld and Linda Berry, JCU, Cairns, Qld.*
- Study into the Factors Which Contribute to the Effectiveness of Sprinklers for Property Protection During Bushfires (10/99), *Mr Troy Williams, Fire Protection Association Australia (FPA Australia), Box Hill, Vic.*
- Review of Bushfire Safety for People with Special Needs Pilot Project (11/99), *Annette Dodson, Knox City Council, Wantirna South, Vic.*
- Disaster Information on the Web - An Index to Prompt and Reliable Information (12/99), *Edmund Bernard Joyce, School of Earth Sciences, University of Melbourne, Parkville, Vic.*
- Workshop on Volcanic Hazards/Operations Support Plans and Awareness Programs for Savo Volcano - Solomon Islands (13/99), *Russell Howorth, South Pacific Applied Geoscience Commission (SOPAC) Secretariat, Suva, Fiji.*

- Reducing Natural Disasters – Special Feature Articles in CSIRO's *The Helix* Magazine (14/99), *Dr Simon Torok, Editor, The Helix, Canberra.*
- Development of Handbook – Designing Landscapes and Building for Bushfire Areas for the Australian Community (15/99), *Mr Lisle Rudolph, Mt Waverley, Vic & Dr G Caird Ramsay, Scientific Services Laboratory, Port Melbourne.*
- *Wet Winds and Dry Earth* - Working Title for an Educational Resource on Drought and Tropical Cyclones (16/99), *Denise Miles, Geography Teachers' Association of Victoria (GTAV), Camberwell West, Vic.*
- Development of a Standard Module on Disaster Recovery in Remote Aboriginal Communities, Northern Territory (17/99), *Nicola Slavin, Environmental Health Officer, Public Health Unit, Territory Health Services, Katherine, NT.*
- *Awareness/ Endurance/ Recovery* – A Kit for Coping with the Psychological Effects of Natural Disaster (18/99), *Kareen Pillar, Cairns City Council, Cairns, Qld, in cooperation with JCU Department of Psychology.*
- Production of an Awareness Community Theatre Training Manual and Video to Enhance Pacific Cyclone Preparedness and Awareness (19/99), *Dr Kevin Vang, Australian Foundation for the Peoples of Asia and the Pacific (AFAP), Crows Nest, NSW.*
- Provision of Equipment to support Public Education and Awareness Programs, Fiji (20/99), *A Tuifagalele, National Disaster Management Office (NDMO), Suva, Fiji.*
- Public Awareness and Education Booklet and Video on Cyclone and Severe Storm Mitigation, Prevention, Preparedness, Response and Recovery for the Norfolk Island Community (21/99), *Mr I F Buffett, Emergency Management Norfolk Island Committee (EMNIC), Norfolk Island.*
- Flood Help – An Online System for Providing Guidance to House Owners in Flood-Prone Areas (22/99), *Dr I S Cole, CSIRO Division of Building Construction and Engineering, Highett, Vic.*
- Automated Processing and Distribution of Remote Sensing Visualisations for Disaster Prevention and Preparedness in Local Government Areas (23/99), *Rick McRae, ACT Emergency Services Bureau, Curtin, ACT.*
- Development and Distribution of Educational Resources to Support Hazards, Disasters and Survival TV & Video Series (24/99), *Jeanne Kriewaldt, Australian Geography Teachers' Association (AGTA), Balwyn, Vic.*
- Development and National Distribution of an All-hazard Emergency Awareness Teachers' Guide for Secondary Schools (25/99), *Lyndall Horton-James, West Education Centre, West Footscray, Vic.*

IDNDR Education 2000

The Unexpected Catastrophe: 1989 Newcastle Earthquake Information Resources is a CD ROM produced by the Newcastle Region Library with funding from the Australian IDNDR Program and Newcastle City Council. It contains a wealth of information resources about the events of the 1989 Newcastle earthquake and its aftermath. They are presented in a searchable database format and are linked to full text documents, photographs and excerpts of sound and video recordings.

Resources in the collection include: seismology; economic aspects; earthquake engineering; seismic history; emergency management; heritage issues; social impact; health and psychology; insurance; and recovery and renewal. The CDs are available for sale from the Newcastle Region Library. ph: (02) 4974 5300 or fax: (02) 4974 5396 for information about CD sales.

Water Water Everywhere is a valuable new IDNDR-funded secondary school resource dealing with hazards, water and farming communities. This 60-page workbook for Levels 6 and 7 in Studies of Society and Environment (SOSE) uses inquiry-based learning activities to help students develop skills and enhance their understanding of flooding. This covers natural and human causes, flood behaviour, and management options to maximise benefits while reducing negative impacts on people and the environment. Case studies throughout Australia are used to highlight different aspects. Simulations allow students to participate in decision-making processes. Contact Geography Teachers' Association of Victoria for details. ph: (03) 9824 8355, Fax: (03) 9824 8295, email: gtav@netspace.net.au.

What's on at AEMI

National Studies Program

14 – 18 February 2000

Dambreak Emergency Planning

The aim of this workshop is to provide generic national guidelines for emergency response by dam owners and emergency management agencies for extreme floods downstream of dams, including dam failure situations.

Courses

Introduction to Emergency Risk Management (IERM)

IERM is the prerequisite for the emergency risk management courses at AEMI. As part of the extension program in the latter half of 1999, each State and Territory has conducted IERM courses and approximately 600 people across Australia have attended this course. These courses will now continue to be run 'in situ' by the States and Territories and will be a powerful tool to 'spread the word' about Risk Management to the broader emergency management community.

Emergency Risk Management

AEMI staff are currently developing and delivering a new suite of training and education products. The new Emergency Risk Management courses to be offered by AEMI in the first half of 2000 are aimed at personnel involved in risk management at a community level. The courses are designed to provide participants with an understanding of the process of emergency risk management as described in the EMA Emergency Risk Management Manual (derived from AS/NZS Risk Management 4360:1999) and with practical guidance in the application of the process.

The syllabuses are based on emergency risk management competencies (Public Safety Training Package, 1999) and will be delivered through a combination of residential

activity at Mount Macedon (two 4-day periods) and workplace learning projects.

Course 1 (including 4 day residential) –

Understanding Emergency Risk Management

This course will offer participants the opportunity to examine the emergency risk management process in detail. Subjects examined will include:

- the risk management process, including an examination of all steps in the process;
- the management of a community risk study, and
- Issues likely to emerge during a risk management project within a community.

Course 2 (including 4 day residential) –

Implementing Emergency Risk Management

This course will focus on how to undertake a community risk management process. There will be a strong emphasis on the processes needed to apply risk management within a community. Participants will examine a range of concepts and principles applicable to working with communities within an emergency risk management context. These will include:

- working at local government level (what is a community and how does it work?),
- communication skills, decision making in the public arena and document management,
- process facilitation within community groups (including roles of the facilitator and facilitator ethics),
- public education and social marketing.

Emergency Risk Management Manuals

In addition to course development a number of manuals are being developed to support the emergency risk management process and to complement the two parts of the Emergency Risk Management course. They are:

- 1. Applications Guide:** This guide passed through the final consultation process with the States and Territories and will be published soon.
- 2. Social Processes Guide:** The development work is underway and should be finished in the first half of 2000.

National Emergency Management Education and Training Advisory Group

At its April 1999 meeting, the National Emergency Management Executive Group (NEMEG) approved the establishment of the National Emergency Management Education and Training Advisory Group (NEMETAG) in response to a recommendation from the 'Report Into the Role of the Australian Emergency Management Institute in the Development and Delivery of Emergency Management Education and Training Post 2000' (E & T 2000). The first meeting of the NEMETAG was held at AEMI on 17 September 1999.

The purpose of the NEMETAG as defined by the NEMEG is to:

- Provide strategic advice to the NEMC on the current and future professional development of persons who have disaster/emergency management functions within the community.

- Support AEMI in implementing strategic advice from the NEMC on education and training matters.

The membership of the NEMETAG is:

Dudley McArdle	DAEMI; Chairman
Joe Paul	SES; NEMEG
Bruce Esplin	NEMEG
Barry Hamilton	NEMEG
Ray Fogolyan	VET Sector
Barry Grear	Institution of Engineers
Stephen Gough	Convention of Ambulance Authorities
Sandra Lunardi	AFAC
Morrie Bradley	EMA representative
Insp. Doug Hocking	Australasian Police Education Standards Council
Prof. Patrick Griffin	Tertiary Education Sector
Tony Bisdee	Australian Local Government Association
Barry McPhee	Recovery Sector

The next meeting of the NEMETAG will be in April 2000.

EMA publication news

New and revised publications now available (as noted below in each category):

Community Awareness and Education:

Natural Hazard Awareness for the Northern Territory (colourful, B2 size, community awareness poster). This new poster map texturally and photographically depicts the history and details of major natural hazard impacts and disasters in the NT. It was funded by IDNDR and produced by EMA as part of a series to cover all States and Territories. It is available (free) through Northern Territory Emergency Services, PO Box 39764, Winnelle NT 0821.

Severe Storms: Facts, Warning and Protection (A5 fold out colour pamphlet). This joint EMA/Bureau of Meteorology publication has been revised and features new photographs and updated information on the dangers of severe storms. It also covers the warning system and information on personal and property protection. (Copies available through all State/Territory Emergency Services.)

Australian Emergency Manual Series:

Part III – Emergency Management Practice
Volume 1 – Service Provision
Manual 2 – Disaster Medicine (2nd Edition)
(Copies available through your State/Territory departments of health)

Part V – The Management of Training
Manual 1 – Small Group Training Management (2nd Edition)
(Copies distributed to relevant emergency agencies through State/Territory Emergency Services. [Training Sections maintain distribution/amendment registers])

EMA addresses for publications orders (first check above for appropriate EMA Office or S/T authority):

Emergency Management Australia, PO Box 1020, Dickson ACT 2602, Australia.

Australian Institute of Emergency Management, Main Rd, Mt. Macedon VIC 3441, Australia.

is easiest to call to mind—the heuristic of availability.

The Port Talbot Plant

The petrochemicals plant in question was owned and operated by British Petroleum Chemicals International. Sited at Baglan Bay near the town of Port Talbot, it covered about 600 acres of a 1,000 acre site. BP built the plant in the 1960s, siting it adjacent to a low-rent housing estate of 15,000 people, (Jones 1989) a school with 1,700 pupils and a sports ground.

The school was situated about 500 yards from BP's perimeter fence. Work on the housing estate had commenced in 1950. The plant came 'on stream' in 1963. By 1968 it employed around 600 people. The company boasted of the plant's 'Space Age technology' that would '... help the Nation's Balance of Payments by eliminating imports'. (BP Chemicals International ad. 1968). BP completed a major addition to the plant in March, 1974, by which time it had invested a total of £140 million. The plant's incremental growth reflected a buoyant UK petrochemicals sector (Cranfield 1974). Petrochemicals plants present both fire and explosive hazards. The larger the plant and the greater the volume of on-site storage, the greater the risk (Napier 1974).

There had been two major fires at the Baglan Bay plant prior to the Flixborough disaster. On 6 February 1973, Baglan's new ethylene plant caught fire during commissioning. Flames 'soared 150ft above the works'. Fourteen workers were injured. In addition to works appliances, five municipal fire engines attended the scene. According to one newspaper (The Port Talbot Guardian, 9/2/1973) the local population seemed ignorant of the cause and nature of the problem:

Thousands of people on the Sandfields and Baglan Estates watched as columns of yellow flames belched skywards. Many believed the fire was all part of the commissioning work.

It emerged that the fire had been caused by a component failure that allowed 'large volumes of flammable hydrocarbon gases' to escape 'at high pressure' (The Port Talbot Guardian, 23/2/1973). There are similarities

between this incident and the later Flixborough explosion, where a flammable mixture escaped under pressure (Kennett 1982). At Flixborough, however, the gas exploded with enormous force (see below).

At the end of February 1974 the styrene plant caught fire releasing a 'large quantity of smoke' which 'drifted like a huge pall across the nearby Sandfields Estate'. Eight municipal fire appliances attended the blaze, which burned for 35 minutes. The headmaster of the local school, on seeing the 'dense black pall', ordered that all the school's windows be closed (The Port Talbot Guardian, 1/3/1974).

By the end of 1977 the number of pollution-related complaints received by the plant had been greatly reduced (The Western Mail 24/11/1977), but the plant continued to suffer periodic fires. In March, 1983, a blast in the ethylene plant injured two workers, one severely. As The Western Mail reported on 10 March:

The blast...sent thick black smoke hundreds of feet into the air. The force of the explosion rattled windows up to three miles away. The blaze took two hours to bring under control...Thirteen fire appliances...including 10 water tenders, two foam units, a turntable tender [sic] and an emergency unit fought the blaze.

In October 1990 the ethylene plant again caught fire. It took 12 hours to bring the blaze under control.

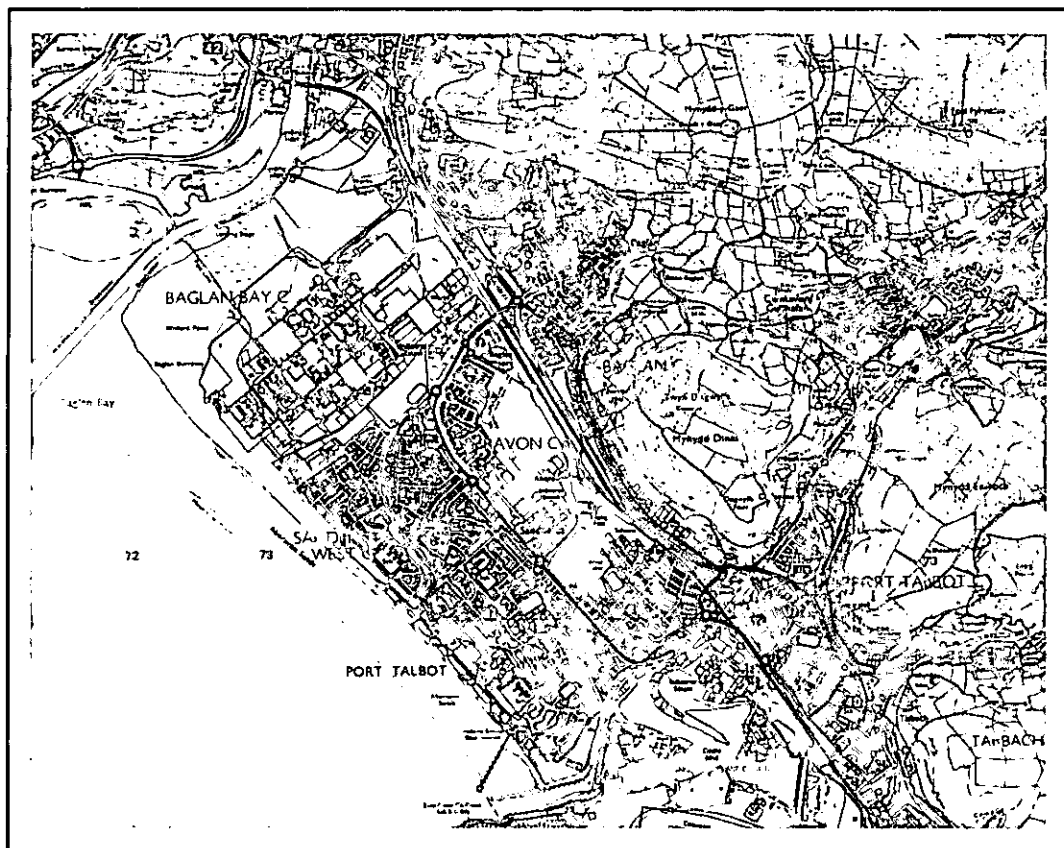
Despite such obvious setbacks, however, during the 1990s Baglan Bay's local management made great efforts to involve the community more with the plant (Bennett 1996).

Baglan Action Group

BAG was formed in February 1974 in response to perceived inadequacies in BP's attitude to pollution. It had ten members. Initial concerns focused on '...the medical effects of industry on people'. While members were aware of the 'potentially explosive' (The Western Mail 19/2/1974) nature of BP's activities, until Flixborough this particular risk did not feature prominently in exchanges between BAG and BP Chemicals.

The Flixborough Disaster

The Nypro plant was located on mostly flat land between two villages, Flixborough and Amcotts. The site extended over 60 acres. The population could choose to work either at Nypro, a local steel plant or in agriculture. Although Nypro employed about 550 people, few Flixborough residents worked there (Clammer 1974). The plant produced Nylon-6 for the garment industry by combining benzene with ammonia. A Nypro chemist likened this process to 'boiling petrol' (Scullion



Map of the Port Talbot region surrounding and including the British Petroleum Chemicals International plant at Baglan Bay. Reproduced from Ordnance Survey mapping with the permission of Ordnance Survey on behalf of Her Majesty's Stationery Office © Crown copyright. NC/99/005.



The British Petroleum Chemicals International plant at Baglan Bay, Port Talbot, South Wales in January 1993. Photographed from the western bank of the River Neath. The town of Port Talbot and the Sandfields Estate are located 'behind' the plant.

1974). Twenty-eight workers were killed and 36 injured in the disaster. Had the disaster not occurred at the weekend many more workers would have been killed (Taylor 1975). The plant exploded with a force of 'between 15 and 45 tons of TNT' (Kirkwood 1997). Some witnesses likened the event to an atomic explosion (Kennett 1982). A police report '...describe[d] an enormous black mushroom cloud laden with debris which rose to over a mile (1.6km) above the devastated area... Falling debris started small fires up to three miles (4.8km) away' (Kirkwood 1997). The main conflagration lasted 24 hours. Smaller explosions occurred throughout the following week. Three thousand local residents were evacuated. One thousand homes lying within a three mile radius were damaged.

Out of Flixborough's 79 houses, 72 were damaged (Brown 1990). There were 53 recorded casualties outside the perimeter fence. The disaster was covered in the media and discussed in Parliament. The local MP asserted that 'the cost in terms of grief and misery my constituents have had to suffer... is too high for a so-called civilised society to bear' (Ellis in the Times 1974).

Methodology

Secondary sources only have been used, specifically the reportage of three local newspapers, The Western Mail, The South Wales Echo ('sister' paper to the Mail) and The Port Talbot Guardian. The papers have been used to tell the history of the risk debate and as a source of 'witness

statements'. The publication dates are given in parentheses.

It is accepted that this methodology is not optimal. Contemporary researcher-conducted interviews with protagonists and participant observation would have provided the most reliable data. Nevertheless, on the assumption that reporters recorded events and the views of group members accurately, the three secondary sources may be considered to provide a truthful account of the terms, nature and course of the risk debate.

The risk debate as reported by The Western Mail, Port Talbot Guardian and South Wales Echo

Prior to the Flixborough disaster, the risk debate pertaining to the BP Chemicals plant had two major themes: environmental pollution and the health risk to workers presented by vinyl chloride monomer (VCM). VCM had been linked to cancer of the liver. The pollution debate revolved around four aspects of the plant's operation: its alleged dust and odour emissions, light pollution and its generation of 'excessive' noise (Mail 15 February 1974). The Baglan Action Group—'Formed to fight pollution'—orchestrated the campaign against BP. As the leader of BAG put it:

Our complaints are well known. They are of smoke, noise and chemical pollutions [sic] and we are desperately anxious to have some early answers to our questions (Echo 19 February 1974).

BAG worried that pollution would 'devalue property' (Mail 20 February

1974). 'It is BP that's devaluing the property' said the action group's Secretary in late February 1974 (Echo 20 February). In the same month a local councillor complained that 'the noise nuisance is as bad now as it was 12 months ago' (Guardian 22 February 1974).

Questions about BP's environmental performance had been raised prior to BAG's formation in 1974. On 19 September 1973 the Headmaster of the school adjacent to the site had 'complained to the Port Talbot public health inspectors office' about a pungent odour. Residents 'complained that the smell... made them feel drowsy and gave them a burning feeling in their throats'. A spokesman for BP stated that it was not certain the odour had come from the plant (Mail 21 September 1973).

