ffects and vulnerability mapping

n vulnerability maps, those aspects of the community (and often of the envi-ınment) that are vulnerable or at risk are overlaid with hazard information. This lows an estimate of the degree of harm or loss that may occur. The simplest way) produce such a map is to use a transparent, removable overlay on a base map. ven if a preparedness programme lacks the time and financial resources for ılnerability maps, the concept of mapping can still be used as an analogy. In etermining the likely effects of hazards it is worth considering how the commu-ity is spatially related to the hazard.

: is equally possible to map the vulnerable aspects of the environment. This can e useful in the following areas:

Fire. Which areas contain forest resources that might be destroyed? Are there fauna and flora that would be severely affected?
Hazardous materials. Are there fishing areas downstream of industrial outfalls that might be affected by acute spills? Are there breeding grounds for waterfowl or fish downstream?
Oil pollution. Are there fauna and flora likely to be affected by oil spills or by the use of oil dispersants? Are there areas that are used for recreation and tourism that may be affected adversely?

Geographical information systems

Geographical information systems (GIS) will be widely used in the future for ıazard and vulnerability mapping. They are computer programs that combine ı relational database with spatial interpretation and output. A more technical lefinition is "A system for capturing, storing, checking, integrating, analyzing ınd displaying data about the Earth that is spatially referenced. It is normally :aken to include a spatially referenced database and appropriate applications ;oftware " (*11*).

It is possible to enter a variety of types of data, and relate them through formulae, or overlap them in a graphic presentation, either on screen or as a printed map Use of GIS is increasing for the everyday administration of communities, and existing systems and information can be used for emergency management purposes GIS allow the rapid analysis of large quantities of related data and can also be used as a predictive tool. When applied to hazard and vulnerability information, GIS can be employed for all aspects of emergency management.

An example of the use of GIS in preparedness and response is in the recording and analysis of data on large stores of hazardous materials. Government organizations often collect data on these stores for the purposes of licensing and public safety. If the data are entered into a GIS, the following information can rapidly be displayed in graphic form:

— locations of the largest stores;
— distances to the nearest fire station;
— who owns a particular storage area and their after-hours contact details;
— what material is stored, where on the site, etc.

GIS can be combined with a gas- or smoke-modelling program to determine the possible concentrations of gas, fumes, or smoke following an accidental release of hazardous material or a fire. The shortest routes from a given fire station to a given store can be calculated and possible evacuation routes plotted. This information can be used both for emergency planning in relation to the storage of hazardous materials and in the response to accidents involving hazardous materials.

Hazard prioritization

Why prioritize hazards?

In any community, resources for the management of hazards, vulnerability, and emergencies are limited. With the best of intentions, the constraints of time and money preclude protecting people, property, and the environment from every hazard. Therefore, it is crucial to decide which hazards should be dealt with most urgently and which should be dealt with later or not at all.

How to prioritize hazards

Determining which hazards to target for management is called "hazard prioritization", or "hazard ranking". There are a number of ways to prioritize hazards, two of which are discussed in the following paragraphs.

The key to prioritizing hazards is community involvement. As in the other steps of vulnerability assessment, consultative and participative processes are necessary. The commitment of those required to take action and those who may be affected by hazards is essential. Without it, the best emergency management strategies, based on the best of vulnerability assessments, may fail. Hence, the first step is to involve the relevant people.

Another reason for using consultative and participative processes in hazard prioritization is that the choices that need to be made to reduce the likely effects of hazards are political decisions. Some hazard mitigation and response strategies will only protect some people and others may not address the needs of the most vulnerable. The decisions as to who and what should be protected, and to what degree, should be made by the whole community.

The second step is to determine which criteria to use to rank the hazards. Criteria may include factors such as the probability of an emergency, the level of vulnerability of people or property or both, the degree of manageability, and whether the hazard may worsen and how quickly. There are a number of methods that use such criteria, including the FEMA (the United States Federal Emergency Management Agency) model and the SMUG ("seriousness", "manageability", "urgency", and "growth" — developed by the Tasmania State Emergency Service) hazard priority system, which are described below.

A simpler method has already been described in the section on hazard identification — the group technique for identifying hazards. Using this technique and a few simple criteria such as "risk" (the likelihood of a given level of harm), "manageability" (whether anything can be done about this hazard), and

"vulnerability" (how damaging is the potential harm caused by this hazard), it is possible to rank community hazards. Community vulnerabilities can also be ranked in this way.