Protest against BP's environmental performance took a number of forms. In September 1973 three residents on a local private housing estate held a rates strike (they refused to pay their property tax). One complained that pollution from the plant was affecting property values:

Our lives have become intolerable as a result of the noise and pollution coming from the BP plant over 14 months and which has continued despite complaints. When our rates were increased under the new assessments it was the last straw, because the conditions have reduced the value of our properties.

Another rates striker complained about the 'inhuman' noise pollution produced by the plant (Guardian 21 September 1973).

At the beginning of 1974 The Western Mail reported that the deaths of three workers in America who had been exposed to VCM gas were being investigated. On 31 January, The Western Mail announced that 'Medical records of about 700 men at BP in South Wales are to be checked after it was found they have been in contact with [VCM]'.

The themes of environmental pollution and workers' health dominated the public debate about the plant between January and May 1974. On 9 May, The Western Mail reported that the British Society for Social Responsibility in Science (BSSRS) had urged local residents '[T]o demand that BP Chemicals at Baglan Bay publish their pollution figures'. BAG's Secretary supported the BSSRS call for more information on pollution to be supplied to residents. Acknowledging the campaign,

BP revealed the extent of its investment in remedial measures to the press. As *The Western Mail* explained on 16 Feb 1974:

The company is spending about £60,000 a year checking on pollution...£30,000 on cutting out smells...and a further £225,000 on installing silencers to reduce noise.

Following the Flixborough disaster of 1 June 1974, however, the focus of concern of the members of BAG shifted from pollution and VCM to explosive hazard. As *The Western Mail* put it; 'Until the Flixborough disaster at the weekend, the Baglan Action Group had channelled their protests towards noise and pollution at the plant' (4 June 1974). BAG's Secretary described the mood shift thus:

I think everybody was a little stunned and shocked when the news came out. But what has alarmed us is that the experts have said this sort of thing could happen again (Echo 4 June 1974).

(This comment bears certain similarities to statements (Kennett 1982) made by Flixborough residents on realising that they had been living next to a plant with the capacity to explode with great destructive force).

Interestingly, in a statement to *The Western Mail*, the group's Secretary hinted that BAG had been conscious of the plant's explosive risks for some time but had chosen to remain silent:

Some of us have had anxieties about this type of incident which we have not pressed publicly to avoid being alarmist (4 June 1974).

In a letter to *The Echo*, BAG's Chairman made the same assertion:

Wishing to alarm no one the Baglan Action Group played down the all-too-real parallel which exists here. Nobody can accuse us of selfishly exploiting the tragedy for our own ends... (17 August 1974).

It seemed to BAG's Secretary that the situation at Port Talbot was potentially more serious than that at Flixborough:

There were acres of farmland surrounding Flixborough, but at Baglan Bay there is a school on the perimeter of the site... If a similar explosion occurred at Baglan Bay, it would rip the school from its very foundations (Echo 4 June 1974).

BAG's Chairman had no doubt that a catastrophe was inevitable:

Unfortunately... the question is not 'will it?' but 'when will it go up and how many will go with it?' In such an event... both workers and BP's closest neighbours... would stand no chance... Should they survive an

explosion the poison gas... would rapidly dispatch them (Echo 17 August 1974).

BAG called for a review of the plant's explosive risks, as did *The Port Talbot Environment Society*, *Port Talbot New Tenants' Association* (PTNTA) and the *Aberavon North Ward Labour Party*. 'Because of the concentration of housing and schools nearby... People have the right to know what the dangers are', said the Chairman of PTNTA (Mail 5 June 1974).

In mid-June, BAG published a report on the risks presented by the petrochemicals complex. It contained the following unequivocal statement of concern:

In the light of the Flixborough disaster the dangers of explosion and fire are obvious (Mail 15 June 1974).

It would appear that Flixborough had 'made obvious' to BAG the 'dangers of explosion'. BAG's report went on:

The two major fires [see above] have caused much concern, but until Flixborough the public did not appreciate the horrifying potential of such a plant... At this time it would be wrong not to press for an inquiry into the general security of the plant (Echo 14 June 1974).

In July 1974 the government's Employment Secretary announced a program of inspections of plants by the *Factory Inspectorate*. The Employment Secretary communicated this news to BAG in a letter. BAG's Secretary commented:

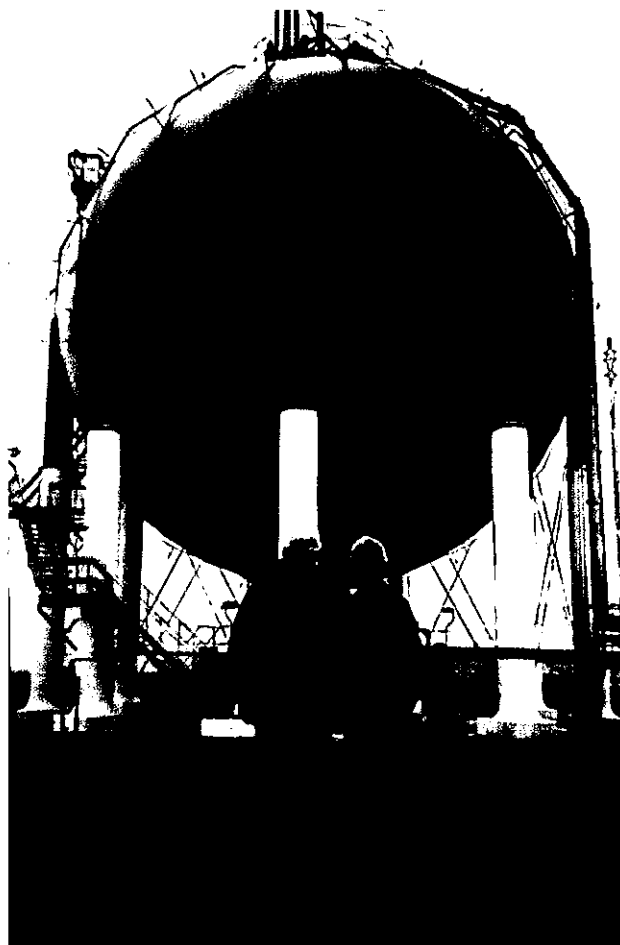
We will be watching the situation closely. Until some firm recommendations are made we are still going to be very worried (Mail 18 July 1974).

Flixborough 'freed up' the local political impasse that had existed between BAG and BP's management. Although BP had invited BAG to the plant for discussions, BAG had refused to go. After Flixborough, however, BAG met BP's management on 'neutral territory' at a local leisure complex. A two-hour meeting saw 'frank speaking'. A further

meeting was arranged. BP also planned to meet the *New Tenants' Association* and *The Port Talbot Environment Society* at a later date (*Guardian* 28 June 1974).

Conclusion

The most puzzling aspect of BAG's campaign was the way the group played down the risk of explosive hazard. BAG's members attenuated the signals that Baglan Bay might present a serious explosive hazard (the two fires), preferring to 'tune in' to pollution and VCM issues instead. This attenuation might be explained by the nature of the emergencies at the BP plant. The two fires were unlike the Flixborough disaster in a number of important respects: The destruction at Flixborough continued for about a week; the fires at BP were quickly brought under control. At Flixborough there was extensive damage beyond the perimeter fence; at Baglan there was no damage beyond the perimeter. Workers were killed at Flixborough; no workers were killed at Baglan. There were off-site injuries at Flixborough; there were none at Baglan. At Flixborough most of the plant was razed; at Baglan only self-contained sections were damaged. There was extensive and prolonged local, national and international reporting of the Flixborough



A storage vessel on the 1,000 acre plant at Baglan Bay

disaster; there was much less reporting of the two fires at Baglan. Following Kasperson's (1992) discourse on the media it may be this differential that explains the group's pre-Flixborough attitude towards explosive hazard.

As Kasperson explains '...Heavy media reporting appears to stimulate social mobilisation'. Could it be that while the group had always been aware of the risk of explosion (see statements by group members, above) it took the world-wide media event that was Flixborough to persuade the group to 'add the risk to its strand of worry beads'? Perhaps the relatively low-key reporting of fires at Baglan had failed to persuade the group to speak out on the issue of explosive hazard. While BAG had identified explosive hazard as worthy of inclusion in its 'agenda of concerns', such risks were well down the list.

Post-Flixborough the group—now fully tuned-in to the risk of catastrophic explosion posed by such plants—moved the risk up its agenda of concerns and launched a sustained campaign. That is, BAG, having 'sought out the hazard event', was sufficiently concerned by the possibility of a similar fate befalling the plant and community at Baglan that it *amplified* the risk. Kasperson also suggests that 'extent of human exposure' affects risk perception. Certainly the 28 deaths and numerous injuries at Flixborough would suggest the sensitisation of other 'at-risk' populations to explosive hazard.

Nuttal's (1959) *Standard Dictionary of the English Language* defines an heuristic as something that 'leads to discovery'. Following this definition the two fires at BP's Baglan Bay plant should have encouraged BAG to air its views on the subject of explosive hazard. However, while BAG placed explosive hazard on its agenda of concerns it remained mostly silent on the matter, preferring to pursue health issues instead.

Then the Nypro plant exploded, killing, maiming and destroying. The disaster was broadcast across the globe. It even led, indirectly, to new safety legislation. Here, then, was an event that was difficult to ignore. Rachlin's analogy of the traffic accident may provide an explanation for the group's behaviour pre- and post-Flixborough. While, as drivers, we are all aware (in varying degrees) of the risks attendant upon road use, it may take some dramatic and horrifying event—like seeing the physical and human costs of a car crash—to first, convince us of the danger and secondly, to persuade us to

modify our behaviour. The car crash—the most dramatic manifestation of the failure of the socio-technical system that is car travel—acts as an availability heuristic, revealing the potential horrors that await the careless driver. As Rachlin puts it, 'You see the flashing lights and you drive a little slower'. Having been sensitised you change your risk-taking behaviour (for a time). As with car drivers, so too with the members of BAG. The lessons of Flixborough were so dramatic and obvious that, for a time at least, challenging BP on the issue of explosive hazard became the group's number one priority. The group modified its behaviour.

But this is possibly not the whole story. There may be another dimension to the risk debate at Baglan Bay: qualitative differences between the various risk-related events. The fires were short-term hazards. The second blaze expired in 35 minutes. While there were transboundary impacts (the pall of smoke) these soon disappeared.

In contrast, the dust, noise and light pollution and odours from the plant were more persistent. Such hazards had an 'irritant' quality. Unlike the transient hazards of fire and explosion, they were frequently manifest. They also generated much complaint from the community. Given that BAG's primary mission was to 'fight pollution', these hazards were obvious candidates for amplification. After Flixborough, BAG's leaders insisted that they had been aware of the plant's explosive risks all along. They had simply chosen to remain silent to avoid panicking the community.

This might be true. Alternatively, it might be that it took a disaster as dramatic and visceral as Flixborough to make obvious the attendant fire and explosive risks inherent in chemical process industries.

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Managing volunteers

Introduction

This paper covers some important aspects of managing volunteers, these include:

- level of control which may be exercised;
- styles of management;
- communications; and
- dispute and conflict resolution.

However, before discussing these issues I feel it is necessary to provide a brief overview of the New South Wales State Emergency Service (SES) for my comments to have some meaning and context.

The State Emergency Service is an emergency and rescue service which is the lead agency for dealing with floods and storms and also carries out the majority of the general rescue in the rural parts of the State. This includes road accident rescue, search and rescue and vertical rescue.

The SES was formed in 1955 after massive floods in which over 40 people lost their lives and millions of dollars worth of damage was done. The SES still puts a lot of effort into this flood role because floods are the most costly natural hazards and the SES is committed to preparing the community.

The SES has 243 units grouped into 18 Divisions with a total of 6,700 active members. There are no permanent staff at unit level. Units are based on local government Councils that are responsible for providing accommodation and it is expected that they assist with funding for vehicles and day to day unit running costs.

The SES has historically been under funded but that is finally improving. Unlike the fire services, which receive most of their funding via an insurance levy, virtually all of SES funding comes from the New South Wales State Government Treasury.

The SES operates under an Act of Parliament and the organisation is essentially a government department. It has 31 staff at the State Headquarters in Wollongong and 38 in the field in the 18 Divisional Headquarters.

Basic Needs

As an emergency service there are a number of basic needs which must be met if we are to be able to operate. Volunteer groups which are not emergency services may have slightly different requirements, although I

By Major General B W Howard AO MC,
Director General, NSW State Emergency
Service. A paper presented to the 4th
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Volunteers in Emergency Services. July 22,
1999, Sydney Australia

suspect that most will be somewhat similar.

Clear Roles

The first need is for clear roles and tasks. These can be stated in legislation or official emergency plans, but they must be clear and unambiguous and there must be definite lines of responsibility. There is a tendency in the public safety industry for volunteer groups to spring up of their own accord and decide that they will carry out some form of rescue or support. I believe that this should not be allowed. Existing groups can also decide that they need to train and equip for tasks for which they perceive a need.

There must be a system to control these tendencies or we can spend most of our time 'fending off invaders'. Fortunately New South Wales is well served in this regard by a system of formal accreditation for the common forms of rescue, which prevents these splinter groups and different directions. It has proved to be a godsend.

Protection

The second framework requirement is adequate protection for individuals. Emergency services work is intrinsically unsafe so the level of personal protection must be high. The SES views protection to include:

- employment protection;
- personal effects insurance;
- insurance against accident, sickness or death;
- protection against legal action; and
- adequate personal and operational equipment and appropriate training.

Once again, New South Wales is well served although the last point, equipment and training, has not always been as good as it should have been within SES.

In meeting these two needs, the question of control is partly answered. If the roles are clear, the volunteers must be prepared to contribute to them or not join in the first place. Naturally not

everybody can turn out every time there is a call, but to remain effective the percentage that will respond needs to be above 50. The level of availability needs to be stated in organisational documents.

Communication

However, I regard the most important aspect of managing volunteers successfully is communication.

Volunteers, whose motivation is not financial, need a stake in their organisation. They not only want to know what is going on, they want to influence proceedings. I support both of these aspects very strongly.

Communication is a real challenge in a decentralised organisation, like the SES, where offices are not manned by staff on a regular basis. Nevertheless, effective communication is absolutely fundamental to the wellbeing of volunteers and the effectiveness of the organisation. We have our own web page which contains a reasonable amount of information that is designed for our own members rather than outsiders, and this has been a great help. We encourage inquiries from our volunteers and always answer them carefully.

The SES operates a quarterly newsletter which goes to all units. It is designed to provide information on current issues and is also well regarded. A copy is placed on the web page. During unit visits we make sure that we locate the last Newsletter and check that it is readily available to all volunteers. We have annual Conferences at Division level where current issues are discussed and problems aired. Invariably someone from State Headquarters is present.

But I suppose personal contact remains the most important means of communication and it cannot be replaced effectively by electronic or paper systems. There is no substitute for regular visits to units. Our Headquarters staff are very active in this regard and, amongst other reasons for visits, we conduct Operational Readiness Inspections on one third of our units each year. These are non-threatening because we are there to work with the local volunteers to fix problems, not just record them, and they are part of the wider system of creating opportunities to talk to the volunteers.

The organisation has a volunteer association which is growing in strength

and it is involved in the SES's organisational Performance Management System. This is a most important aspect of Volunteer Management and, in my experience, volunteers need consultation more often than do employees. There is no need to be nervous of this process as the vast majority will accept reasonable explanation. However, they are always coming up with ideas that need somewhere to go and that must be dealt with.

We conduct regular surveys on all kinds of issues in an attempt to be reasonably sure that we are meeting needs. Examples are uniforms, leader insignia, Code of Conduct, vehicles, funding and so on. We are currently looking at what the volunteers think we can do to improve our profile.

We know the community holds us in high regard but we also know that they don't know much about what we do. Within reason we are committed to acting on the findings of these surveys.

While a proper chain of command is essential in an emergency service, volunteers need access to the senior staff to air their views and put their suggestions. This puts a strain on those staff, but they must be available.

I don't pretend that we have been as successful as we could be in communicating, but we do try hard. Of all the methods I have described the most effective has been personal contact. I don't believe the other means can replace it.

Training

If effective communications is our biggest challenge, providing proper training comes next. It doesn't matter whether a rescuer is paid or not, that person must be trained properly.

With the wide range of skills required of SES volunteers, there is a real problem on our hands. In addition, volunteers demand credibility. Unfortunately there are still people who equate being a volunteer with being an amateur. Nothing could be farther from the truth, but we in volunteer management must work hard to make sure that our training will stand up to outside scrutiny.

Our approach has been to develop national competency standards for all skills and embrace competency based training. This has been something of a nightmare as many of the processes are extremely bureaucratic and the Australian National Training Authority (ANTA) has a history of changing its mind and the system. However, despite their best efforts we are making progress. Competency based training will ensure

our credibility in the public safety industry and see off the sceptics. It also suits our decentralised nature because self-paced learning is normal and formal course requirements are minimised.

The majority of the trainers and assessors will be volunteers themselves and we are training several hundred a year through a mixture of internal and external means.

There is no doubt that no matter what volunteers do, they must be credible both for their own self-esteem and, in our industry, for the safety of the community.

Recognition

The other high priority amongst our volunteers is their need for recognition. I believe that as a community we tend to undervalue volunteers and we do so at our peril.

Our volunteers are eligible for the National Medal and that is highly prized. We need to make sure we process nominations as soon as someone is eligible, not in due course in the good old public service fashion.

We also have internal long service awards and we award commendations for outstanding performance. I make sure I write to any unit that does something particularly well. I also write similar letters for our Minister to sign. All these simple acts contribute to morale.

Qualification Certificates are also very important to volunteers and they need to be issued as soon as humanly possible after the activity. Don't underestimate the importance of this seemingly minor point, failure to provide certificates promptly can cause people to leave.

We will shortly have our own award, the Australian Emergency Services Medal, which will supplement the odd award in the Order of Australia we are able to get.

Disputes and Grievances

One of the most important initiatives we have undertaken in recent years has been the development of a Code of Conduct. It is simple and non-threatening but very, very important. Our volunteers sign it as part of their induction program and its existence has provided a simple guide as to what sort of behaviour we expect of them.

The Code has been helpful in reducing conflict, particularly challenges to the authority of those in leadership positions. It is also the other half of the answer to how we exercise control. Remember the first half was clear roles and tasks.

As described, the Code of Conduct is the cornerstone of our method of exercising control and of dealing with

disputes and grievances. But we do have formal procedures for dealing with such problems. They are a simplification of the normal public service system, managed by either a senior volunteer or a staff member. We also provide training in negotiating skills, which works well. Transfers between units are available where practical when personality clashes occur, but occasionally we need to remove people. This is not common, but the option is available.

To pull all these pieces together, I will return to the original questions.

Management Styles: With communication being the main requirement, the style must be personal because people communicate more effectively in person than with pieces of paper. This doesn't mean that the head of the organisation is alone. All senior officers must participate.

A non-bureaucratic approach is fundamental to success; volunteers generally don't join an organisation to fill in heaps of forms, so find other means. We are fortunate that our Divisional Headquarters takes care of most of the paperwork for their units.

Level of Control: If the role of the organisation is clear, the contribution required by volunteers is clear, and if there is a Code of Conduct which is enforced with common sense, the volunteers will move mountains.

We in the SES have never had a problem getting enough volunteers for a call-out, and most times when someone doesn't do the right thing, other volunteers will sort out the problem.

Communication: I have already spoken at length about communication, but I would emphasise volunteer participation in decision-making as an essential element, not merely passing on decisions.

Conflict and Dispute Resolution: Prevention is always better than cure, so a Code of Conduct is essential supported by standard conflict and dispute resolution procedures. Senior volunteers need to be trained as well as permanent staff.

Conclusion

You have now heard how we manage volunteers within SES. We know we could do better if we were more effective at communicating with them.

We know they want to be led well and managed effectively.

In our view, good communication equals good leadership and contributes significantly towards good management.

NSW State Emergency Service Volunteer Code of Conduct

Introduction

To be effective, the State Emergency Service must have a special relationship with the community. The people we serve must be prepared to trust us with their lives and property. To ensure that this is the case, we must always act in a professional manner and maintain the highest standards of honesty.

Purpose

The purpose of this Code of Conduct is to provide a benchmark for the personal and professional behaviour of the volunteers of the State Emergency Service whenever they are identifiable as members of the Service. Failure to adhere to this code will represent unacceptable behaviour.

Knowledge

All volunteers of the State Emergency Service must gain and maintain an adequate knowledge of the functions of the Service and their responsibilities under those functions. They must also be familiar with the policies and procedures which relate to their particular appointments.

This information is summarised in the Operations Manual and the Controllers Handbook.

Controllers at all levels are responsible to pass information to the members of their units and are to ensure that the Operations Manual, Controllers Handbook and other references are available within units.

Training Standards

It is the responsibility of every volunteer to achieve and maintain at least the minimum training standards set by the Service or to seek 'temporary exemption' from operations until training levels are regained.

Professional Behaviour

In the performance of duty as members of the State Emergency Service, volunteers should:

- Be polite at all times when dealing with the public and the media and report any incidents as soon as possible;
- Provide all reasonable assistance to the

community when requested to do so and report inability as quickly as possible;

- Utilise resources appropriately and avoid waste;
- Follow reasonable directions from those within the Service who are placed in leadership positions and those of other organisations who have appropriate authority;
- Treat other volunteers, staff of the Service and those of other organisations with courtesy and sensitivity to their rights and responsibilities.

Personal Behaviour

Volunteers of the State Emergency Service should remember that whenever they are identifiable they are on show. Every action will be noticed and they must at all times act in a manner which will bring credit on the Service, whether in SES uniform or not.

Harassment and discrimination on any grounds are not acceptable practice within the State Emergency Service, whether or not they relate to other volunteers, staff of the Service, members of other services or members of the community.

Abuse of alcohol or drugs represents unacceptable behaviour.

Honesty

Volunteers must act with total honesty when performing duty as members of the State Emergency Service and should report any instances of known or suspected corruption to their Headquarters, or if this is not appropriate the next higher Headquarters. Reports on this nature will be treated confidentially.

Acceptance of gifts and benefits

There may be occasions when a gift or a benefit is offered. Of course, you should not expect to get anything for doing your duty as a member of the State Emergency Service. The golden rule is that no volunteer should seek any personal reward for services in support of the community.

Conflicts of Interest

Volunteers who are involved in business

activities must take great care to avoid the possibility that products or services with which they are associated could receive favourable treatment due to their involvement with those products or services. When there is any doubt the matter should be referred to Division Headquarters.

Fairness

Volunteers of the State Emergency Service who are placed in leadership positions must ensure that their authority is exercised consistently and fairly. Guidelines are contained in the Controllers Handbook.

Public Comment

Volunteers of the State Emergency Service are encouraged to comment publicly on matters of fact about which they have personal involvement. This applies particularly to operations, although they must respect Unit SOP in this regard. However, they should not publicly criticise Government or Service policy or other organisations and must respect information given in confidence.

Chain of Command

Volunteers are expected to use the normal chain of command other than in extraordinary circumstances and should always give the next higher authority the opportunity to resolve a problem before taking any other action.

Use of official facilities and equipment

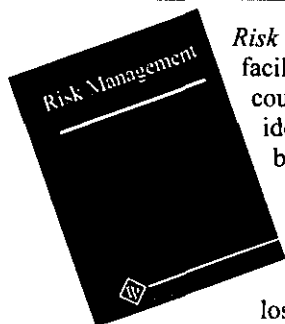
Volunteers of the State Emergency Service are expected to be efficient and economical in the use of public resources. Volunteers should not use official facilities or equipment for private purposes without permission.

Conclusion

This Code of Conduct is designed to assist volunteers of the State Emergency Service to carry out their vital role of assisting the community during emergencies in a safe, effective and efficient manner by providing a guide to the standards of professional and personal behaviour which it is reasonable to expect from them.

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New thinking on disasters; the link between safety culture and risk-taking

Introduction

Disasters are often tragic outcomes of high-risk technologies such as mines.

In Australia, more mines are being developed every day, and the risk of disasters is ever increasing.

No matter how effective our conventional safety devices are, there is a form of accident that is inevitable. This relates to accidents that result from 'interacting failures' in a way that could not be foreseen by the designers. In so-called 'tightly coupled production systems' (processes that happen very fast, such as on a high producing mine) the risk is even higher and our risk controls mostly introduce some sort of a technological fix. While we are on the one hand attempting to control the risk, we are also introducing another level of complexity. Are we really controlling the risk?

This is one of the fundamental questions that will be addressed in this paper: Do we have the ability within the Mining Industry and other industries to effectively prevent these catastrophes, or are we, on the contrary, faced with an increasing risk as a result of increasing complexities of our technology, management systems and practices.

This paper will contend that perceived improvements in risk control is an illusion of activity, and that the likelihood of mining catastrophes may be exponentially increasing. Although the paper focuses on the mining sector many aspects may be applicable across a range of industries.

This paper will further contend that we are applying the right solutions to the wrong problems. Our focus is technological and procedural, while our problem is one of *production cultures ripe for error and failure*.

Disasters in the mining industry.

It is impossible to determine the total number of mining employees killed in disasters. In the USA alone, it is estimated that more than 13,000 miners were killed in disasters during the past 200 years, while internationally the figure could be

By CJ Pitzer,
Managing Director, Safemap

in excess of 100,000 people. It would not include single fatal accidents.

Mine Disasters in Australia

Over the past 100 years, 438 mine emp-

loyees lost their lives in 28 mine disasters, and many more have been injured.

Table 1 is a list of such disasters in which two or more persons lost their lives in Australia in mining disasters.

Death is part of the process, it has been said many times. The mining industry is very much under public scrutiny for its

Location	State	Year	Type of Incidence	Fatalities
Creswick Gold Mine	VC	1882	Mine flooded	22
Bulli Colliery	NSW	1887	Explosion	81
Mount Kembla	NSW	1902	Explosion	94
Mount Mulligan	QLD	1921	Coal dust explosion	76
Bellbird Colliery	NSW	1923	Fire & explosion	21
Metropolitan Colliery	NSW	1925	Outburst of CO ₂	2
Redhead Colliery	NSW	1926	Gas explosion	5
Hart's Aberdare	QLD	1936	Gas explosion	4
Wonthaggi Mine	VC	1937	Explosion	13
Ebbe Vale No 3	QLD	1945	Gas explosion	4
Aberdare Extended	QLD	1954	Gas explosion	2
Metropolitan Colliery	NSW	1954	Outburst of CO ₂	2
Collinsville Mine	QLD	1954	Outburst of CO ₂	7
Bulli Colliery	NSW	1965	Underground fire	4
Wyee State Colliery	NSW	1966	Fall of roof	5
Blockman's Flat	NSW	1972	Fall of roof	3
Box Flat Ipswich	QLD	1972	Gas & dust explosion	17
Kianga Mine	QLD	1975	Gas & dust explosion	13
Agnew Mine	WA	1977	Fall down shaft	5
Leichhardt	QLD	1978	Gas outburst	2
Appin Colliery	NSW	1979	Explosion	14
Laleham No 1 Colliery	QLD	1982	Fall of roof	3
Moura No 4 Mine	QLD	1986	Explosion	12
Emu	WA	1989	Mine flooded	6
Western Main	NSW	1991	Roof fall	3
South Bulli Mine	NSW	1991	Gas explosion	3
Moura No 2 Mine	QLD	1994	Explosion	11
Gretley Colliery	NSW	1996	Shaft flood	4
Total				438

Table 1: Mine disasters in Australia, 1882-1996. Compiled from Dept of Mineral Resources in various states

poor safety records, in Australia and in every mining country in the world. Why is it that we seem to have more disasters than many other high-risk industries? Are we inherently more risky than, say, chemical and construction industries, or are we simply not managing safety as well as they do?

Risk—In the Eye of the Beholder

Risk is like beauty—it exists in the eye of the beholder.

We make a fundamental mistake when we, as safety managers, deal with risk as a 'fixed attribute', something physical that can be precisely measured and managed.

The misconception of risk as a fixed attribute is ingrained into our industry and is a product of the so-called science of risk management. Risk management has created the illusion that risk can be quantified on the basis of probability, exposure to risk, and from the likely consequences of accidents occurring. Risk management science can even produce highly technical and mathematically advanced models of the probabilistic nature of a risk.

The problem with this is that risk is not a physical quantum. It is, instead, a social construction. Everyone has a unique set of assumptions and experiences that shape their interpretations of objects or events. People tend to ignore, 'misperceive' or deny events that do not fit their worldview. People find what they expect to find.

Management Stands Accused

This is not a game of semantics. How we look at risk is extremely important. If we accept risk as a physical quantum, we are inevitably led to the view that management, as an 'amoral calculator', is responsible for accidents—an accusation that is hard to escape or disprove.

What happens when a post tragedy analysis is conducted? Management stands accused of culpability by unions and the public: 'They knew about the risks, they violated safety rules, yet they pursued economic goals at the cost of workers' lives'.

If, instead, one accepts the argument that risk is a social construction, a totally new perspective on disasters and accidents emerges. This will be explored in detail later on.

Three high profile disasters pointed to management culpability:

- the Challenger Shuttle disaster of 1986;
- the Piper Alpha disaster of 1986;
- the Moura disaster of 1994.

In each of these events, the blame was squarely placed at the door of management. By looking at one of these

events—the Challenger disaster—in some detail I would like to demonstrate or, at least suggest, other explanations for the Moura disaster and possibly for many other mining disasters where the common accusation was that of gross neglect and poor attitudes. This paper asks why.

I would also like to offer an alternative approach of preventing accidents and, when accidents do happen, I propose another way of inquiring into them.

Lessons from Challenger

An organisation is a complex set of dynamics, systems, power plays, actions and reactions. Organisations are able to take risky decisions because of the large quantity of expertise available to them, and they are willing to take these decisions because the responsibility for them is often absolved and dissolved (Janis 1973).

The Challenger disaster offers an excellent case study of these influences.

Countdown...

On 26 January, the date the Challenger space shuttle was scheduled for launch, the weather forecast predicted poor conditions and the launch was rescheduled for 27 January.

On 27 January, during countdown, alarms indicated that an exterior latch locking mechanism had not closed properly. Launch was postponed for a few hours to fix the problem.

During that time wind speeds at the launch pad increased above an acceptable level and launch was rescheduled for 28 January.

The weather forecast predicted that the temperature would drop below 20F and the engineers attached to Thiokol, the contractor who manufactured the solid rocket boosters, were asked via teleconference to assess the risk.

The Thiokol engineers expressed concern about the low temperatures (below 56F was their threshold), and recommended that the launch be postponed for a few hours.

NASA reacted harshly with one senior administrator asking over the phone 'My God, when do you want us to launch, next April?'. The meeting was adjourned with Thiokol being asked to review their decision. A recorded teleconference was arranged a few hours later to listen to Thiokol's 'reviewed response'.

In those few hours Thiokol changed their recommendation to 'OK to launch'. The four top administrators in Thiokol had met to discuss NASA rejection of their original recommendation and three of the four changed their vote to launch, with the

fourth, more junior, person still dissenting. He was told to 'take off his engineer's hat and put on his management hat'.

He changed his vote.

Their decision was communicated during the second teleconference and the launching procedure recommenced (President's Report 1986).

Launch...

On 28 January, 1986 at 11.38am, Challenger was launched. Seventy-three seconds later a huge fireball erupted and Challenger disappeared in a cloud of smoke. The seven-crew members trapped in their seats were apparently still alive as they fell back to earth, dying instantly when the capsule hit the water at 200 miles per hour.

A cheap O-ring had failed causing a multi-billion dollar rocket to fail. But was it that simple?

Of course not. NASA had known for a long time about the O-ring problem. A year earlier, a budget analyst wrote a memorandum warning about the risks associated with the O-ring and seal failures.

Even worse, a NASA internal memorandum prior to the disaster warned about suspect seal technology. Seal erosion on rocket boosters had occurred 12 times since 1977!!

The night before the fateful Challenger launch, Thiokol had warned NASA about the possible risks associated with O-ring failure. Charts and graphs were produced clearly showing the serious doubts Thiokol had about launching.

A separate contractor, Rockwell, builders of the shuttle, did a launch pad inspection just prior to the launch. They found ice on the rocket outlets and equipment and they also recommended that the launch be postponed. This was overridden by NASA mission management who recommended launch to senior NASA management.

The final recommendation that these NASA managers made to the senior NASA management the next morning was simply: 'OK to launch'.

This communiqué said nothing of the cold weather or the launch postponement recommendations the previous night, and Thiokol's concerns about the O-ring problem (President's Commission Report, 1986).

The President's Commission of Inquiry into the Challenger disaster discovered these glaring anomalies and deficiencies during its investigations. The Commission's conclusions are summarised below.

Enormous pressure to launch...

NASA was under enormous pressure

to launch. This pressure arose from numerous associated events:

- budget cuts by Congress;
- commercial concerns that the European space program was gaining on them;
- the need to prove that the shuttle program was viable for commercial and military reasons (this was the time of the Reagan Star Wars program);
- previous postponed launches;
- inability to sustain the high launch rate needed to demonstrate and justify the economic viability of the shuttle program;
- the massive publicity accompanying this launch because of the first civilian (teacher) astronaut on board;
- the media linking the timing of the launch to an important presidential speech by Reagan that was scheduled to take place during the mission.

Structural causes...

Structural causes were identified as:

- budget cuts and compromises to safety to meet cost constraints;
- a widening gap between NASA goals and the means to achieve them;
- flawed decision making processes;
- substantially reduced work forces;
- managers overriding engineers' concerns and warnings.

In short, production pressures and managerial wrongdoing appeared to be the culprits.

The structural origins of the disaster—competition, scarce resources and production pressure—permeated NASA and dominated decision-making on the eve of the launch. The NASA managers were highly competent people who thoroughly understood the engineering and managerial issues involved.

But in order to secure resources for their organisation's survival, and to please their shareholder the U.S. Government, they took a calculated risk, violated safety requirements, and they lost.

Afterwards, all their decisions could be shown as flawed, and some even as callous.

Why Do Good People Do Such Dirty Work?

The pressures and structural problems experienced by the NASA managers happen routinely in most, if not all, organisations.

If any organisation were analysed with the same intensity and magnification of the Challenger Inquiry the conclusion would be the same: production pressures compromising safety, and middle managers and workers routinely taking risks.

Risks are taken as a matter of routine

in most organisations for who is to know exactly what the level of risk is—how safe is safe enough? Despite the best intentions and commitment to safety, trade-offs have to occur.

Why do competent experienced managers make decisions that lead to accidents and the loss of lives and property? Why do good people do such 'dirty work'?

Managers are normally well-qualified and experienced, and most have positive intentions to further the goodwill of the organisations they work for. Why do these law-abiding citizens violate rules, laws, and regulations, knowingly risking the lives of their subordinates or workmates?

Are managers conscienceless 'amoral calculators' of risk?

If we accept the majority of public inquiries into mining and industrial disasters they certainly seem to be. In the past five to ten years almost all public inquiries have blamed management. Prior to that, blame was cast on human error and, before that, God got the blame.

Mine Managers - Amoral Calculators of Risk?

Let's return to the question posed in the beginning of this paper: are mine managers 'amoral calculators of risk'?

Despite the apparently overwhelming evidence against management, the answer is emphatically 'no'.

There are at least two reasons to assert this. Let's go back to the Challenger example to explain.

Anecdotal evidence...

The first reason is a peculiar one. It concerns anecdotal evidence and the powerful influence it has over the judgment process. A disaster inquiry should be a scientific analysis of an event, performed by highly qualified and experienced people. The flaw in the process is the quality of information the investigators use.

Not only are inquiries restricted to information that is available at the time, but this information is:

- often very distorted, twisted or slightly changed by the 'accused'—intentionally or unintentionally;
- incorrectly assessed as linked to the disaster event. Information that seems to offer clues or indicate problems contributing to the event may in fact not be linked at all. It is seldom possible to link prior incidents or events to a disaster event in a way that would withstand scientific scrutiny.
- ignored if it doesn't fit into the paradigm of 'managerial wrongdoing'.

As an example of the last point, NASA

management stood accused, and was found guilty, of safety and production trade-offs. Production demands overrode safety (recognise this accusation?). Yet, what was not scrutinised was the number of times safety was *not* traded off against production demands. The reality was (and is in most companies today) that the vast majority of daily production decisions are made with a clear focus on safety. A comprehensive review of the NASA decision-making processes found only exceptional cases of such trade offs and these were always done within a context of a competent consideration of opposing facts.

The problem that eventually led to the 'flawed decisions' prior to the Challenger disaster was that the engineers and managers together developed a definition of the situation that allowed them to carry on as if nothing was wrong even though they were continually faced with evidence that something was wrong.

The logic behind the statement that safety/production trade-offs were made is flawed. If an organisation is heavily production-oriented it makes no logical sense for managers to make decisions that risk the very existence of a whole project, such as the Space Shuttle program.

In effect, the critics are saying that the management would risk the project for the same reasons that they would not risk the project.

Why would a mine manager, knowingly and willingly risk his job, his career, the lives of fellow employees and the very future of his organisation to win so relatively little? He would have to be very stupid indeed!

When examining the Moura disaster in Australia, what was *not* scrutinised was the hundreds and thousands of times management made routine decision in the interest of safety.

However, in the Challenger disaster, the President's Commission found a host of decisions that supposedly demonstrated cost/safety trade offs. But an intensive revision of the very same Commission's report shows that many, if not most, decisions were made in the interests of safety (Cook 1986).

A similar review of the report on the Moura Disaster shows numerous decisions were made in the interests of safety or as precautionary measures.

Most training dollars, most dollars spent on systems and controls, and most of the money spent on most activities on a mine is inherently meant to ensure safety. Unfortunately so much of this spending has become 'routinised' that it is hard to

identify its contribution to safety. To make this clearer, think of driving your car and try to identify any action which is *not* designed to ensure your or others' safety. Except for stepping on the accelerator to 'make the car go' (production) everything else is focused on safety.

Honest errors...

The second reason why the 'manager as amoral calculator' theory does not hold water is the complex question of risk evaluation and the possibility of making honest errors in risk calculation.

The risk management discipline often gives the impression that the probability of an event is calculable and that it can be classified on the basis of the likelihood of it occurring.

From a statistical point of view this approach is correct; it is possible to calculate the likelihood of any event occurring, say at 2 times per million per annum. However, any manager individually faced with a single event is in no position whatsoever to make any sense of that statistical number. It is humanly impossible to work with a figure of the magnitude of 2 per million per annum. How can a manager judge whether a task is 'too risky'? He simply cannot, unless the probability of an accident approaches 1 (100%), like jumping off a cliff.

Unfortunately most work place accidents are on the category of highly unlikely and can approach a likelihood so small (0.0000002%) that no human mind can come to grips with it. Managers, like everyone else, use 'gut feel' in these circumstances.

Even the highly specialised engineers of NASA could not agree afterwards on the likelihood of the Challenger disaster. Their estimates ranged from 1 in 100 launches to 1 in 100,000 launches (Dala, Fowlkes and Hoadley 1988). These differences are, in statistical terms, enormous. The difference between the two is one failed launch every ten years or one failed launch every ten thousand years!

In summary, the assertions that managers are 'good people doing dirty work', and that their actions may actually be classified as 'criminal' is seriously flawed, yet these assertions are widely accepted, even by managers themselves. The many events that make up a catastrophe can be so trivial and banal by themselves that they are routinely overlooked, underestimated or ignored. In the catastrophic interaction of these events, however, the accusations of dirty work and management wrongdoing are often inescapable.

Who is to be blamed?