In prioritizing hazards there is no "right" answer, and there will be a number of hazards that are considered to be more serious than others. It may also be difficult to equate or compare different hazard analysis results. This is to be expected, since different hazards may have very different effects, and it is not always possible to compare hazards precisely. In short, resources should be committed to hazards that the community considers to be most serious, using whatever criteria of "seriousness" they deem correct. Hazard prioritization should be used as a guide to decision-making and modified to suit the requirements of particular communities.

The FEMA model

The FEMA model uses four criteria in an evaluation and scoring system — history, vulnerability, maximum threat, and probability (*12*):

- *History.* If a certain type of emergency has occurred in the past, it is known that there were sufficient hazardous conditions and vulnerability to cause the event. Unless these conditions no longer exist, or have been substantially reduced, a similar emergency may occur again. Lack of a past occurrence, however, does not mean that there is no future emergency potential.
- *Vulnerability.* This attempts to determine the number of people and the value of property that may be vulnerable, based on such factors as vulnerable groups (aged, disabled, and children); population densities; location of population groups; location and value of property; and location of vital facilities, e.g. hospitals. Overlaying hazard maps on a map of the community assists in this process.
- *Maximum threat.* This is essentially the worst case scenario; that is, it assumes the most serious event possible and the greatest impact. It is expressed in terms of human casualties and property loss. Secondary events (such as dam failure following an earthquake) also need to be considered.
- *Probability.* Probability is the likelihood of an event occurring, expressed in terms of chances per year that an event of a specific intensity (or greater) will occur. There is some link between probability and history; however, since some hazards are without historical precedent, an analysis of both history and probability is necessary.

An evaluation of low, medium, or high is made for each criterion shown in Table 15.

For each evaluation, score the following:

Low	1 point
Medium	5 points
High	10 points

Some criteria have been determined as more important than others, and the following weightings have been established:

History	×2
Vulnerability	×5
Maximum threat	×10
Probability	×7

A composite score for each hazard is arrived at by multiplying the score by the weighting, then adding the four results. Table 16 gives an example:

The FEMA model suggests a threshold of 100 points. All hazards that total more than 100 points may receive higher priority in emergency preparedness. Hazards totalling less than 100 points, while receiving a lower priority, should still be considered.

This process should be repeated for all identified hazards and for a range of scenarios with the same hazard.

Table 15. **The FEMA evaluation and scoring system**[a]

Criteria		*Evaluation*
History: whether an emergency event has occurred:	<2 times in 100 years	Low
	2–3 times in 100 years	Medium
	>3 times in 100 years	High
Vulnerability: of people	1%	Low
	1–10%	Medium
	>10%	High
of property	1%	Low
	1–10%	Medium
	>10%	High
Maximum threat: area of the community affected	5%	Low
	5–25%	Medium
	>25%	High
Probability: chances per year of an emergency	<1 in 1 000	Low
	1 in 1 000–1 in 10	Medium
	>1 in 10	High

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Table 16. **Sample use of the FEMA evaluation and scoring system**

Criteria	*Evaluation*	*Score × weighting*	*Total*
History	High	10 × 2	20
Vulnerability	Medium	5 × 5	25
Maximum threat	High	10 × 10	100
Probability	Medium	5 × 7	35
Total			*180*

SMUG hazard priority system

The SMUG hazard priority system allows a direct comparison of a number of possible hazards, through ratings of high, medium, or low, against four separate criteria common to all hazards (*12*):

- *Seriousness.* The relative impact of a hazard, in terms of financial cost or number of people affected or both. If a hazard represents a threat to the greatest number of people or would cost the most (or both), that hazard is given a "high" rating. All identified hazards are rated as "high", "medium", or "low", in terms of seriousness If the group cannot agree, the highest rating should be given.
- *Manageability.* "Can anything be done about the hazard?". If the impact of the hazard can be lessened, the rating for manageability would be "high". If it were manageable only after it had occurred, the rating would be "low".
- *Urgency.* "High" means that something should be done now, "medium" means something should be done in the near future, and "low" means there is no urgency and action can be deferred.
- *Growth.* If nothing is done about the hazard, will it grow worse or remain as it is? If the hazard would increase quickly, it is rated "high", if it would grow gradually, "medium", and if it would stay static, "low".

Once a relative rating has been allocated to all identified hazards according to these criteria, the list of hazards should be reviewed. Those with the most "high" ratings are the ones that warrant priority attention. It is very important to provide clear evidence to support the ratings. Table 17, for example, would be useful for recording decisions.

Example of use of prioritization techniques

There is a basic difference between the FEMA and SMUG hazard priority systems. In the FEMA model, each hazard is rated individually, using a number of quantitative criteria such as history and probability, and individually given a numerical score, based on the value of each of those criteria. The SMUG system, on the other hand, compares hazards directly using a number of criteria, in a stepwise fashion, and is qualitative.

Table 17. **The SMUG hazard priority system**[a]

Hazard	*Criteria*			
	Seriousness	*Manageability*	*Urgency*	*Growth*
Hazard A	H/M/L	H/M/L	H/M/L	H/M/L
Hazard B	H/M/L	H/M/L	H/M/L	H/M/L
Hazard C	H/M/L	H/M/L	H/M/L	H/M/L

[a] Reproduced from reference *12* by permission of the publisher, Emergency Management Australia (formerly Natural Disasters Organisation).

The FEMA model, because it judges each hazard individually in a numerical manner, may provide more satisfying results than the SMUG system if there are sound numerical data on the hazards in question. The SMUG system, on the other hand, allows close comparison of each hazard with the others on the basis of the given criteria and therefore allows a closer examination of the differences between hazards in a more holistic sense.

In the following example of prioritization, the possible effects of hazards that exist in and near a fictitious country town are summarized.

Example

The town is situated near a river and bordered on one side by a forest. It has a population of approximately 1200 people, evenly spread throughout the town. Most families have vehicles, there are no care homes for the elderly, and there is one school. The townspeople all speak the same language, have a similar cultural and ethnic background, and consider themselves self-sufficient in most respects. The town's economy is based on providing services to the surrounding rural community and there also a few light industries. There is a strong in the town, and there are a number of ac groups. The town is the seat of local government for the area but the services the local government provides mostly relate to road maintenance, garbage collection, and sewage disposal. The local government has not developed any emergency management strategies.

The river floods regularly, and major flooding has occurred about once every 40 years for the past century. Alterations to the environment upstream suggest that flooding may be more extreme in the future. Major floods have the potential to destroy the sewage treatment plant and contaminate water supplies, incapacitate all telephone and electricity services, destroy most bridges in the area, and cover many roads, forcing the evacuation of about 15% of all homes and disrupting half the town's light industries. It is not thought likely that many residents would be killed by floods while in their homes or during evacuation, but it is possible that some may be killed using flooded roads. A major flood has not occurred for many years and most residents do not perceive flood as a serious hazard.

The forest adjacent to the town is fairly dense and subject to selective logging. There have been frequent forest fires, some of which have threatened houses on the forest side of the town. The vegetation in the fields surrounding the town is generally kept low by grazing animals, but there are periods in summer following heavy rains when there is considerable growth of grass, which then dries. There is an active fire service in the town, but it is called only infrequently to fires. Telephone and electricity services may be disrupted by a severe fire and about 5% of houses may be burnt, but deaths and injuries are likely only among firefighters and during evacuation in the event of a serious fire. Geologists believe the area to be potentially subject to earthquakes, with a 10% chance of exceeding modified Mercalli VII intensity in a given 50-year period. The area has experienced one severe earthquake in known history, but this occurred before the town's construc-

tion, when the first settlers had only just arrived. Half of the town is built on alluvial soils that may be prone to liquefaction. Most buildings are of medium-quality masonry and timber construction, so that there is not much likelihood of building destruction or of a large number of deaths. The greatest risk is the destruction of all electricity, telephone, water supply, and sewage services, partial destruction of most bridges and many roads, and long-term disruption to light industry. There is no local knowledge of any earthquake hazard.

The town is almost totally dependent on the economic success of the surrounding rural areas — the raising of livestock for domestic consumption, for live export, and for export as meat products. There is a rudimentary quarantine system in place for the entire country, but no planning for response to an outbreak of exotic disease among livestock. An uncontrolled outbreak of such a disease would lead to the quarantining of the entire country and an immediate end to all animal product exports. This would cause an almost immediate closure of most businesses in the town, resulting in widespread bankruptcy and unemployment. It is highly unlikely that the disease would be a direct cause of human deaths or injuries. Local farmers and veterinarians are aware of the possibility of exotic animal disease, but unaware of the possible implications of an uncontrolled outbreak.

Using the SMUG hazard priority system

How would the SMUG system prioritize the four hazards of flood, forest fire, earthquake, and exotic animal disease for this town, based on the information given in the example? Table 18 shows a possible prioritization.