It is unfortunate that an inquiry or even a simple accident investigation is a blaming process. If it is not the human operator, then it is his/her superior or, more likely today, the manager or management, that gets the blame, often for events over which they had little or no real control.

If none of the above can be blamed, and God can't be blamed, who then is responsible for the event? Someone or something must be!

There are two main reasons why operators, supervisors or managers cannot automatically be blamed for these events.

Firstly, it has to do with the complexity of even the most trivial events, a complexity that renders any operator or manager instantly incompetent to deal with the situation at hand.

Secondly, it has to do with a situation in which people, whether they are operators or managers, often find that they are forced to carry on as if nothing is wrong even though they are continually faced with evidence that something is wrong. In other words, a process in which abnormalities are 'normalised'.

Interactive Complexity

Let us look at the first reason for fixing the blame elsewhere than the operators or managers, namely the issue of complexity and operator/managerial incompetence.

Virtually every type of industry rates operator error high on its list of causal factors, generally at a level of about 60 to 80% (Peterson, 1989).

Is this valid and is it logical? I shall argue 'no' to each question.

From the beginning of human time, we have had natural disasters, and for many centuries, our definition of a disaster was that it was God-made. As we marched ahead in the process of industrialisation we built devices that could crash, sink, burn or explode and, when these events happened, our answers were relatively simple and effective: We prevented accidents by removing the causal factors and, through trial-and-error, we eliminated most of the problems, for example safety relief valves became a requirement for pressurised vessels.

Our focus then turned to the actions of people. (This factor had, of course, always been there but had not been as noticeable because of the preponderance of technical accidents). We declared war on human error and did this, at least since the 1920's, by treating workers as chimpanzees that needed to be trained, conditioned, rewarded and regulated. This has continued to modern times

through the proliferation of vast volumes of safety and health legislation, and through the advent of risk and/or loss control management systems. Combining this with a huge increase in technology over the last 25 years we have added a new cause of accidents: 'interactive complexity'.

The production system within a large coal mine industry today is extremely prone to these 'interactive complexities'. This occurs even though the mining methods may be less complex than underground mining, simply because of the speed and volume of production activities.

Perrow (1984) provides a classification systems of types of industries, which in many ways is a useful framework to identify high-risk or disaster prone circumstances.

The two continuums used are Complexity—Linearity, and Tight and Loose Coupling.

Complex systems are characterised by features such as tight spacing of equipment, proximate production steps, personnel specialisation, unfamiliar or unintended feedback loops, many control parameters with potential interactions and limited understanding of associated process in the organisation.

Tightly coupled systems are characterised by having time-dependent processes e.g. in chemical plants, reactions are instantaneous and cannot be allowed to be allowed at certain stages of the process, as with underground mines. Sequences of activities are invariant, and the production processes are fixed. There is little 'slack' in tightly coupled systems. (Figure 1)

The mining industry, especially the underground and high volume surface mines, belong the highest risk category for potential disasters, by design and by organisational structures. (But even so, the incidence of disasters in the mining industries is far higher than the in higher risk industries such as the nuclear, chemical and space industries. Perrow, (1984) concluded that the mining industry is simply 'not managing safety well enough'.

Furthermore, in the social environment of employees, they are subjected to increasingly complex systems of management, engineering and legislation.

We have placed the operator in a production environment in which he/she is expected to:

- make rational and logical observations of his/her environment;
- rationally interpret events, requirements and procedures; and
- act and react rationally on those interpretations.

	Linear	Complex
Tightly Coupled	<ul style="list-style-type: none"> • Rail transport • Airways 	<ul style="list-style-type: none"> • Nuclear plants • Space shuttles • Oil rigs • Chemical plants • Deep underground mines
Loosely Coupled	<ul style="list-style-type: none"> • Assembly line production • Most manufacturing 	<ul style="list-style-type: none"> • Underground coal mines • High volume mines • Military

Figure 1: A classification of different types of organisations (based on Perrow 1984)

Yet it is very seldom possible for the average operator to really know all the possible links between systems and the effect of one on the other. Of course the same operator would, after an accident has occurred, be able to recognise his mistakes and correctly identify the alternatives he should have selected.

It can therefore safely be concluded that the operator made a mistake, and that a repetition of the error can be eliminated with better training, simpler systems, or with another more back-up systems or alarms.

But, of course, these things are only possible *after* the event. *Before* the event the possibilities can be complex, or at least confusing, and in a tightly controlled high volume work environment you don't need much more than this to create havoc.

Something else to bear in mind is that great events have small beginnings. On the Piper Alpha oilrig, the small beginning was an inadequately tightened flange on a gas pipeline which leaked causing gas to ignite, followed by explosions and fire and the death of 167 people (Cullen 1990).

In modern organisations the following 'layers' of complexities often exist:

- The basic skills and **engineering knowledge** of the management and supervision introduce numerous requirements;
- Management and **administration systems** are implemented on top of that;
- **Legislative requirements** are to be maintained on top of that;
- The **quality management system** is implemented on top of that, bringing with it its own volumes of standards, inspections and audits.
- The **safety management system** is

implemented on top of that, with safety requirements and regulations to be maintained, and another level of auditing.

- **Risk management process** are implemented on top of that with new risk controls to be maintained.

The level of complexity of each of these systems on their own is often mind-boggling. The level of interactive complexity could be disastrous.

Over-trained, over-rewarded and under-punished...

Is the only way to avoid disasters attributable to human error, like Piper Alpha, to train them to tighten flanges, punish them if they don't, reward them if they do, and put the problem in the 'too hard basket' if none of these work?

This is an approach followed in the coal mining industry to the point where we now probably have a workforce that is over-trained, over-rewarded and under-punished. And we're not winning the war against accidents because we are fighting it with more and more risk assessments, involving Bayesian probabilities, ALARA principles, discounted future probabilities, F-curves and isopleths and the like. All this results in more rules; alarms, systems, and more interactive complexities.

Ironically, the more risk assessments and analysis we throw at the problem, the more we *increase* the risk.

Risk assessments can seriously lead us astray. Consider the following scenario at a board meeting of a large corporation.

As low as reasonably achievable...

The Financial Director announces that he has received advice from his risk assessors: If the Company does not install a planned safety device the outcome is

likely to be the death of one more worker per year in a business employing 130,000. With a depressed labour market and an attitude amongst workers that fatalities always happen to someone else, the Company is not facing a lot of pressure to install the device.

On the benefit side, by not installing the device the Company will save \$50 million dollars. This saving will enable the Company to avoid a \$20 million price rise in their products and allow it to retain this year's \$30 million merit bonus. Against a statistical probability of one worker death this year, the customers, the shareholders and the workers will greatly benefit. What is a life worth? Well, the Board considers that \$50 million is pretty high for the possible loss of a random anonymous worker and the safety device is scrubbed.

If this story appals you, just remember that the risk analysis presented by the Financial Director is correct. It is a good bargain. Risk assessment is, after all, about getting risk down 'as low as *reasonably* achievable'.

If you consider the story as immoral and irrelevant and refuse to believe that no one could think like that, you will be surprised to learn that a similar decision was made at the Ford Motor Company during the 1970's when they decided not to buffer the fuel tank in the Pinto car. This led to a significant increase in fatal accidents where crash victims, trapped in their cars, were burned to death. Ford Pintos were known to easily catch fire during rear-end accidents (Dowie 1977).

This type of thinking is encouraged, even facilitated, by risk assessment procedures. Most companies, at some stage, try to quantify the cost of accidents, if only to express concern that accidents are costing money, or substantiate a statement that safety is good business.

I am not criticising this thinking, but I am expressing concern that assessing physical risk without also assessing sociological risk, the thinking patterns of the organisation, the forces, and the influences within the organisation all lead to the creation of a very poor, restricted and potentially damaging definition of risk.

And of course risk is one step away from disaster. That is the focus of this paper.

Can the situation be so desperately bad as portrayed here?

In practical terms and looking at our day-to-day operations the situation is not so bleak. We produce coal in greater volumes more efficiently, and with fewer accidents.

Risk management, however, still seems to be the 'beast' within our organisations.

Management still seems to make amoral decisions and ignore risks. So why is there a perception of 'risk-taking amongst management'?

The answer to this is not simple.

Normalisation of Abnormal Events

Earlier I said that there were two reasons why operators, supervisors and managers cannot be blamed for a disaster. We have looked at the first one, namely the complexity of events.

The second factor is called the 'normalisation of abnormal events', and I said that such a process commonly exists within organisations, as it did in the NASA management prior to the Challenger launch.

Three factors explain this process of normalisation:

- the production of culture;
- the culture of production;
- structural secrecy.

The production of culture...

A culture is a set of solutions produced by a group of people to meet specific problems which they commonly face. These solutions become institutionalised and passed on as the rules, rituals and values of the group.

It is falsely assumed that each large organisation has a common culture. Most organisations are segmented and frequently have as many cultures as they have sub-units. Although there may be some commonalities between sub-unit cultures, the degree to which sub-units hold these commonalities will always differ.

The culture within a workgroup, or sub-unit, may be even more focused. People in a unit, or from different units, may be drawn together because they have a certain task to perform, and they develop a culture that is unique to that specific task. When the task ends the group and its culture dissolves, while new ones form around new tasks.

The work groups develop and share certain definitions of each situation, definitions that often persist (Robbins 1991).

The creation of work group cultures ensures that new information is interpreted in terms of the culture concerned.

To illustrate this point, I'll return to the Challenger disaster.

As reported in the President's Commission Report (1986): Prior to the shuttle program early tests showed that the solid rocket booster (SRB) joints (which contained the O-rings) had unexpected performance deviations. The engineers alerted management in accordance with procedures, who reinterpreted the deviation and officially labelled it

'acceptable risk' (Naturally there was no risk in this decision, because the shuttle program had not been launched yet!).

The workgroup accepted this new standard and treated each new program deviation within the wider band of acceptable risk thus created.

Between 1977 and 1985 the first abnormality was normalised to accept that the primary O-ring would withstand erosion by hot gases, and in the unlikely event it did not, the secondary O-ring would. Although problems with the O-ring were identified twelve times, and there were discussions and disagreements about mechanics, the workgroup culture that the O-ring joint was an acceptable risk was never questioned. For 10 years this 'culture' prevailed, until that fateful morning in January 1986, despite the occurrence of a new problem; cold temperatures never before experienced. This is the fatal effect of culture.

At most coal mines in Australia a very fixed and pronouncedly negative culture existed between the levels of the organisation. There existed little trust between operators, supervisors and management.

A report on culture surveys conducted previously by CJ Pitzer (1996) in the coal mining industry showed extremely negative safety attitudes, largely influenced by a negative industrial relations climate in the industry. Moura probably did not escape this.

So why did they continue to 'normalise' these abnormalities despite all of the evidence? The answer lies in the culture of production.

The culture of production...

The engineering and production professions give the impression of precision, rule-making and qualified thinking. The reality, often overlooked, is often the opposite.

When accidents do *not* happen the opportunity to investigate the engineering process in depth does not often present itself. If an organisation, any organisation, were subjected to an on-the-spot investigation, the public would discover the real messy inside story of 'normal' engineering practice which, after a disaster investigation, looks like an accident waiting to happen.

There are some powerful processes in organisations, focused on creating satisfaction and minimising stresses, strains and conflict.

No dynamic organisation (and that includes individuals) can constantly function under stress. There is therefore

a powerful drive towards equilibrium.

Vaughan (1996) shows that NASA had two formal processes in the organisation designed to facilitate the management of launches, namely the Acceptable Risk Process (ARP), and the Flight Readiness Review (FRR).

The ARP process classified all risks, to enable a comprehensive analysis of risks and a proper classification record. The O-ring joints were investigated, tested and reviewed over many years and, although they were accepted as a risk, there was never any serious doubt about their resistance, because:

- the Apollo programs had, for many years, operated with the same design on Titan rockets;
- a secondary O-ring was added as a back up should the primary ring fail. Plus, many laboratory tests showed that the O-ring would hold;
- most of the Challenger and SRB parts and systems could only ever be fully tested under real flight conditions. When the SRBs' of previous launches were disassembled (a routine process) no problems with the O-ring were found;
- 'flying with flaws' was not abnormal in the culture of NASA. It was normal, acceptable, even essential. While outsiders may have seen them as 'known flaws', insiders saw them simply as 'residual risk' which they had analysed and rationalised through the Acceptable Risk Process;
- organisations that constantly have to deal with high risks develop the means (or mindsets) to deal with them. If they don't, the continuous risk will destroy them;
- the high level of risk analysis, and the qualification process, created an 'impression of invulnerability' in the organisation—which it wanted to assume as quickly as possible. The more risk assessments were done, and the more successful the organisation became at managing the risks, the less they expected risks. (It is folly to argue that risks are under control as soon as they are qualified and quantified and a control measure introduced - because, as discussed earlier, risks are a social phenomena.)
- no one in NASA had the ability to recommend that the whole Space Shuttle program should be put on ice until the SRBs joint was redesigned. Those pressures would have been simply too excessive for any team or individual to handle. And, despite all the numerous attempts to flag the issue, no-one was ultimately brave enough to

go against the production culture.

All this created a powerful culture, which accepted the risk and proceeded with the flight.

Piper Alpha

- On the Piper Alpha Oil rig, the water deluge system, its main fire fighting capacity, was seriously deficient for four years. It is difficult to understand why this could occur, but on the oil rig, it had become 'acceptable and normal'.
- An engineer warned the management of Occidental Petroleum, owners of Piper Alpha, that the gas outlets on Piper Alpha were extremely dangerous and exposing the workers on the rig to enormous risks. These warnings were ignored, and everybody accepted the risks associated with it. They even considered to get rid of the emergency ship.

They were 'flying with flaws'.

Moura disaster

Let us look at the Moura mine, and the prevailing 'culture' prior to the explosion. The following are extracts from the Warden's Inquiry report (1996):

- The Mine manager was informed that the increase in CO was linear not exponential and they concluded that no problem was evident – no different than 'flying with flaws'.
- 'The background of sealing panels at Moura No.2 was that, apart from a couple times, practice rather than exception was to continue to work underground as sealed panels passed through the explosive range'. The risk is known, defined and accepted, in the same way the risk of O-ring failures were.

The following deficiencies and practices all became 'normal' and 'acceptable' to the people dealing with and working in these conditions every day.

- 'Ventilation was sluggish...'
- 'In practice there was evidence that these appliances were affected by roof falls or local strata stability and that their function was, at times, compromised...'
- 'There was evidence of ventilation problems...'
- 'The likely compound effect of all these ventilation alterations was considered undesirable...' (by the Inquiry)

In an underground coal mine the lifeline is ventilation, and this lifeline was compromised. They also were 'flying with flaws...'

Belief in margin of error

All the risk assessment processes and engineering history of the SRB's pointed

to one thing: there is margin for error. They have had many successful launches, many laboratory tests showed that the secondary O-ring provided a margin of error which did not exist before, and the engineers of Thiokol and NASA turned their attention to more immediate and more urgent problems.

With that, the next critical ingredient for a disaster has been created: the redundancy of risk.

As soon as this cultural feature becomes fixed in the organisation, the 'bandwidth' for accepting risk slowly increases, and every day, the potential for a disastrous failure looms closer...

Many times in its history, there will be 'no failure and no event', but only if they heeded the warnings!

An analysis of the launches of all the shuttle missions after the event produced a graph which was almost damning: It showed that of all flights launched *above 65 degrees (Fahrenheit), 17% of these had anomalies during launch. Of the flights launched below 65 degrees, 100% showed anomalies* (Vaughan 1996).

On 28 January, NASA launched at 27 degrees.

But this graph was never drawn and an opportunity to avert the disaster was lost.

At Moura, a similar graph was never drawn, namely the ones mentioned above on the increases in CO and the ones on the so-called Graham's ratio, which had it been used in context with other information, 'may have tipped caution in the right direction'.

Further examples of the gradual acceptance of risks through a continuing belief in margin of error at Moura:

'Reliance on incubation period as primary determinant of likelihood of spontaneous combustion led to some false sense of security...and some complacency...'

'It was widely believed that a slow steady rise in CO production could not constitute a problem and that an exponential rise was required to indicate a heating ...'

'However none could recount the source of such impression' (Warden 1996).

The belief in a margin of error is a result of all high-risk work environments. In organisations such as this a 'mindset' develops over time that risk can and should be conquered. In fact the most fundamental purpose of organisations such as NASA, oil rigs and mining companies is to conquer risk. And they do that through a belief in their ability to achieve a culture of 'can do' and a belief in the redundancy of risk.

An organisation that does not believe in the redundancy of risk will find it impossible to continue as a business. And there in lies the irony—what makes us successful as a mining company is also our undoing, our weakness.

Structural secrecy...

It was later revealed that on the eve of the Challenger launch, the higher levels of NASA were not informed of the initial concerns expressed by Thiokol about launch. According to Centre Director Lucas' testimony NASA's directors were only afterwards informed of Thiokol's and Rockwell's warnings. He said that he had been told that 'an issue concerning the weather had been resolved and that the launch had been discussed very thoroughly by the people at Thiokol and the Space Flight Centre and it had been concluded agreeably that there was no problem'. He said further that he had a recommendation by Thiokol to launch and the 'most knowledgeable people and engineering talent had agreed with the recommendation' (Vaughan 1996).

The President's Commission found that communication problems existed (heard that before?) and, because the engineers failed to express their doubts about the issues surrounding the launch, it was concluded that the lower levels of management had deliberately withheld information flowing to the senior levels.

Was it just a question of deliberate withholding of information, something that can be described as human, and therefore both understandable and punishable? Or on the other hand, was it something senior management could be blamed for, if it was their autocratic, aggressive behaviour that led to the suppression of communication or to the faulty communication systems?

The answer, as always, is not that simple. Secrecy is built into the very structure and fabric of organisations.

The division of labour between sub-units, levels of management, geographic location and so on, actively segregates knowledge about tasks and goals. Specialisation further inhibits this knowledge. The functional focus of organisations (production, engineering etc) is such that almost every organisation has departments at loggerheads. Communication systems in most modern organisations have grown so complex that *more* communication frequently results in *less* knowledge. Secrecy in organisations is on the increase.

Top people do not get all the information churning around in their organisations.

In fact they get very little—by design and by necessity. The sheer quantities of information, especially in our electronic age, are such that we cannot make sense of it all unless it is severely edited.

Decision-makers have to rely on 'signals' developed based on experience. The bulk of the information remains unknown to them.

Secrecy also develops as a result of weak signals. Often in organisations warnings about any course of action are many and diverse. No activity, program or project is done with absolute certainty and risks are never completely understood and calculated.

Even if people overcome their reluctance to voice opinions about danger, risks or threats to an intended course of action, their signals be may simply too weak to be heard in the organisation and they get lost in the static. For example, one engineer at NASA explicitly recommended that launches should be terminated until the problems with the O-ring failures were sorted out. This signal, although highly significant in hindsight and apparently indicating criminal inattention among those who should have heard it, was simply not heard!

The signal was not given to anybody with sufficient authority to do anything about it.

Systematic censorship...

Adding to secrecy in the organisation is the process of 'systematic censorship', common to all organisations.

At every level of all organisations a process of information censorship takes places continuously and at varying rates. It is a process over which management has no clear control.

There is a natural tendency at every level to withhold as much bad news as possible if it can be done unnoticed. Although this can lead to catastrophic consequences it is essentially a very functional and necessary process in most organisations. It ensures that top levels are not overwhelmed by paperwork, that decisions are taken at the appropriate level of the organisation, and that only critical exceptions are communicated to senior management.

One of the most important reasons why 'structural secrecy' has developed in mines in Australia today is the untenable situation developing on the IR front. Strategically, we have modern approaches to people management sweeping through the industry, with a new and positive emphasis on the critical interfaces of

management and supervisor-operators.

Against this we have an industrial relations arena where the battleground and the battle rules are antiquated, and where unions have been unable to establish a new and modern role for themselves. It seems that the unions' most basic point of departure is still that management is exploiting workers and they see their role as fundamentally that of protection. This outdated notion has no links with the reality of mines implementing benevolent, and very participative, management systems. The result is a high degree of emotional and philosophical conflict between the opponents. This, in turn, has profoundly increased secrecy at the lower organisational levels.

It is certainly true that trade unions played an important role in organisational communications in the past and ensured that management were 'kept honest' in balancing capital goals with social needs of workers. But modern organisations are highly participative and flexible and unions, in their failure to adopt a flexible approach to modern organisational practices, may themselves be contributing to the very processes that foster a high-risk culture.

A high degree of job specialisation is also contributing to the loss of information in organisations. The people occupying the many new specialist positions are experiencing great difficulty in sharing information amongst themselves. Add to this the tendency, at middle and senior management levels of organisations, for engineers to become managers and administrators, losing their hands-on engineering exposure and their day-to-day understanding of production and engineering processes. This may inhibit their ability to effectively understand, challenge or reject the technical information they receive from lower levels.

Another factor is the creation of highly specialised safety departments in many organisations from which managers must often accept information and interventions on face value. Most companies today operate some kind of safety and/or risk management system. These systems create blizzards (even cyclones!) of paperwork, terminology and jargon which managers have no option but to accept and visibly support.

This was the process typical of the NASA management structures.

Quite often—as happened with the O-ring—warning signals may be only weakly received in the organisation and lost sight of. Combine these weak signals

with the mixed signals that managers in the real world have to contend with and you have, at the very least, a confused situation.

It is practically impossible for any management team to act on each of the multitude of signals that reach them. One reason for this is that the levels of probability of any of these possible events often fall in a range where it is physically impossible for managers to logically and rationally prioritise them.

An example of this was the NASA manager who was accused of neglect because he spent most of his time prior to the launch on the problems of the SRB's parachutes, instead of working on the O-ring problem. But at that stage, the O-ring was regarded as a classified and acceptable risk, and the parachute problem (it continuously tore and had the potential to cause the large boosters to fall back to earth unrestrained) was an acute, very urgent and very realistic problem to deal with—and he dealt with the problem with great commitment. The critical issue here is that the manager could not possibly make a rational judgement about two risks of equal probability but of different perceived urgency.

At Moura, management was dealing with safety problems far removed from the one of spontaneous combustion. Of sixty six risk assessments conducted on the mine site just prior to the disaster, only one dealt with the problem of spontaneous combustion. The management of that mine was, like all managements of mines all over the world, just dealing with urgent problems, reacting to signals which they receive about the relative importance of these events. They could not possibly be expected to weight one risk against another, and make a 'mathematically correct' decision. No one can do that.

Nor, sensibly, can mine managers make similar judgements before the event—and be expected to make them logically. Yet in hindsight, it is all too easy to demonstrate that their failure to do so was neglectful and wrong.

On Piper Alpha, it was 'regretfully evident' to the inquiry that 'management failed in some very basic duties' (Cullen 1988). Even a decision the manager of the oil rig made to reduce the risk to divers in the water was slammed by the inquiry as a 'wrong decision'.

What the inquiry overlooked in this case was that it was a decision in the interest of safety, in as much as NASA managers made similar decisions and also at Moura, where several decisions they made can only be seen as 'in the interest

of safety' or as precautionary.

Yet in hindsight, these decisions appear flawed, but they were not. They were realistic decisions made at the time under realistic circumstances.

Systematic distortion...

A close relative of structural secrecy is the concept of 'systematic distortion'. At the same time systematic censorship in the organisation reduces the information available to the top levels, unfavourable information—that is information that does not support the ambitions, goals, or survival needs of the organisation—is also filtered out.

This unfavourable information is not lost by malicious intent, or purposeful concealment, or even just because of a reluctance to tell superiors things they do not want to hear. The information is lost because that is the way organisations tend to function: people deliberately seek out favourable information, often to the exclusion of negative information. The resulting distortions can have disastrous consequences.

A source of distortion which prevents risk experts and decision-makers from coming to grips with the likelihood of failure lies in the tricky area of 'failure probabilities', also called 'disqualification heuristic'. In simple terms, if you hold a conviction that, for example, it is safe to fly, or mining is a safe activity, you neglect contradictory information and focus selectively on confirming information.

Going back to the Challenger Disaster you will recall that there was evidence that the probability of a disastrous failure of the shuttle varied from 1: 100,000 to 1:100 (there was even one estimate of 1:25!). The higher probabilities came from engineers and safety officers and the lower probabilities from NASA managers.

The engineers' estimates varied so markedly from the managers' because they had access to a variety of tasks, calculations and risk reviews, information the managers did not have as readily available.

In mining, as in other organisations, the same inherent problem exists: It is easy to see how a 'can do' culture can develop in organisations, especially in mining companies, where high production volumes continuously demands a high achievement culture.

Very few mining organisations have the internal structures, processes or units to foster or force self-criticism and critical self-review, but almost all of them are inherently focused on survival and therefore information distortion

thrives. At some point these intangible forces in the organisation may become so powerful that, if the right physical conditions and deficiencies exist, a disaster becomes almost inevitable.

The organisation that produces a disaster has not done so out of neglect, wrongdoing or criminal misconduct. Yet so often our own inquiries into such events, even those that look at minor work accidents and incidents, fall prey to the 'politics of blame'. We need to put the blame somewhere but, in our hurry to do so, we generally fail to identify the real organisational and cultural causes and influences on such events.

We demand straightforward, simple answers, but the answers are seldom simple.

The heart and mind of organisations are beyond the control of individual managers, because mistakes are socially organised in a highly complex, unpredictable manner.

At Moura, they were criticised by the inquiry because: 'Not one person or group of persons at any time had all the facts available to them on which to base their decisions'. In normal circumstances, at normal mines and companies on a normal day, this is just normal. It is normal in any organisation where complex processes exist, where decisions are being made at all levels of the organisation, and where the fundamental aim is to conquer risk. And many other communication issues appeared suspect or seriously flawed from the outside, such as the various reports on 'benzene-type' smells underground that failed to raise concern, the assumptions made by several individuals at the mine, for example, the assumption that workers knew of the risk of spontaneous combustion on the day of the event, etc. All these issues point to another feature of the high risk organisation, namely the *distortion of information*.

At Piper Alpha, the manager stated in the inquiry that he 'knew that everything was all right because he never had any report of anything being wrong' (Appleton). The statement may appear to be extremely naive, or even stupid, but there is a message in there: the information that reached him was simply distorted to the point that his only impression of it could be this one—that everything is all right. It was no different at NASA (e.g. what was reported to the NASA launch director on the morning of the launch!) and it was no different at Moura. The inquiry of the Moura incident reported that the 'Mine Manager on

return from leave was not aware of the condition of the panel even after discussion with the Safety/Training Manager' (Warden 1996).

Our willingness to accept risk is a phenomenon that is often underestimated or not even taken account of at all. The factors which make it possible for us to accept risk—and the possibility of disastrous breakdowns—include:

- risk assessment processes;
- the culture of production;
- a margin of error which develops misplaced confidence;
- organisational pressures;
- the probability that an accident may happen to the individual are incomprehensibly small;
- illusions of invulnerability that develop over time as a result of a 'can do' culture.

The Social Organisation of Mistakes

The Challenger disaster, like all others, happened because mistakes were made. It is however not a simple case of human error—the mistakes themselves were 'socially' organised and systematically produced.

Disasters have systematic origins that transcend individuals, organisations, time and geography. Their source of disasters can be found in the routines and the taken-for-granted aspects of organisational life.

Those key questions about Challenger—why did they launch despite their knowledge of the O-ring deficiencies, and despite the pre-launch warnings by engineers?—can be asked about most disasters and accidents.

The answer lies in the processes already described: *production of culture, the culture of production, systematic complexities and structural secrecy*.

Each factor on its own cannot explain the Challenger disaster, or any other disaster. But combine these three factors, add to that the mixture the right combination of circumstances, and mistakes will happen, some of them leading to disasters.

In looking for causes of disasters we need to shift our attention from the technical (such as the O-ring) to the managerial, and then to the psychological and beyond - to the organisational and cultural factors. By doing this we highlight the influence of culture on risk assessment. Even if risk assessments are done daily they can be fatally flawed, the biggest flaw being the impression they create of being scientifically complete and sufficient to manage risks. It needs to be

stressed that risk is not a 'quantity of threat'. It is a social construct that changes continuously and cannot be captured by simplistic categories or 'levels' of probabilities.

Routine decisions in organisations are taken every day without resulting in disasters—but they do routinely result in mistakes. When disasters are analysed after the event many of these routine decisions can be demonstrated to be rationally flawed and blame is cast on those making the mistakes. But decisions are taken within the context of an environment, a paradigm, and a culture in the organisation. They cannot be divorced from that culture.

It can be argued that organisations suffering disasters generally suffer from failures of foresight, that these disasters had long incubation periods during which warning signals were ignored, rationalised or accepted as normal. And this is true. Organisations need mechanisms to counteract these organisational influences.

In Conclusion

We are not talking of guilty people who should 'carry the can' for disastrous events. We are talking of people who are doing their job as diligently and honestly as they see fit at that moment in time, and as they are permitted by the circumstances.

Combine this with honest mistakes, misplaced risk perceptions, widespread organisational failures and a touch of coincidence, and the risk of disaster increases exponentially. It may never happen. But on the day it does...

Right now, on the shop-floors of companies, employees are going about their tasks in exactly the ways described in this paper. And if one or more of our controls falter, such as happened with Challenger, Piper Alpha and Moura, disaster will strike again—a disaster that has been created over a period of time and is in the process of creation now, by us, by our organisations.

Is it then true, as stated in the Moura report, that we can expect another spate of disasters in about ten years time, as soon as the current shock and reactions have waned? History shows that it is true.

It is not a question of *when*, it is a question of *who* will be the next victims...

Learning from mistakes...

In 1995, the Discovery space shuttle was successfully launched. It was lauded as one of the most successful shuttle missions to date.

The following was reported in Avion, Summer 1995:

'Discovery's safety was brought into question by an examination of the solid rocket boosters retrieved after the launch of the space shuttle Atlantis two weeks prior to the launch of Discovery... Burning rocket propellant had burned one of the primary O-ring seals in one of the booster rockets of Atlantis. This problem was not discovered until four days after Discovery's launch... The problem was particularly worrisome due to the fact that it was a similar leak that had caused the explosion of the Space Shuttle Challenger in 1986.'

To their astonishment, engineers discovered that the seals in the Atlantis solid rocket boosters had failed, in the same way, but without the disastrous consequences of the 1986 Challenger O-ring failure. After many years and many millions of dollars, exactly the same failure re-occurred.

Organisations have very poor memories. Whole industries have no memory at all.

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Controlling crisis chaos

It was just over 10 years ago when Captain Joseph Hazelwood sat in a local bar enjoying a quiet few drinks before going off to work. Joseph Hazelwood later walked down from that bar to his awaiting tanker, the Exxon Valdez, and prepared his departure to carry a full load of Alaskan crude oil.

Two hours later, at midnight, the oil tanker ploughed into Bligh Reef and 42 million litres of crude oil began leaking into the Prince William Sound, presenting the worst oil spill in US history. A decade later, it has cost the Exxon Corporation \$3 billion in fines. No-one ever predicted such a spill. No-one ever predicted the chaos of environmental problems, the clean-up costs and the effects on the fishing industry. And the response was an unmitigated disaster.

Exxon had a long list of major problems in dealing with their crisis response including:

- they took a long time to make a statement about the situation and when they did 'blame' was a key message;
- they did not have a plan to cope with the spill;
- company spokes-people were not 'on top' of the problem;
- affected communities needed answers;
- there was slow communication with many of the affected stakeholders;
- they let the media run the agenda. In the early stages, they did not explain what they were doing to fix the problem.

The good thing to come out of this Exxon disaster is that legislation was put in place that new ocean going tankers were to be built with double hulls. Exxon did have plans - emergency plans, but not plans to deal with a crisis of this size. No plan to deal with the big one.

Union Carbide had an emergency plan to deal with most plant emergencies. They did not have a plan to deal with a massive explosion that killed more than 2,000 people at Bhopal in India—certainly the worst peace-time disaster this century. For Union Carbide this was the big one—\$15 billion in damages.

When the Piper Alpha oil production platform operated by Occidental Oil blew up and was completely destroyed, killing 167, no-one expected such a disaster. No-one expected the leak of gas condensate to cause an explosion that would spread through the platform and to other

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platforms. I am sure many have seen the training film that shows the problems with lack of safety checks and of course evacuation problems related to the fire on an oil rig.

Exxon Valdez, Bhopal, Piper Alpha. They were the big ones. They said they couldn't happen.

Most of this happened a decade ago. Last year was Australia and New Zealand's trifecta of big ones. They said they couldn't happen. But they did. Mercury Power company in New Zealand seemed to have neither emergency nor crisis planning in place. Auckland's business district was plunged into darkness when the last major power cable in New Zealand's biggest city failed in February last year. While police and fire services warned people to stay away from the city centre, mixed messages from employers and the determination of some retailers to stay open meant thousands turned up for work as usual.

There was chaos on the streets of Auckland. Businesses affected by the crisis were shouting for compensation from Mercury. The New Zealand government moved for a full inquiry. The crisis cost the economy tens of millions of dollars.

While it was all happening...when people wanted to know why the power was off...a Mercury spokesperson said there would be time to talk once power was restored. So Auckland waited to get the facts. This had all the characteristics of the worst kind of crisis management. Lack of comment and lack of response to consumer questions.

David Elias reported in the *Melbourne Age* 'Mercury Energy, the disaster-stricken electricity supplier at the centre of Auckland's power crisis, is facing a growing clamour for compensation and internal reform.'

The Mercury power company did not attend an invitation to address the affected businesses at the Auckland City Council. Eventually, while not openly admitting any

liability, Mercury created a compensation fund to help businesses. But everybody waited too long to get the facts.

Did Mercury have a crisis plan linked to an emergency plan in case of total loss of power? Had they identified the big one? It seems they had not.

Sydney Water was also unprepared for their big one. The major contamination scare hit the city hard. The giardia and cryptosporidium parasite had contaminated Sydney's water and with it the fear of affecting three million people with severe diarrhoea and vomiting. This was the big one with major complications.

Sydney Water Corporation temporarily closed down their water treatment plant, which had been isolated as the source of the contamination. The State Government took control of the situation and managed the crisis.

The Premier launched a major investigation, and threatened to sack the managers responsible for the problem.

All at a time when Sydney was preparing for the forthcoming Olympic Games. Australia, of course, has a world reputation for its clean air and pristine wilderness.

As the rest of the world watched, Sydney Water's Chief Executive and a wide range of water experts struggled with the problem. Schools, hospitals and child care centres went into damage control as children are highly vulnerable to the parasite. People were told to avoid washing, gargling or bathing with the water.

Sydney Water's CEO and Chairman both resigned. A legal nightmare for the government followed as organisations and businesses dealt with major disruption to production lines and huge bills for bottled water. Suggestions were made that Sydney Water was negligent in not preventing the contamination and that it had not advised consumers fast enough. Some media suggested that the water company had been slow to communicate and had waited two days before advising the public. Sydney major's newspaper, the *Sydney Morning Herald*, carried the headline: 'Safe water: the big lie'.

Two months later, following a major industry inquiry, the senior managers of the Water Corporation were severely criticised for their poor handling of the crisis. The investigation found there were unacceptable delays in releasing effective warnings at the start of the crisis

and that there was inadequate testing after the parasite was identified. A breakdown in decision making at the executive level was also identified. While there may have been a central emergency plan, nobody had set down the processes, powers and responsibilities of each government group involved in declaring and managing a major disaster.

The Victorian gas crisis reiterated the need for integration of emergency and crisis planning. Esso had a plan. The Victorian gas industry had a plan. And the government had a plan for an emergency. The big one hit Victoria's gas industry in September last year.

This crisis began as a plant explosion and resulted in a loss of gas supply to one of Australia's largest capital cities.

It all began with a gas leak at the Esso (Exxon) Longford plant in country Victoria. Gas was leaking from the plant, and as maintenance workers were inspecting the problem, a gas explosion occurred triggering a fireball. The explosion killed two men and injured eight others. Over 200 police, firefighters and emergency services specialists worked for many days to control the disastrous situation, assess damage and repair the crippled plant. This one plant provided the entire State's gas supply.

The gas crisis hit the car industry, plastics production, food and drink industries hard. Estimates were that the crisis would cost industry \$35 million a day. Hospitals cancelled surgery and emergency plans were put in place to deliver essential services to the elderly and frail. Farmers had to dispense with millions of gallons of milk. Tens of thousands of workers were stood down as the shut-down affected the operations of many industries. Lawyers on behalf of businesses, unions and consumers, launched one of the biggest class actions in Australian legal history.

All businesses and households were ordered to turn off gas at the meter and in a spectacular response, the public reacted quickly and stopped using hot water, central heating and cooking facilities. The cut-off lasted almost two weeks.

Then followed the process of plant recovery involving the isolation of the crippled plant and the testing of associated plants. During these efforts to restore the gas supply, the sombre and tragic funerals of the men killed posed a stark reminder of the severity of the incident.

This was the big one. So many said it couldn't happen.

There is no doubt that conventional incidents can be effectively handled by

clearly defined emergency procedures under a well acknowledged authority structure, but a major event creates a whole new situation. No longer is the incident clear cut. No longer is the degree of preparation and competence enough.

Now, we have the big one. No-one understands why it is out of control. It is not easy to label because it is taking new directions every few minutes. It is coming at you from every angle. Too many people have been affected. The bad news is getting worse. And as you look around you, you see the whole world collapsing.

Yes, I am talking about the unimaginable event. The huge breakdown that we saw in New Zealand with power, in Sydney with water and in Melbourne with gas. Let's just look at some of the difficulties faced by emergency and crisis managers when the big one hits. When the problems are so complex, that recovery is difficult. When the chain of events triggers an even more serious chain of events.

Just like the Longford Esso explosion that triggered the cut off of gas supplies and inevitably triggered an even more serious energy-related incident. Eventually people had to turn their gas back on, and the risks alone in this action could have been a crisis in itself.

It was similar to a disastrous fire in the switching centre in Chicago at the Bell network. The loss of the network triggered so many serious events—banks could not cash cheques, mail order companies were paralysed, cellular phones and paging systems were knocked out, emergency services were placed in a critical communications situation.

These disasters don't have any rules:

- there are often not enough emergency services to cope;
- vital resources are knocked out;
- there are inadequate procedures for dealing with the situation;
- resolution is a long way off. Events keep escalating;
- the media moves from being very local to very international;
- there are serious differences of opinion in how things should be done;
- the government of the day and the bureaucracy become seriously involved;
- the public takes an armchair position (and is fed by the media);
- the victims and their families become the visual antithesis of the problem (again, projected by the media);
- there are growing numbers of authorities and officials involved.

Sometimes there is complete chaos in simply trying to identify which of the emergency services and investigative

bodies is doing what. *And* who is in charge.

There were 21 agencies involved in the TWA explosion in 1996. Two thousand people and 21 agencies.

This was the case on July 17, 1996, when a Boeing 747-131 operating as TWA Flight 800, departed from New York's John F Kennedy International Airport on a regularly scheduled international flight to Paris. The plane exploded at 13,800 feet on its ascent, at twilight, at about 8.31 pm. There were 230 people aboard.

The Flight 800 tragedy has captured the attention of millions and has been reviewed by airline and airport management worldwide. Many believe that the manner in which the TWA crisis was handled was a crisis in itself.

Let me quote James E. Hall, Chairman of the United States National Transportation Board. '...No-one expects to have a catastrophic accident, and therefore it seems no-one is fully prepared for one. I urge your companies to draw up plans for how you would handle not just the media onslaught, but the needs of potentially hundreds of family members who will descend upon your city and your company.'