To summarize the SMUG prioritization, the hazards should be ranked in the order shown in Table 19

Using the FEMA model

Using the FEMA model to prioritize the hazards described in the example produces the results summarized in Table 20.

To complete this FEMA prioritization, a number of assumptions have been made about the frequency and consequences of an event; in a real analysis these assumptions would have to be explicitly written down. According to the principles of the FEMA model, where a score in excess of 100 suggests that management of that hazard is required, the earthquake hazard would not be considered particularly serious compared with the other three.

Comparing FEMA and SMUG results

Table 21 compares the FEMA rating with the SMUG rating for the hazards described in the example.

The two prioritization systems may, in reality, provide different rankings because they use very different criteria, and some variation between their results would be

Table 18. **Sample use of SMUG hazard priority system**

Hazard	*Criteria*			
	Seriousness	***Manageability***	***Urgency***	***Growth***
Flood	May cause some deaths, will cause considerable inconvenience and property and services damage — H	Manageable in that future developments can be protected from flood damage and response plans can be developed — H	As major floods occur infrequently, may not be considered too urgent by some — M	This problem will become significantly worse if there is no control of development in the flood plain — M
Forest fire	May cause some deaths, some property and services damage — M	Hazard reduction and fire breaks may completely eliminate the threat — H	Moderately urgent, but will be more urgent during dry season — M	If hazard reduction measures are not undertaken this hazard may become worse — L
Earthquake	Will destroy services, therefore economic and social costs will be high — M	May not be cost-effective to mitigate effects by structural means; response and recovery plans would alleviate effects — L	Currently impossible to predict, but probably an infrequent occurrence; overall impact over the years is low — L	Will not become a greater problem if not addressed now — L
Exotic animal disease	Will cause extreme social and economic disruption, many effects may be irreversible — H	Can be managed with good quarantine procedures and effective response procedures — H	Because of serious consequences should be addressed as soon as possible — H	Will not become a greater problem if not addressed now — L

Table 19. Sample hazard rating

Hazard	*SMUG prioritization*
Flood	2
Forest fire	3
Earthquake	4
Exotic animal disease	1

Table 20. Sample use of the FEMA model

Criteria	*Flood*	*Forest fire*	*Earthquake*	*Exotic animal disease*
History	(medium) 5 × 2 = 10	(high) 10 × 2 = 20	(low) 1 × 2 = 2	(low) 1 × 2 = 2
Vulnerability	(high) 10 × 5 = 50	(medium) 5 × 5 = 25	(medium) 5 × 5 = 25	(high) 10 × 5 = 50
Maximum threat	(medium) 5 × 10 = 50	(low) 1 × 10 = 10	(medium) 5 × 10 = 50	(high) 10 × 10 = 100
Probability	(medium) 5 × 7 = 35	(high) 10 × 7 = 70	(low) 1 × 7 = 7	(medium) 5 × 7 = 35
Total	*145*	*125*	*84*	*187*

Table 21. Comparison of hazard ratings

Hazard	*SMUG prioritization*	*FEMA prioritization*
Flood	2	2
Forest fire	3	3
Earthquake	4	4
Exotic animal disease	1	1

expected. Experience has shown, however, that they tend to produce similar results.

It therefore seems that exotic animal disease is the greatest hazard for the town in the example, with flood coming second. Most of the hazards for this town are relatively minor since there is little expectation of loss of human life, but there are some significant economic implications

Recommending action

At the end of a vulnerability assessment there should be conclusions, recommendations, and a summary.

The conclusions are a logical extension of previous work and focus on work already performed. They are based on the information in the vulnerability assessment and should not introduce any new facts. Recommendations focus on the work that needs to be accomplished in emergency preparedness, response,

and recovery. The summary is a short synopsis of the entire work, containing the method, planning group composition, very brief conclusions, and a list of the recommendations.

There are three important questions that the planning group should consider when writing the conclusions and recommendations:

- To whom is the planning group to report the conclusions and recommendations of the vulnerability assessment?

  Reporting will normally be to the individual or organization that authorized the vulnerability assessment.

- How does the planning group gain support for the conclusions and recommendations?

  To gain the support of the authorizing individual or organization, a copy of the vulnerability assessment should be provided and a summary of the assessment should be given in an oral presentation.

- What form should the conclusions and recommendations take?

  The conclusions should be a series of short statements of fact and/or interpretations of information. Justification and supporting arguments for these conclusions should be contained in the body of the vulnerability assessment with cross-references to specific sections of the assessment if necessary. The recommendations for action that could or should be taken are based on the conclusions; they provide the link to the rest of the emergency preparedness process.

Summary

- Vulnerability assessment is a procedure for identifying hazards, describing community vulnerability, and determining the effects of potential emergencies on communities.
- Communities, hazards, and the environment interact with each other.
- A vulnerability assessment should be developed using a rational process.
- A planning group and community consultation are essential for the efficient development of an appropriate vulnerability assessment.
- Different people think of hazards, risk, and vulnerability in different ways, and this perception will affect their actions.
- A description of the effects of hazards and potential emergencies on communities must form the basis of emergency preparedness.

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Chapter 4

Emergency planning

Introduction

What is an emergency plan?

An emergency plan is an agreed set of arrangements for responding to and recovering from emergencies; it describes responsibilities, management structures, strategies, and resources.

Why develop plans?

People who do not believe planning is necessary argue that:

— everybody knows what to do;
— emergencies are unpredictable and impossible to plan for;
— people do not follow plans in emergencies;
— developing emergency plans will worry the public.

These arguments are considered in the following paragraphs.

Everybody knows what to do

In a well prepared community or organization, all those involved in emergency management may be aware of their role, but that role may not have been considered in the overall context of what needs to be done. It is possible that the roles of some people may conflict with those of others.

Have all the tasks required for effective, efficient, and appropriate emergency response and recovery strategies been allocated? Without emergency planning, it is probable that many fundamental and necessary responsibilities will not have been allocated, and this may be realized only during or after the emergency event. While people may know their own role, they may be unaware of the responsibilities of others with whom they must interact. Without emergency planning and appropriate training, it is unlikely that people will understand how they should work with others.

Have all the management functions been decided and the potential problems solved? Without emergency planning, confusion will arise over management arrangements during an emergency and this may result in minor crises.

How are people newly appointed to a job going to be informed of their emergency management role? A written plan is the best way to begin their education.

Emergencies are unpredictable and planning for them is impossible

It is precisely because emergencies are difficult to predict and the effects are uncertain that vulnerability assessments are performed and emergency plans developed.

> "The aim is to reduce uncertainty through anticipation of what the situation requires . . . planning is not a cure-all. All emergencies present in some measure unanticipated contingencies and difficulties. In those cases, action has to become innovative and emergent. However, planning will clearly improve any organized response effort by identifying what in all probability must be done, how it should be done, and what resources will be needed. In this manner, organized response can be made more highly predictable and efficient." (*1*)

People do not follow plans in emergencies

It is common for people not to refer to written emergency plans during the more critical moments of emergencies. However, if they have a basic understanding of the content and intent of a well prepared emergency plan, their actions are more likely to be appropriate. It is not just the written plan that is important — the planning process itself is important because it is a tool for problem-solving and education.

The development of emergency plans will unduly worry the public

The arousal of public anxiety is a common political objection to emergency planning. However, if there is a realistic threat to life and the environment, something must be done about it. The planning process is designed to achieve this end.

What can emergency plans do?

Emergency planning is about protecting life, property, and the environment. Evidence proves that planning increases this protection. Figure 18 illustrates one aspect of the value of emergency planning, that of effective warnings. The horizontal scale indicates the number of people at risk from a dam failure; the vertical scale indicates the number of actual deaths from recorded dam failures. The two curves on the graph represent the number of deaths due to dam failure for a given size of the population, with and without sufficient warning. The data for this graph come from actual events. The warnings were the result of emergency planning, and the graph clearly demonstrates that emergency planning reduces harm to people.

Fig. 18. **Deaths due to dam failure and extreme flood events — with and without warning systems***

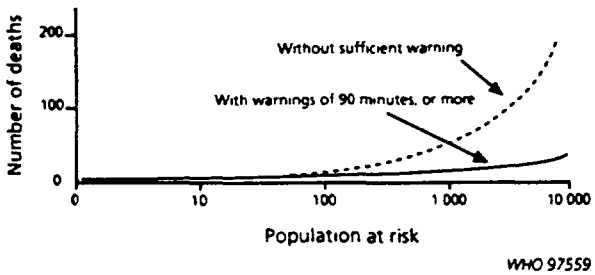

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Fig. 19. **Context of emergency plans for a community**

Context of emergency plans

Emergency plans do not operate in a vacuum — they are linked to the culture and perception of risk of those developing the plans and of those for whom the plans are developed. They must be developed to suit the context in which they will operate, which is one of the reasons that adapting an existing plan to a different area does not work. Quite apart from their application to general emergency management, community emergency plans should be considered in the context of other emergency plans — plans at other administrative levels, those that operate at the same level, and any plans developed for specific hazards or by other organizations (see Fig. 19).