The reports from the Contingency Planning Exchange Incorporated identified that what TWA had to face was far more than an emergency.

It was:

- dealing with distraught families;
- managing an emotional public;
- coping with a huge press response;
- managing rumour and innuendo;
- coping with a large number of government enquiries;
- managing collection of evidence and finding the cause.

Agendas run high in crises. Political agendas, personal agendas, corporate agendas, emergency agendas, legal agendas. In TWA's case:

- **New York's Mayor, Rudolph Guiliani, was concerned about** notifying victims' families, the environmental damage and telling the public;
- **the Coast Guard was concerned about** recovering evidence from the water, dealing with retrieval of bodies and managing the area of water where the wreckage was located;
- **the New York Police Department** was concerned about the huge security problems at JFK. In addition to the normal airport traffic, there were literally hundreds of other people making enquiries;
- **the FBI** was concerned about the federal and international implications of terrorism;
- **lawyers** from around the United States

wanted to represent the families and the businesses affected.

There were in fact 21 agencies involved in the investigation, cleaning up the beaches, security of the airport, investigations at the airport and counselling grief-stricken families. Twenty-one agencies who were dealing with the crisis management team at TWA. Something like 2,000 people. Five hundred media representatives set up operations at the airport and coastguard stations.

The importance of crisis planning and communication was emphasised in all of the post-incident evaluations. Planning and communication—two areas in which TWA was—'woefully inadequate' said Mayor Guiliani on US television.

TWA was criticised on many fronts. As a result of much of the criticism and the Gore Commission for the US Congress, changes have been made to future crisis management strategies.

Some of the problems were:

- **TWA was threatened with arrest.** They did not release the list of passengers for 24 hours. There were delays in dealing with families still at the airport or those who returned to the airport immediately after the disaster. The press went berserk. Government officials from the City of New York joined family members in their condemnation. When TWA's Joanna O'Flaherty arrived to set up a crisis centre at the Ramada Inn, she was threatened with arrest by the New York Police Department for not releasing the passenger list.
- **There were too many agencies.** During the first few days, the airport and TWA offices were crowded with investigation agencies. The public became very confused about the investigation. At the beginning, there was some dispute over who would be in command. Finally the U.S. President appointed an overall crisis director.
- **There was a media invasion of privacy.** The New York Post obtained a family identification card and invaded the family assistance area. A reporter began to disturb families soliciting interviews. She was jailed and stripped of her press credentials.
- **There was debate about eligibility for family assistance.** There were no guidelines as to who should receive assistance. There was no clear definition of who should participate as next of kin - boyfriends, girlfriends, siblings.
- **Press briefings did not consider the victims.** In the early stages of the disaster, the members of the press were

briefed about discoveries before members of the families.

- **There were problems and issues that arose dealing with communication to families.** Problems and issues on the identification and return of bodies, the establishment of a family assistance centre, the return of personal effects, and the responsibilities of the air carrier. There was much confusion as to who should deal with these responsibilities. The management of briefings and other matters are now the responsibility of the National Transportation Safety Board.
 - **There was confrontation with lawyers.** Litigating attorneys were not allowed into the Emergency Information Centre at the Ramada Inn. This caused a major problem because many of them represented families who were making enquiries at the Centre. In fact, many lawyers appeared and caused serious problems attempting to push the families into using their law firms in the promise of a lot of money.
 - **Parents who were estranged fought over the body and the baggage.**
 - Some passengers had both a spouse and a lover.
 - **There was poor crisis administration.** In terms of crisis administration, no-one person had been assigned to arrange faxes, telephones, copying machines and computers with the necessary software programs.
 - **Fifty percent of the passengers were of French and Italian nationality.** This meant that apart from the huge number of US investigation agencies, there were additional government representatives from France and Italy who added to the overall mass investigation. Translation was another problem.
 - **Rumour was rife.** Lack of direction or knowledge *can* and did result in rumour and innuendo and in this case, it was rife. The media responded to public curiosity about air travel. The crisis was not managed well and the results were, for TWA, devastating.
- There were up to 50 scenarios circulating about what caused the explosion. And, as you remember, the investigation went on and on.

Crisis management is about the protection of an organisation's most valuable assets—its stakeholders—employees, customers, governments, suppliers—all the audiences that a business relies on to exist. Crisis management is about protecting an organisation's reputation, and name.

It is about being ready for the big one.

In a recent survey conducted by KPMG and the Institute of Company Directors, 40% of surveyed companies said they had no crisis plan in place for major business interruption. I am sure they have adequate, efficient and reliable emergency plans but insufficient and inadequate procedures in place for dealing with the big one.

Emergencies and Crises

I see an emergency as an immediate, sudden and often unexpected incident that requires prompt response action. An emergency can escalate to a crisis. A crisis is the stage where the organisation's future is threatened—it is a turning point often resulting in permanent, drastic change.

Unfortunately, there is very often a large gap between emergency response and crisis management response. This gap can create serious communication breakdown, particularly with employees. The gap can result in mixed messages to the media and a very slow response to government and regulatory stakeholders. The emergency management people are generally not the problem.

The problem is usually the result of senior management's lack of understanding as to how emergency response works. Crisis management and emergency management must work together to a standard framework.

Emergencies, Issues and Security Triggers

The first step in managing a crisis is assessing where the potential trouble will come from. Whether your company is a government organisation, a multi-billion dollar organisation or a small to medium business, analysing where potential crises can come from is about looking at your organisation strategically.

It requires thinking beyond the normal insurance risks and emergency planning threats. It requires you to think about the worst possible triggers for emergencies, issues or security problems.

All crises are born from slow burning accidents that burst into large explosions like Esso; slow burning issues that escalate rapidly into chaotic events like the Sydney Water contamination; or slow burning security events like extortion that move out of control like that of the threatened poisoning of Arnotts Biscuits.

Triggers for a crisis can be identified. Plans can be laid to prepare for the big one. Decision-making tools can be developed for all those who inevitably may become involved in suddenly having to deal with massive demands. These demands can be from victims, families, journalists, governments, experts, political

leaders and the general public.

So how do you prepare for a major event where there are enormous and unusual problems? How do you prepare for an event that does not play by the rules? How do you deal with the acute rather than the chronic? What are the best strategies for prevention, control and damage limitation? How do you respond when the phones start to ring - when your operation starts being questioned? How do you avoid being a victim of chaos?

Let me outline a plan that could create a turning point in an unfolding sequence of events. A plan to put some control on crisis chaos when the big one hits.

First of all, you have to recognise you can be hit by a crisis at any time. You have to believe that the damage can be controlled...so can the agenda.

In addition to the emergency team, you need to form a crisis team. Draw up a list of team members that will give you your best chance of managing the crisis agenda...HR, Operations Manager, Public Affairs/Public Relations and Insurance and Legal. A team of alternatives must back you up. Get your team together.

You need to establish a crisis management centre (in addition to the emergency control room or radio room). It's a war room. A control room. A bunker with fax and phone numbers that are accessible. And don't put this room near your foyer—it needs to be secure and away from cameras and complaints.

Identify your organisation's top threats. Not just the insurance risks but the threats to your reputation, your people and your future. Identify the big threats that may hit. Maybe your emergency response can deal with one or two people being injured, but can they deal with 20 or 30 being affected.

Once you have your set of threats identified work through the most appropriate responses that put you in charge of the agenda. List your team response actions as checklists and duty cards. Pick a spokesperson. Have that spokesperson and a back-up trained.

Have back-ups for everyone.

Work out how you will liaise with contractors, joint venturers, police, ambulance, defence, rescue. Workshop your combined responses to confirm processes, powers, rules and responsibilities.

Clearly identify the way in which you'll get the message of what you're doing and why you're doing it out to all your stakeholders—your employees, customers, the media, government and so on.

So you need a team...identify your

threats and how you'll respond, a place to work from, a spokesperson and a message strategy.

Keep an up-to-date list of contact numbers readily available inside and outside the office. Have alternative premises arranged. This could be an agreement with another organisation. Put all your plans into an easy and simple manual and test them once a year for accuracy and capability.

Crisis Response - Learning from an event

Recently, a major resource company in Australia used their crisis management team to manage a serious emergency, a crisis—for them, a big one at their plant. The incident required front-line emergency services response, an overall crisis management team response to manage each stage of the incident and its effect on employees, the community and other stakeholders.

They also needed a great deal of help from outside—there were a number of people injured, the local hospital could not house all the injured, and victims had to be sent to another hospital. Additional emergency services support had to be flown in and they had to back up their inadequate communications technology.

The company have given permission to share the learnings in a post-evaluation of these incidents. The learnings are an invaluable contribution to management planning. The key issues to come out of the post-evaluation of those incidents were:

- serious accidents or incidents seldom happen from 9.00 to 5.00;
- accidents can more often than not involve contractors—this one did and they had not integrated emergency plans and processes;
- can the site contact employees and contractors' next of kin effectively? In this case they couldn't because many of the contractors were not listed in the company's HR files;
- crisis management procedures need to be easy to find and easy to read—it took them some time to find the plan and some of the contact numbers were out of date;
- only one spokesperson needs to be appointed at site—one of the main spokespeople for the site was actually injured in the incident and the back-up was on annual leave;
- there needs to be easy access to post-trauma counselling—they found it difficult to contact trauma counsellors in the middle of the night and therefore

it took some time to get support at the location

- a fast message about what has happened needs to be presented to employees and nearby stakeholders. They spent too much time debating what should be said and whether it fitted the legal requirements and therefore there were no messages handed out until late morning;
 - support from the Business Unit or Head Office is essential—in this case they provided enormous back-up support and resources;
 - executive personnel from outside the site need to consider the sensitivity of the issue when arriving at the site. One or two gentlemen in suits did not seem to understand the mood of the accident location when they arrived;
 - telephone systems are put under enormous stress—they needed three additional telephonists. Mobile phones were an enormous help;
 - 'local' personal issues can affect emergency response—one of the rescue team suffered severe shock when he discovered his brother was one of the seriously injured;
 - emergency contact lists need to be regularly updated—although changes had only been made recently to certain phone numbers, lists had not been updated;
 - additional facsimile and email systems need to be in place—there were simply not enough facsimile and email facilities to provide an even flow of urgent information;
 - a satellite phone is essential for distant sites—it would have provided uncomplicated, direct contact where mobile phones could not;
 - one 'control room' is essential—initially both the contractor and the company had two control rooms dealing with the incident.
 - log-keeping is vital—after the event, logs were found to be lacking in clear records of the response actions;
 - switchboard, receptionist and security personnel need to be trained in response methodology—they were confused and unsure how to deal with victims' families inquiries and employee information.
- Solid learnings in managing crisis. During crisis, management behaviour moves into an area of concentrated intensity - and every organisation is vulnerable to the big one.

So, how do you control crisis chaos when the big one hits?

With a crisis plan, you can.

Media coverage of mass death: not always unwelcome

When ordinary persons die in unremarkable ways, the media usually pay little attention. In contrast, when someone dies in an unusual or violent way—especially in a mass death accident or disaster—the media react as if the dead were celebrities. They head to the scene, record the grief of survivors, sometimes even film and photograph the bodies of the dead. They also track down family members, friends and associates for information, comment and pictures.

An ordinary person dying of a heart attack at home is not news, but one who is murdered or dies in a fire will certainly make the local news, and those who die in a major air crash will have the cause of their death raked over in fine detail by the national media (Walter, Littlewood and Pickering 1995).

Emergency responders tend to see media behaviour in such incidents as inappropriate and try to control access to the scene of mass death incidents and protect the privacy of the bereaved. This is often very difficult and, on the basis of the evidence available, may be inappropriate. This article looks at how the media treat mass death. It concludes that although some efforts to control media behaviour are justified, much media behaviour is acceptable to those who are most affected—though it is not clear why.

Literature Review

Although there is a small but detailed literature on mass death and a growing literature on the mass media and disaster both sets of the literature generally ignores the way the media deal with death, especially mass death. The most recent discussion of the handling of bodies (Scanlon 1998) makes no mention of the media. That is also true of earlier major reports on the same subject (Blanshan 1977; Blanshan Undated; Blanshan and Quarantelli; Catron, Hershiser, Hershiser and Quarantelli 1976; Hershiser and Quarantelli 1979; Pine 1969a; Pine 1969b; Pine 1974; Pine 1980). Similarly, when the Disaster Research Center of the University of Delaware prepared a major bibliography on the media and disaster they included no articles on how the

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media deal with death Wenger, Dennis and E. L. Quarantelli 1989). Other major reviews of media performance in disaster also ignore this issue (Committee on Disasters and the Mass Media; Scanlon and Alldred; Scanlon, Alldred, Farrell and Prawzick). Even when articles cover both the handling of bodies and the role of the media in a mass death incident, they don't link the two together (Emergency Communications Research Unit 1985). Discussion of the media's relationship to death, including mass death has, in other words, not been documented in the academic literature but left to the text books and to guides on professional practice.

Normal Death

At one time, preparing an 'obit' was a standard assignment in introductory Journalism classes and reporting texts had full sections on writing obituaries (MacDougall 1968; Metz 1977; Harriss, Leiter and Johnson 1992).

Besides being cherished by newspapers for their readership, obituaries are... clipped, saved, sent to friends and relatives, pasted in scrapbooks and albums, placed in family Bibles. They endure virtually forever (Metz 1977).

However most obits are run because someone did something in life considered newsworthy. For example, the *Toronto Daily Star* ran a 12-paragraph story on the death of Rudolf Krogler because he was a classmate of Pope John Paul II in Poland: a photo of Krogler and the Pope accompanied the obit (Turnbull 1998). Similarly, the *Markham* (Ontario) *Economist & Sun* carried coverage of the death of Markham's mayor and even covered his funeral. The stories included quotes from those who knew him and from the eulogy ('Mayor Tony Roman Dead at 56' 1992, Belgrave 1992).

Major newspapers ignore ordinary death but do carry obituaries for truly prominent figures. For example, on November 21, 1998, *The (London) Times*

ran obituaries on:

- Alan Pakula, the US film director, responsible for 'To Kill a Mockingbird' and 'All the President's Men'; and
- Paddy Clancy who with his brothers, Tommy and Liam, attracted the attention to Irish music that eventually led to the spectacular success of 'Riverdance' ('Alan Pakula' 'Paddy Clancy' November 21, 1998).

There was also a note of the earlier death of Valerie Hobson, a British film star perhaps better known as the spouse of John Profumo, central figure in a British cabinet scandal ('Milestones' November 21, 1998). These stories appear so quickly and with so much detail because for the really well known, the media stay ready for death: wire services and many newspapers maintain biographical files on prominent citizens who are in their mature years, so that obituaries can be prepared quickly. Indeed, obits of the most important people are already written: should one of them suddenly die the editors need only add the circumstances of death to the beginning of the story (Metzler 1986).

Some deaths are seen as so significant that newspapers assign a reporter to interview those persons while they are still alive. Alden Whitman of the *New York Times* reports that only twice was he refused such interviews:

Some others have been hesitant at first, but having acquiesced, seem to have enjoyed themselves. One of these was Sir Anthony Eden, British prime minister during the murky Suez Canal crisis of 1956, now Lord Avon. At first his Lordship was adamant. 'I have never given a private interview,' he wrote me. In London in 1967 I pressed him by telephone. Pleasantly, he said no again until I had the wit to say, 'Please, sir, this is not an interview for now, but for the future.' 'Oh,' he replied, brightening, 'you mean it's for when I'm dead.' Well, that's the short of it,' I said. 'In that case,' he continued, 'do come and have tea with me at the House of Lords.' The result was a behind-the-scenes recapitulation of the Suez business as well as some glimpses of his private self (Whitman 1972).

Other who agreed to similar predeath interviews included Harry Truman, Samuel Beckett, Henry Miller, Francois Muriac and Graham Greene.

Coverage Continues

If the death of someone prominent is tragic or has other newsworthy qualities the coverage may continue for days, weeks, months or even years. When Michel Trudeau, son of former Canadian Prime Minister Pierre Trudeau, was washed into a British Columbia lake by an avalanche the story made page one and the coverage continued for more than a week. There were television interviews with Royal Canadian Mounted Police explaining how they would search Kokanee Lake for Michel's body. Eventually, Michel's brother Sacha appealed to the media: 'As you all understand, I'm sure, it's a lot of pain for my family so I would ask you to respect our peace' (Steffenhagen, 1998, p. A3). The coverage was minute compared to coverage of the death of President Kennedy:

The networks abandoned entertainment programs and commercials and devoted themselves to the big story from Friday to Monday evening...The newspapers covered it in extenso and the wire services moved thousands of words on it...During those days the average home in the Neilsen sample had a television receiver tuned to the Kennedy report for a total of 31.6 hours...people estimated that they had spent on the average of 8 hours Friday, 10 Saturday, 8 Sunday and 8 Monday watching television or listening to the radio (Schramm 1965).

Coverage still continues for Kennedy and for Diana, Princess of Wales, both because of their prominence and speculation about the details of their deaths.

Although the media are often ready for the death of celebrities, they are not prepared for the death of less notable persons. That means when they do decide to give major coverage to the death of someone less well known they have to scramble for information and photos. For example they send reporters to the person's home for what are called 'pick-up pictures', a task that McKercher and Cumming state is seen by editors as a test of a young reporter's ability to be persistent under difficult circumstances.

The authors report how Ottawa *Sun* reporter, Stephanie Chamberlain handled three such assignments. On one she noticed an air force sticker on the door and mentioned she had worked for an air force magazine. On another, after being turned away, she returned with doughnuts

and coffee. On a third—an incident where a woman was murdered by her husband—she persuaded one of the woman's friends to find a picture by arguing that the story needed to be told to emphasize the need for society to stop spousal abuse. Chamberlain said she felt a certain triumph in getting all three photos: she was also conscious of 'an element of manipulation' (McKercher and Cumming 1998).

In the wake of the Port Arthur massacre in Tasmania, Australia (25 dead, 22 injured), the Hobart *Mercury* ran a huge front-page photo of Martin Bryant, the man accused of the killings, with a huge headline, 'THIS IS THE MAN':

Late that morning I received a phone call from an employee of the *Mercury* who described with disgust how three staff members had distracted the Constable on duty outside Bryant's house while one of them broke in to steal the photograph (Easton 1997).

In addition to chasing photos of the dead, the media call all possible sources for information and flock to the scene or the community that is the focus of the response. They also jam the phone lines with calls to any agency or anyone who might have information. More than 200 journalists—from Canada, Denmark, England, France, Ireland, Japan, Norway, Scotland and Sweden—showed up in Jonesboro, Arkansas after a teacher and four girls were shot at an elementary school. There were 325 media personnel on hand after a charter aircraft carrying US military personnel crashed in Gander, Newfoundland and roughly 1,000 media at Lockerbie after the air crash. So many media helicopters responded to Coalinga, California after an earthquake that they created an aerial traffic jam

In addition to heading to the scene, journalists try to find persons in their own community or coverage area who are related to those involved. When the ferry *Estonia* sank en route from Tallin to Stockholm on September 28, 1994, most of the 913 passengers were Estonian or Swedish. However, the *Ostlandets Blad* in Ski, south of Oslo, tracked down the ex-wife of a local resident who died in the incident, interviewed her and ran a page one story based on that interview. The next day there was a second page one story with photo based on an interview with a friend of the victim. Because Matti Sormul, the man who died, was a successful local businessman, the newspaper had his photo on file (personal interview with Espen Larson, the reporter who did the interviews). Similarly, media

in Australia and elsewhere tracked down the families of those who were shot and killed in the massacre at Port Arthur, Tasmania.

Morbid Interest

Along with stories and photos the media go for graphic, often gruesome coverage. For example after the Swissair crash off Nova Scotia, *Time* ran a feature story on Master Seaman Rene Poirier, one of the divers who recovered debris:

In every direction, nothing but tiny pieces of debris. The jet lay unrecognizable, 'like a huge pane of shattered glass'. And scattered among the shards were the people he had come for. He found an eye, a heart, a jawbone. Part of a hand imbedded in an armrest. Poirier tries the word hellish to describe the scene then takes it back. 'There is no way to describe it' (Lopez 1998).

At Lockerbie journalists photographed a body being removed from a roof:

'The day they brought the body down the photographers were running around stupid,' a neighbourhood resident recalled. 'They were running through my garden up on to my step to get as near as they could to get a photo of it being brought down. That was really ghastly and I thought they were pigs at the time' (Deppa *et. al.* 1994).

Four publications including *Time*, *Newsweek* and the *Washington Post* used those photos. If access to such photo opportunities is denied the media may resort to subterfuge. After US soldiers were killed in the air crash at Gander, Newfoundland, reporters were barred from the crash site until it was no longer possible to see bodies. One photographer slipped by security, climbed a ladder and shot a picture of the floor of an aircraft hangar that was being used as a morgue.

After the Port Arthur massacre, the media also provided coverage usually reserved for the prominent—they broadcast a memorial service for the dead. Even CNN aired a live satellite feed from Hobart, Tasmania:

CNN intended to take the first half-hour of the service live before switching to its regularly scheduled interview program Larry King Live. But as the service unfolded CNN decided to continue airing the whole memorial service and delay Larry King Live (Raedler 1997).

While that coverage was relatively unobtrusive, that was not the case when a vigil was held in Hendricks Chapel at Syracuse University the evening a number of Syracuse students were killed in the Lockerbie crash:

As the chapel filled media were asked to stay away from the area in front of the raised platform, where chaplains and representatives of the various faiths would lead the service. Photographers were asked not to use flash. But the emotion generated by the event, especially in the moments of meditation between scriptures and sacred music, created compelling pictures and the whirl of automatic levers advancing film echoed from both sides of the sanctuary. *Soon flashes began going off.* Upstairs, at the back of the balcony, a local television reporter 'went live' over the protests of students in the area (Deppa et al., 1994, p. 55).

Journalists often feel uneasy about this type of behaviour. After the Swissair crash, reporters gathered at Halifax airport so they could film relatives arriving, at the Lord Nelson Hotel (so they could film relatives coming and going) and at Peggy's Cove the closest community to the crash site (so they could see relatives gazing out to sea). Television journalist Kim Brunhuber felt guilty about what he was doing. He recalls editing footage of a woman leaving the hotel en route to the scene:

She catches sight of our camera 20 feet away, lowers her head, pulls part of her black dress to hide her face. When we put our report together, we stay with the shot until the moment she shields her face. Saving us the public acknowledgement of our grim voyeurism. Days later what I suspected becomes clear. I can edit the shot, but I can't edit my guilt (Brunhuber 1998).

Support for Media

Although such customs have been criticised by others, journalism text books support the custom of survivor interviews and provide much the same advice they give for writing a simple obit: get the interview; be sensitive how you do that; and, if you do it properly the effect may be positive.

4. *If possible, interview the victims.* Survivors...may be badly shaken, but if they are able to talk, they can provide firsthand detail that an official report never could....

6. *Be sensitive to victims and their families.* You have a job to do and you must do it. That does not mean, however, that you can be insensitive to those involved.... (The Missouri Group 1992)

One of the toughest things that a reporter has to do while covering a disaster is to interview the families of victims. At no other time does the public's right to know seem to come into direct conflict with people's right to privacy...

Professionals realize that if they handle the interviews with a great deal of sensitivity they can offer survivors an opportunity to grieve openly and to eulogize a loved one (Itule and Anderson 1991).

One journalism publication carried guidelines on how to approach victims and their families. It suggested reporters ask for permission to do an interview and indicate they will stop or stop taking notes or recording any time an interviewee wants that. It suggested that reporters make clear precisely what they want at the start of the interview (Cote and Bucqueroux 1996). It said such an approach makes the person being interviewed feel a sense of power and reduces uneasiness. Frank Ochberg is a specialist in dealing with victims of violence. He not only condones such interviews, he suggests that reporters must understand and respect their interviewee's reactions:

When victims cry during interviews they are not necessarily reluctant to continue. They may have difficulty communicating but they often want to tell their stories. Interrupting them may appear as patronizing and denying an opportunity to testify. Remember, if you terminate an interview unilaterally because *you* find it upsetting, or you incorrectly assume that your subjects wants to stop, you may be re-victimizing the victim (Ochberg 1996).

He says that research shows that victims have some anxiety when journalists interview them but that they also experience an overall increase in self-esteem.

Survivors Agree

Though some emergency personnel might question this advice survivors seem to agree. When the Broadcast Standards Council in the United Kingdom interviewed 210 victims of violence or disaster including 54 who had been interviewed by reporters, they found that three-quarters were not offended by news coverage and that that was especially true of those involved in a disaster. Those who did complain were concerned about newspaper especially tabloid reporters, but not about broadcast journalists (Shearer 1991). Survivors said they were prepared to be interviewed if the stories had a purpose, for example, 'exposed the human frailties and negligences that had contributed to major disasters and so help to minimize the danger of such disasters happening again' (Shearer 1991).

There were similar findings in a study by Karen McCowan, a reporter with *The Arizona Republic* who surveyed victims

and reporters after an air crash. Two victims complained about interviews. A third had mixed feelings. Most said they wanted the public to know about their loved ones and saw the interviews as a way to ensure accuracy and to allow them to vent their emotions. Again, most complaints were about print media (Itule and Anderson 1991).

In some cases survivors do not only welcome exposure to the media, they exploit it. Relatives of the dead have formed groups to try and do something about the incident that caused the death of their loved ones or to share information about lawsuits or other actions that result from these deaths. Those groups put out news releases formalizing their relations with the media. There were, for example, two such groups formed after Lockerbie—'UK Families Flight 103' and 'Victims of Pan Am 103'. One specific goal of the second group is to 'disseminate to the general public through the means of a newsletter and other materials, information regarding the issues of airline safety and security...' (McIntosh 1989).

Flashbacks

When normal death occurs, memories of loved ones flash back during a visit to a familiar setting or because of a familiar piece of music. They also occur on anniversaries: persons who have lost loved ones around a religious festival such as Christmas are reminded of their loss every Christmas from then on.

In the case of mass death, however, the trigger for such memories is often the media. Many people have discovered that when someone in their family is involved in unusual, violent or mass death, contact with the media is not a one-time affair. The 1917 Halifax explosion—2,000 dead, 9,000 injured—is still news in Halifax each December 6, and the local media still run interviews with survivors. There were also items on French and English Canadian television 10 years to the day after the massacre of women engineering students in Montreal. (Of course, the media were not solely responsible: the news reports all contained coverage of vigils in the memory of these students who are seen as victims of male violence against women.) Similarly, on New Year's Eve 1998, the *Express* in Blenheim, New Zealand carried front page photos of two young people, Ben Smart and Olivia Hope who disappeared in Marlborough Sound the previous New Year's Eve. Their bodies have never been found but a youth named Scott Watson has been charged with their

murder (Nicholson 1998). The same day the anniversary story appeared in the Blenheim paper, the first name of one of the missing was the crossword answer to 142 down in Wellington's daily, *The Dominion*, the following day ('Mindgames Monster' 1998).

The same re-visiting happens every time a tragic incident again becomes news or when a similar event occurs. When a person is charged with a crime, is convicted, or appeals, or applies for parole, the media will run the story, often using photos. While relatives of those who die from mass violence or disaster may brace themselves for anniversary stories—it may even help them to know that others remember—relatives of victims of individual violent crime are sometimes startled to turn on the TV and see their loved one's photo because of some development unknown to them or, for that matter, to find their child's name as a clue in a crossword.

...such material...is available to be reused months or years after the event whenever a news story occurs directly or indirectly connected to the event. Particular photographs or film footage become symbols of a particular disaster and are reused on an anniversary or whenever a similar tragedy occurs. The sudden appearance of these images can be distressing (Eyre 1998).

Summary and Conclusions

When someone dies after a long illness or a long life, the passing may attract limited attention in the media except for a death notice in the ad columns—unless that person is prominent. Then the death is treated very differently. That changes when anyone dies in a violent, tragic or bizarre way and it changes dramatically when a number of people die at the same time. On those occasions, people who have been largely ignored by the media throughout their lives suddenly become the focus of media attention: they are treated as if they were prominent. The grief of their friends and family becomes a public rather than private matter—and the attention may last for decades. For those who are related to or know someone who has died violently, mourning is a media, as well as a private, experience.

Emergency responders may be able to control media behaviour at the scene of such incidents. At Gander, after the air crash, the media were taken to the site in a school bus and kept in the bus as it followed a route that guaranteed they would not be able to see or take pictures of any bodies. Emergency responders can

also provide some privacy for survivors and relatives of the dead when they are at or near the scene. After the Swissair crash the media were kept behind barricades when relatives arrived at Halifax airport. They were also kept some distance away from Peggy's Cove, the nearest location to the crash, when relatives of the dead came for a visit. There can also be controls at the hospital and the experience at Munich (after the Manchester air crash) suggests the media will cooperate with such arrangements. The increasing sophistication of video equipment makes such actions less and less significant. The media can take shots from a distance that makes it appear they are beside the person being videoed.

In mass death situations, however, complete control of the media is very difficult. This is partly because of the numbers involved and partly because in a real disaster where there is widespread destruction, there is no 'site' and no place to establish a perimeter. Most important, control is difficult because the media activity is diffuse: media far from the scene 'localize' the story by finding a nearby survivor, relative or friend. Even if control measures are effective at the scene it is difficult to impossible for official agencies to control media activity away from the scene. As journalists try to find a local angle to such stories they will track down the relatives and friends of the dead wherever they may be located.

In any case, there are so many journalists doing so many things and talking to so many people that media control is more of a fiction than a reality. It may be especially difficult in an incident like the Swissair crash where there was no visual evidence of what happened except the occasional piece of aircraft or human debris trapped in a fisherpersons' net, brought to shore and turned over to the Royal Canadian Mounted Police. The media had nothing else to do but to chase visuals of the families. Finally, media control is next to impossible in a widespread disaster, especially one not predicted, such as an earthquake. There is simply too much happening in too many places for the media to be restrained.

In short, media behaviour after mass death seems to be more a function of media perceptions of what is acceptable than perceptions by personnel from emergency agencies as to what is appropriate. There is little doubt that the relatives and friends of the dead will continue to be the objects of media attention—attention that may last for

days, weeks, months or even decades; and that media replays will often force unexpected recall of what happened. Yet as the limited research available shows, it is far from clear whether that is as bad as some critics would suggest—though it is not clear why this is so. Perhaps it is because talking with a reporter allows a relative or friend to tell someone about their loved one. Perhaps it helps them deal with the finality of death. Perhaps through the media they ensure their memories will endure in more lasting form. Perhaps—there is some evidence to support this—the media help make death meaningful.

For some, coverage of death is a one-time affair, a brief moment of attention for someone who has lived an unremarkable life. For others, it is just another page in a life of prominence. For those involved in violent or unusual death or mass death incidents, the exposure to the media may be the start of a long-term relationship, one that some will at first resist but later seek out. It is difficult for those on the sidelines, including emergency responders, to understand what sort of media behaviour is intrusive and what is acceptable, even desired—in other words to know when the media are uncomfortable vultures and when they are welcome, sympathetic listeners.

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Book Reviews

Global environmental crises: an Australian perspective

Aplin, G. [et al.], 1999, *Oxford University Press, Melb., 2nd ed., 392pp.*

Explores the pressing environmental problems facing the earth from an Australian viewpoint. Case studies dealing with population and health, land, water, forests, the atmosphere, and cities illustrate a number of fundamental themes relevant to all such crises: humans play a pivotal role as both cause and potential solution; environmental issues are complex and require interdisciplinary and multi-disciplinary approaches; there is a need to achieve sustainability in all human activity. The concluding chapters bring the case studies together in a discussion about attempts at international cooperation and possible paths to a viable, sustainable future.

Major incident procedure manual

Metropolitan Police Service, 1998, Metropolitan Police Service, Lond., 50pp.

The procedures adopted by each of the emergency services in response to a major incident are understandably devoted to the role of the service concerned. The purpose of this document is to describe the agreed procedures and arrangements for the effective co-ordination of their joint efforts. In this way the overall response of the emergency services will be greater than the sum of their individual efforts, to the benefit of the public.

Using cyberspace to enhance disaster mitigation, planning and response: opportunities and limitations

Much has been learned about effective mitigation, planning and response to disaster during the past forty years. Those who develop mitigation strategies, plan for and respond to disasters, have learned through first hand experience, through trial-and-error, and through the application of insights gained from various training activities. The source of much of the knowledge has been those in academia who study behavioural and organisational response to disaster. The pioneering work of researchers such as Samuel Prince, Charles Fritz, Allen Barton, E.L. Quarantelli and Russell Dynes has given witness to the proliferation of such research throughout the world. This proliferation is exemplified by the work of Neil Britton, Wolf Dombrowsky, Thomas Drabek, Gary Krepps, Dennis Mileti, David Neal, Joanne Nigg, Walter Peacock, Uriel Rosenthal, Robert Stallings, and Kathleen Tierney. During the last forty years, in particular, we have observed the development of a ever larger body of knowledge which has been shared among disaster researchers through various journals which have emerged during this time period. The International Sociological Association's International Research Committee on Disasters (RC39) has served as a networking link for disaster researchers from around the world. Various international conferences are now regularly held to facilitate the sharing of research findings and practitioner concerns. Research centres with international reputations periodically offer workshops for the same purpose. National government emergency management organisations have created strategies for facilitating the development of emergency management training degree programs at universities (for example, in the USA there is the Federal Emergency Management Agency Higher Education Project).

Challenge

Despite the wealth of knowledge and experience gained in recent decades, a here-to-fore insurmountable challenge

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Based on the author's presentation at the
meeting of the International Sociological
Association in Montreal, July 1998

has been in trying to develop a more effective strategy for researchers and practitioners to share the insights they have gained. Few researchers and practitioners are able to garner the resources necessary to participate in conferences. Often the same cadre of specialists are interacting with one another at such national and international events. How might the educational process be more effectively facilitated to potentially involve all of us? How might we develop a process, which might also enable practitioners to interact with one another and with researchers during emergency time periods to employ the knowledge and experience of others at a critically useful time? The purpose of the current paper is to offer a few suggestions in answer to these questions and to raise a few important issues, which may be useful to keep in mind pursuant to implementing answers to these questions.

Implications of the information technology

Recent technological advances have resulted in a communications explosion and a levelling of information hierarchies (Burstin & Kline 1995, Davis & Botkin 1994). The revolution that these emerging technologies have created is transforming how we work, live, communicate and learn (Drucker 1993, Gates 1995, Jones 1995). Workers can communicate with the company CEO by email without having to traverse the chain of command. Students are able to access a wealth of information on-line as well as communicate directly with professors at any institution in the world. Any citizen who has access to a computer connected to the Internet can quite easily access holdings of libraries around the world, publications lists at

university research centers, academic articles as well as 'how to' fact sheets outlining how to prepare for and respond to hurricanes (and other disaster agents), and explanations on how hurricanes form—complete with pictures, sound, and video vignettes. Disaster victims have the potential to directly access their national emergency response organisations to complete on-line applications for assistance e.g. in the USA citizens can access the FEMA web site.

What new technologies?

The information technologies to be currently addressed include CD-ROM, email, web sites and distance learning through web-based university courses. Each of these provide options for enhancing mitigation, planning, response through the use of cyberspace. Each of these technologies also has its limitations. We will first review each of these technologies, and then we will examine illustrative applications for mitigation, planning and response. Finally, we will consider several issues, which one may be wise to keep in mind when pursuing the use of cyberspace to fill to information dissemination void previously noted.

CD-ROM

The CD-ROM was introduced in 1981, primarily to store high-quality, digitised music (Goldberg 1996). Two companies gave birth to the CD, Sony and Philips (Fischer 1998a). Both saw much greater use for the product. Even without compression a CD can hold up to 650 megabytes of digital data of any kind. CD-ROM drives are now in widespread use among computer users. Libraries could store the equivalent of 250,000 pages of text on a single disc. Companies could store records for an entire year on one disc. A disc for CD-ROM use can be duplicated, depending on volume, for less than a dollar. CD-ROM is also easy to distribute via bookstores, record stores, software stores, mail-order houses, and so forth. And, CD-ROM already has a large user base—over 17 million (for example see Goldberg 1996), and growing rapidly. Desktop, as well as laptop,

computers now being sold usually contain a CD-ROM drive. This feature ensures a sizeable target audience for CD-ROM content. Multimedia materials on CD-ROM continue to flow into the marketplace at an exponential rate. *Encarta* (1997) serves as one early example of how not only text, but also pictures and video can be interactively accessed through the use of CD-ROM.

Email

Electronic mail, for those who are not familiar with it, is a means by which individuals can communicate with one another by electronically mailing text through cyberspace. Their personal communication is stored in the host computer. Through using email software one individual can correspond with another anywhere on the net. Email addresses are proliferating daily as the rush to connect continues. Connectivity for email is currently most often achieved through desk or laptop computers, modems and telephone access to a commercial service or through one's place of employment. Email is currently most used for personal and business correspondence.

Web sites

We are only a few steps down a road that promises to lead to readily accessible information and real time communication (Gates 1995). Hundreds, perhaps thousands, of new home pages appear on the World Wide Web daily (Kidder and Harris 1997). This medium is currently proliferated by businesses with an entrepreneurial orientation, government and service agencies, and universities. For those not yet familiar with the web, it is a network of computers with the ability to communicate through the use of software such as 'search engines' or 'browsers'. Information files are stored on host computers. The browsers are used to locate specific cyberspace addresses or to search for all locations with a similar name. The websites are the stored files in the various linked computers, which contain the information accessible through the browsers.

Distance learning through web courses

'Distance learning' simply refers to the concept that the instructor is in one location while the students are in another—and each student may be in a different location from one another. It is presently often characterised as that which occurs through satellite linkage rather than connectivity through cyberspace. The instructor or trainer is viewed

by trainees at diverse geographical locations throughout a nation or around the world via televised, often closed circuit, broadcasts. With continued proliferation of the new technologies, we will undoubtedly find more learning, training, and conferencing conducted by these means. When the technology is more universally adopted, then resources (time and travel funds) may be saved when the principals do not have to physically relocate in order to meet for instruction.

Distance learning can also be characterised as instruction occurring via connectivity through cyberspace. In this instance the trainee is able to access web sites, digitised video and audio presentations, instructional chat rooms, and communicate via email or digitised video and audio. In the future such distance learning will use the CD-ROM, Web sites, and digitised video far more than it does as of this writing. Early uses of these technologies include the medical practitioner who, while at a location distant from his patient, is interactively providing diagnostic information during real time. *Increasingly courses are being developed which students or trainees enrol for and complete through cyberspace.* These Web courses (e.g. Fischer 1998b) provide the opportunity for the student to proceed at his or her own pace, to enter the cyberspace classroom at the time and day of his or her choosing, and to increase his or her active participation in the course and with the instructor. Web courses are beginning to include the following in their cyberspace classroom: text material, lecture notes, video vignettes in which the instructor provides instructional snippets (video and audio), links to other materials and sites, links to tutorials, class chat rooms, on-line synchronous and asynchronous interaction with the instructor.

Examples of applications to enhance mitigation, planning and response

Multimedia CD-ROM, email, Internet web sites, and web courses all comprise a continually emerging array of the new information technologies which are being applied to education and emergency personnel training activities. Most applications to date have been in other fields of endeavour. Market driven, applications in the USA have been aimed at the primary and secondary education markets. How they are *currently* being applied to disaster research, training, and education and how they *may* be applied in the *future* will be addressed.

CD-ROM

Products currently available are those designed as classroom teaching aids. Multimedia products currently marketed employ CD-ROM technology to provide users with encyclopedic information including text, pictures, audio, and video vignettes. *Encarta* enables the user to access the topic of his or her choice for a multimedia learning experience e.g. how a hurricane forms. The Federal Emergency Management Agency (FEMA) has produced, under contract with Sytel, Inc., field training course materials on CD-ROM which herald the entry of FEMA into the usage of this technology pursuant to enhancing disaster mitigation, planning, response and recovery. There is a paucity of multimedia materials suitable for disaster training or planning purposes are, as of this writing. There is definitely a market vacuum waiting to be filled. If we look into our crystal ball, one can envision state-of-the-art training materials being produced by well-trained, highly skilled teams of curriculum developers for use not only in traditional classrooms of current and future emergency management personnel, but also for use via cyberspace courses. Instructional materials could include dynamic, interactive approaches to disseminating information and providing training in areas such as principles of emergency management, building a disaster resistant community, a survey of natural disaster agents and hazardous materials. The use of such CD-ROM based materials may provide for greater student-centered learning which is highly engaging and interactive. This technology has the potential to move the trainee from passive receptacle to active learner. Since a tremendous amount of text-based, video, and audio information can be stored on such a disc, the potential for an emergency management workforce which is highly trained and very knowledgeable is great.

Email

An inexpensive, easy, and fast way of communicating between friends, acquaintances, and co-workers, email has proliferated to the point where hundreds, perhaps thousands of new users enter the information highway daily. Disaster researchers primarily use it to interact with one another as well as with practitioners and government agencies. Some emergency management professionals communicate with one another by email during normal time to exchange personal and professional information. They are also increasingly likely to communicate

with disaster researchers. This use of email helps to break down boundaries and hierarchies. One goal of the Natural Hazard Centre's (University of Colorado, Boulder) annual workshop is to facilitate practitioner-researcher interaction—cyberspace interaction eliminates the restrictions of time and place and facilitates ongoing communication throughout the year. Anecdotal information, however, suggests this form of practitioner-researcher (and researcher-practitioner) communication is in the early stages adoption. Its potential is far from being realised. In the future, researchers are likely to regularly invite practitioner input (through email) on research questions the practitioners would like answered. Conversely, practitioners are likely to use email to seek public policy advice from researchers. Email will likely be incorporated, far more than it is now, in the education and training of emergency management personnel (we will return to this theme later when we consider the use of web courses for educating and training emergency managers). Disaster chat rooms (addressing mitigation, planning, response, recovery issues) can be expected to be used more widely, not only for normal time education and training activities but also for consultation during disaster time periods. Direct email consultation during normal and emergency time periods, with one or several specialists, will likely become increasingly common (for additional examples please see Anderson 1995, Birkerts 1994, Botterell 1996, Butler 1994 & 1995, Gant 1996).

Web sites

A cursory survey of current disaster-related web sites in the academy, government agencies, emergency organisations and businesses suggests that we are in the very early stages of applying *this* technology as well. While variation is observed in the scope and detail found at such sites, they basically appear to have the same goals. Academic sites usually identify personnel, outline current research projects, provide on-line literature search capability, provide mission statements, offer publications lists, and link to other sites. Some also provide miscellaneous information including student opportunities at their research centers, career opportunities in emergency management, alumni accomplishments and so forth.

Disaster relevant government agencies and organisations tend to provide on-line assistance through email capability as well as on-line assistance application forms.

They also often supply mitigation, preparedness, response and recovery information. Some of this information is quite detailed and specific. For example, information can be found on how to prepare one's home for a hurricane or flood. Specifics are even provided down to the level of addressing plumbing needs, complete with a diagram to help the homeowner. Virtually all sites have been created by international or national emergency organisations. Several states have developed such an opportunity. The opportunity also exists for local emergency management organisations to do the same—tailoring the provided information to the needs of their community.

A plethora of increasingly sophisticated Web sites will undoubtedly emerge in the future which will incorporate the use of multimedia materials and email (including chat rooms) in the dissemination of basic knowledge about disaster agents, mitigation needs as well as response and recovery procedures. Linkage with other sites will undoubtedly increase dramatically resulting in an intricate network of educational and training materials produced by the *best* among us for ready access by *any* of us. The ability to build a disaster resistant community should be enhanced in the process.

Web-based university courses

Distance learning is currently characterised primarily by teleconferencing or satellite connectivity. Future distance learning will encompass much more. Web courses are being designed that will enable emergency management personnel to complete courses, or other types of training, without the necessity of attending class during a certain time period each week for a semester. Web courses will instead provide the opportunity for one to complete the educational experience through cyberspace. The web student is able to access the curriculum materials at his or her leisure, anytime of any day, progress at his or her own rate, and is actively involved in the learning process—not a passive vessel into which information is poured.

Once enrolled, the cyber-student is able to access the secured web course site. What is found there? The cyber-student is welcomed and usually finds a detailed course syllabus. The learning objectives and agenda for each cyber-class are normally encountered next. The required text materials may be found in some combination on-line, in hard copy, via CD-ROM, or through links with other

sites. Sometimes tutorials are also available as well as instructional video and audio digitised vignettes. Interactive, computer corrected quizzes provide rapid feedback. Course chat rooms are often available to provide a cyber-classroom for students to interact with others also in the cyber-course. On-line office hours are posted by the professor enabling the student to interact with their course instructor.

One illustration of this cyberspace approach is the Emergency Management Certificate Program currently under development at various universities. For example, Millersville University of Pennsylvania (USA) is currently pursuing the possibility of developing five multi-disciplinary web-based courses: Sociology of Disaster, Natural Hazards, Hazardous Materials, Issues in Geographic Planning, and Principles of Emergency Management. University credit would be earned as the cyber-student completes each course. An Emergency Management Certificate would be awarded upon completion of the five-course program. Both the university credits and the certificate would be useful to emergency managers in the USA when making application for Certified Emergency Manager status (obtained through application to the International Association of Emergency Managers). Cyberspace holds the potential for facilitating the dispersion of the accumulated knowledge base to all those who access such programs from anywhere in the world.

The new information technologies have the potential to assist emergency management in any number of ways. For example, emergency time consultation could be provided by appropriate university or government personnel as well as those who offer themselves as consultants. Such individuals can be listed and accessed through web sites, rendering them accessible 24-hours-a-day through email, fax, page, or telephone. A rumour control web site and a community advisor could participate in an emergency time chat room for and or respond to email. In addition, information could be provided through cyberspace which provides an all-hazards check list of what the emerging EOC should consider during pre-impact, impact, post-impact periods. *Encarta*-style information sites could be provided which take advantage of multimedia options including pictures, video, animation and sound. 'Students' of any age, grade, or location could access such via search engines whether it be for emergency time

use, normal time education or personal growth.

Limitations: a few issues to consider

While the information revolution appears to offer a means to redressing earlier limitations in disseminating disaster mitigation, planning and response information, there are problems inherent to the process. Quarantelli (1997: 96–104) has insightfully identified ten issues, which may be problematic with the advent of these new technologies:

- the probability that the 'rich will become richer' in dealing with disasters;
- the possibility that technology that is a 'means' will be turned into an 'end' in itself;
- the inevitable information overload problem;
- the loss of, or outdated, information;
- the greater likelihood of the diffusion of inappropriate disaster relevant information;
- the implications of even further diminution of non-verbal communication;
- intra- and inter-level group communication will be made even more difficult;
- the negative consequences of the probable acceleration of fads and fashions associated with computers;
- the kinds of general social infrastructures and cultures necessary for the adequate functioning of disaster-relevant technology;
- the certainty of computer system-related disasters.

Will the poor be further disadvantaged?

While the price of computer hardware and software continues a downward trend, the ability to obtain the latest in the new technology is heavily skewed toward those who have the financial resources to make the continual race toward the cutting edge. Those who comprise the lower socio-economic levels within wealthy nations as well as perhaps the majority of citizens in poorer nations are likely to find themselves falling farther and farther behind in the information based global economy i.e. the rich become richer syndrome. The probable outcome of such a scenario is the further solidifying of current world order, rather than the attainment of levelled hierarchies and a greater sharing of resources.

Will technology be an 'end' rather than a 'mean'?

How many of us have experienced some version of the following? Our office computer becomes increasingly over-

burdened with ever greater volumes of increasingly sophisticated software . . . so much so the memory size must be increased. The cycle continues and the machine must be replaced. If we think about it, most of the software is not even used and most of that which is used has so many functions that are never really used—only to upgrade with greater capacity for non-use. The point? Some of us need massive computer capacity while others need much less. Is having an ever-increasing capability the means to greater productivity or an end in itself—an end pursued primarily to enhance prestige? If so, the process does not help alleviate the problem of the rich getting richer.

What about information overload?

With the help of any Internet search engine, a practitioner or researcher can gain access to a fair amount of information on, for example, disaster mitigation. In fact, if we conduct such a search today the result may be 45,000 hits! Even if all the located items proved valuable to the searcher—a big if, that is just too much information to digest. Perhaps the Internet is so effective at locating every possible related item on the net that the information consumer actually becomes *less* efficient as a result. The situation is not likely to get better any time soon as every day brings another explosion of more and more web sites.

Some information will quickly become outdated, others lost

While journal articles and academic books take on a life of their own after publication by remaining on microfilm and in the library stacks for years to come, the information consumer is easily able to determine which these items is outdated. The efficacy of the information available on the Internet is not as readily discernible. Furthermore, anecdotal evidence suggests that many web sites appear only to quickly become obsolete when the site webmaster fails to update the site in a timely manner. Alternately, sites often disappear from the web resulting in the loss of a valuable resource.

The problem of diffusing inappropriate information

Not all web sources are created equally. The inherent advantage of democratisation provided by the Internet through the levelling of hierarchies also creates at least one unintended consequence. Those who are truly expert may appear equal to those who have no background in the field. An information consumer unfamiliar with the literature would have

no way of distilling one from the other. The outcome? Information may be incorporated into public policy, which leads to ineffective or inappropriate disaster mitigation or response activities. One purpose of bureaucratic hierarchy is provide checks and balances. While the Internet provides the user with quick access to greater volumes of information, a greater burden is placed upon the consumer of such information.

The limitations of non-verbal communication

Instant, worldwide communication via email and web site access contributes to a more rapid dissemination of needed information. Anecdotal information again suggests email interaction often results in *miscommunication*. When the non-verbal communication clues are lacking, it is more difficult to ascertain the intended meaning. A friendly joke can more easily be misconstrued as sarcasm resulting in a damaged relationship. Some find it easier to be informal and speak more freely via email. Sometimes it would be better to let such thoughts go unsaid.

Group communications

The problematic aspects of the diminution of non-verbal communication observed between individuals can only be further exacerbated when we multiply their impact in intra- and inter-group communication. The potential is great for an acceleration of misinformation, miscuing, and misinterpretation.

Fads and fashions

Those of us who author textbooks which encompass a particular version of software, (e.g. Fischer 1996) soon discover *at least* one new version of the software has been released by the time the book is published. Since most textbook publishers would like a three-year run, imagine how far behind such a text becomes by that third year. Computer hardware and software fads move very quickly and are sometimes humorous to observe. The laptop is a wonderful way to write and communicate when away from the home office. It can be humorous to observe all the 'techno geeks' in airports, hotel lobbies and beaches checking into the home office. Is productivity enhanced? Often. Is this a fad that brings some of the earlier mentioned electronic prestige? Probably. The use of Power Point in presentations is another example. An emerging pattern is discernible. The computer trendsetter in the organisation makes a Power Point presentation. What happens? Two things: underlings emulate, and the product is

over used sometimes complicating the communication process that it was intended to enhance. For example, some essentially abuse the audio options involving the bells and whistles.

Computer system failure as a new disaster

Our increased dependence upon computer technology in our individual, group, societal, and global lives sets the stage for a potential new form of disaster: that which may occur with a massive computer system failure. Akin to the blackouts experienced in several urban areas in the United States in recent decades, a massive computer system failure could result in a loss of information on such a scale that serious economic disruptions may result. What mitigation strategies should we employ? How should we prepare to respond to and recover from such an event? To what extent has an infrastructure been developed to address this eventuality?

Social infrastructure and culture

Sociologically speaking, it is the social structure and culture of a group that guide's behaviour and helps meet human needs. If we apply the sociological perspective to the information highway what do we observe? Throughout human history, technological advances have often out-paced human ability to socially absorb and effectively incorporate new technologies. The problematic aspects of the new information technologies discussed above are arguably the direct result of these technologies outpacing our development of the emerging social structure and culture needed to guide us. We will develop an infrastructure and a guiding culture. The question at this juncture is to what extent will they be dysfunctional, rather than functional, in our individual, societal, and global needs? Quarantelli (1997) admonishes us to proceed with care. In his view 'if we do a good job, the actual future will be different from the [problematic] future'. Current and future uses of the new information technologies may provide great assistance in addressing the information-sharing void, they will not, however, be the panacea that some envision.

Concluding comments

The new information technologies will, no doubt, be *more* effectively used in the future. The current generation of web sites only hint at their potential. For example, emergency time consultation could be provided by appropriate university or government personnel as well as those who

hire themselves out as consultants. Web sites could list such individuals, along with their email addresses and telephone numbers at which they could be paged 24-hours-a-day. In addition, information could be provided in cyberspace which provides an all-hazards check list of what the emerging EOC should consider during pre-impact, impact, post-impact periods. *Encarta* style information sites could be provided which take advantage of multimedia options including pictures, video, animation and sound. 'Students' of any age, grade, or location could access such via search engines whether it be for emergency time information or normal time education or personal growth—which at the very least has, once again, the potential for contributing to the knowledge base of the larger community and the expected resulting benefits for mitigation, planning and response.

While all of these ideas, both those currently employed as well as those in our future, may actually contribute to information overload, one of Quarantelli's concerns, strategies such as email mentoring will help to educate many as to appropriate sources to turn to for such information. The danger will, of course, be that inaccurate and outdated information will, as Quarantelli fears, exist on the net. Of course, these problems have already existed before the advent of these new technologies, though their dissemination was usually not as readily widespread. Our new technologies will still be used by humans—with all their limitations. These problems will continue even in cyberspace (on a brighter note, at least for academics, the continuation, even exacerbation of such problems further justifies the need for those in the academy).

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Disaster Events Calendar

12-16 February 2001
Auckland, New Zealand

Cities on Volcanoes 2

Organisers: Institute of Geological and Nuclear Sciences, Auckland Regional Council, Massey University, University of Auckland, and the International Association of Volcanology and Chemistry of the Earth's Interior.

Contact:

Secretary, Cities on Volcanoes 2
Wairakei Research Centre
Private Bag 2000
Aupo, New Zealand
fax: 64 7 374 8199
email: citiesonvolc2@gns.cri.nz
www.gns.cri.nz/news/conferences/cities.html.

14-18 February 2000
Mount Macedon, Victoria, Australia

Dambreak Emergency Planning Workshop

Preliminary announcement

The Emergency Management National Studies Program has accepted a proposal by ANCOLD to hold a Dambreak emergency planning workshop at the Australian Emergency Management Institute at Mount Macedon in Victoria in February 2000. The workshop will follow on from an earlier session in 1993 ('Beyond the Spillway'), with the aim of providing generic national guidelines for emergency response by dam owners and emergency management agencies for extreme floods downstream of dams, including dam failure scenarios.

Contact:

David Stewart, ph: 61 (03) 5833 5410
Norm Himsley, ph: 61 (02) 9895 7349

February 21-25 2000
Istanbul, Turkey

Third Japan-Turkey Workshop on Earthquake Engineering

Contact:

M. Hasan Boduroglu
Third Japan-Turkey Workshop on Earthquake Engineering
Istanbul Technical University
Faculty of Civil Engineering
Maslak 80626, Istanbul, Turkey
ph: +90 212 285 3797
fax: +90 212 285 6587
email: bodurogl@itu.edu.tr

March 11-17 2000
Melbourne, Australia

World Water Congress 2000

Sponsors: International Water Resources Association (IWRA) and others.

Contact:

IWRA, 4535 Faner Hall, MC 4516
Southern Illinois University
Carbondale, IL 62901-4516; or
Secretariat, World Water Conference
c/- ICMS Pty Ltd
84 Queensbridge Street
Southbank, Victoria 3006, Australia

ph: 61 3 9682 0244
fax: 61 3 9682 0288
email: worldwater@icms.com.au
www.icms.com.au/worldwater

16-19 March 2000
Melbourne, Victoria, Australia

Third World Conference for the International Society for Traumatic Stress Studies: The long-Term Outcomes of Trauma in Individuals and Society.

Contact:

Dr Di Clifton, Scientific Program Coordinator
121 Fortescue Ave
Seaford VIC 3198 Australia
email: dclifton@silas.cc.monash.edu.au
ph (work): 61 3 9550 1479, fax: 61 3 95501499
ph/fax (home): 61 3 9786 1918
Conference Organiser
PO Box 214
Brunswick East, 3057, VIC Australia.
email: conorg@ozemail.com.au
ph: 61 3 9380 1429
fax: 61 3 9380 2722

The themes of this conference will include, amongst others, understanding the context of trauma, how people heal with and without therapy, factors that increase or lessen the risk of adverse outcome, and the relationship of basic Research to clinical practice. The conference also aims to look at the longer-term outcomes of traumatic stress in individuals across generations and in society, as many of the longitudinal studies undertaken in the flourishing period of research of the last two decades are coming into maturity.

25-28 April 2000
Boston, Massachusetts, USA

11th Global Warming International Conference and Expo (GW11): Kyoto Compliance Review—Year 2000 Conference

Sponsors: Global Warming International Program Committee and Global Warming International Center.

Contact:

Professor Sinyan Shen
GWIC-USA
22W381-75th Street
Naperville, IL 60565, USA
ph: (630) 910-1551
fax: (630) 910-1561
email: syshen@megsinet.net
http://GlobalWarming.Net

29 April-3 May 2000
Las Vegas, Nevada, USA

2000 National Disaster Medical System Conference

Sponsors: U.S. Department of Health and Human Services, Department of Defense, Department of Veterans Affairs, and Federal Emergency Management Agency:
NDMS, 12300 Twinbrook Parkway, Suite 360,
Rockville, MD 20875
ph: (301) 443-1167
fax: (301) 443-5146 or (800) 872-5945

email: ndms@usa.net
www.oep-ndms.dhhs.gov

The 2000 NDMS Conference will provide practical information on implementing inter-disciplinary strategies for preventing or reducing the health and medical consequences of disasters of any origin. The education will feature counter-terrorism programs, clinical updates, extreme environmental events, disaster team development, information management systems, mass gathering events, critical incident stress management, sheltering and congregate care, health systems, emergency planning, mass fatality operations, veterinary services in disasters and new standards in emergency management. The program will offer approximately 20 hours of continuing education credit for a wide range of health practitioners and administrators.

4-7 May 2000
Boston, Massachusetts

Eighth International Conference on Emergency Medicine: Emergency Medicine in the Third Millennium. Presented by: The International Federation of Emergency Medicine.

Contact:

American College of Emergency Physicians
P.O. Box 619911
Dallas, TX 75261-9911, USA
ph: 1-800-798-1822 or (972) 550-0911
fax: (972) 580-2816
email: edmeetings@acep.org
www.acep.org/meetings

May 7-10, 2000
Austin, Texas

2000 National Flood Conference

Presented by: Federal Emergency Management Agency/National Flood Insurance Program

Contact:

Becky Reardon
National Flood Insurance Program
Bureau and Statistical Agent
7700 Hubble Drive
Lanham, MD 20706, USA
fax: (301) 918-1471
email: becky.reardon@fema.gov
www.fema.gov/nfip/2000conf.htm

May 8-11, 2000
Baltimore, Maryland, USA

CPM 2000 - Contingency Planning and Management Annual Conference: 'Furthering Business Continuity in the New Millennium.'

Sponsor: Contingency Planning and Management Magazine

Contact:

CPM 2000
WPC Expositions
84 Park Avenue
Flemington, NJ 08822, USA
ph: (908) 788-0343, ext. 135
fax: (908) 788-9381
email: CPM2000@witterpublishing.com
www.contingencyplanexpo.com