Community, provincial, and national emergency plans are multisectoral. They include communications, search and rescue, police and security, health, social welfare, and transport and lifelines sectors, and coordinate the emergency work at each administrative level. Sectoral plans (sometimes called "functional plans") describe the management, resources, and strategies within one of these six sectors. Organization-specific plans are useful for members of a given organization, whether public or private, military, or nongovernmental. They describe in detail how that organization will fulfil its assigned roles and responsibilities. Hazard-specific plans may be developed for hazards such as flood, hazardous materials incidents, and epidemics.

Some principles of emergency planning

Emergency planning is based on certain principles (*1*) in order to facilitate decision-making. Planning:

— is a continuous process;
— attempts to reduce the unknowns in an emergency;
— aims to evoke appropriate actions;
— should be based on what is likely to happen;
— must be based on knowledge;
— should focus on principles;

— is partly an educational activity;
— always has to overcome resistance;
— should be simple enough to avoid confusion;
— should be flexible enough to adapt to any situation;
— can only define the starting point for response and recovery operations;
— should allow for the development of emergent strategies.

The prerequisites for planning are:

— recognition that hazards and vulnerability exist and that emergencies can occur;
— awareness among the community, government, and decision-makers of the need to plan and of the benefits of planning;
— appropriate legislation to guarantee implementation of the plan;
— a designated organization responsible for coordinating both planning and response and recovery in the event of an emergency.

The planning process will produce:

— an understanding of organizational roles in response and recovery;
— a strengthening of emergency management networks;
— improved community awareness and participation;
— effective response and recovery strategies and systems;
— a simple and flexible written plan.

The written plan itself is only one outcome of the planning process. Emergency planning does not require the creation of a new emergency management organization; it should make use of the abilities and resources of existing organizations.

An emergency planning process

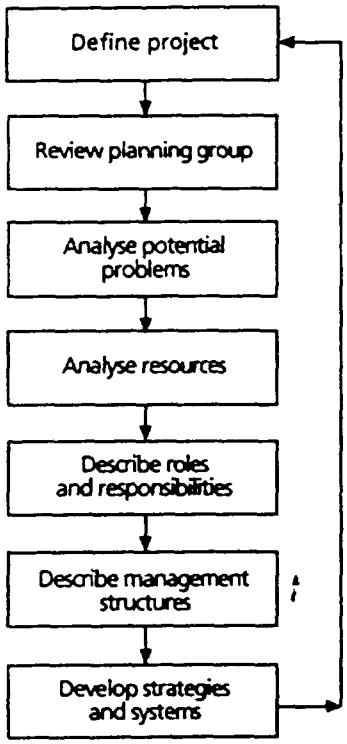
The *process* of emergency planning is of major importance: if this process is not rational and appropriate, it is unlikely that the plans produced will be of value.

The planning process described here is a series of rational steps for producing an emergency plan; each of these steps involves standard management methods. This process can be applied to any community, organization, or activity, e.g. the health sector in general, hospitals, and search and rescue organizations. It is intended primarily for preparedness, but can be used equally well for planning during response and recovery operations.

Each step of the planning process is defined briefly here (see Fig. 20), and discussed in greater detail later in the chapter. These steps must be documented, and the written emergency plan will consist of the results of each step.

- *Project definition* determines the aim, objectives, scope, and context of an emergency plan, describes the tasks required and the resources needed to perform these tasks (see Chapter 1 and Annex 1). Recommendations based on the vulnerability assessment should be used in the planning process.
- A representative *planning group* is essential for emergency planning. Without such a group it will be difficult to gather the required information and

Fig. 20. **An emergency planning process**



gain the commitment of key people and organizations. There may be a need to review any existing planning group to assess its appropriateness. The composition of the planning group may change during the planning process.

- *Analysis of potential problems* examines in more detail the hazards and vulnerabilities, their causes, possible preventive strategies, response and recovery strategies, and trigger events for these strategies. It will provide information for later steps of the process.
- The *resource analysis* asks what resources are required, what is available, what is the variation between requirement and availability, and who is responsible.
- A description of *roles and responsibilities* outlines who does what.
- The *management structure* involves the command of individual organizations and control across organizations.
- Development of *strategies and systems* is concerned with response and recovery strategies and the systems that will support them.

Some planning groups may choose to alter the sequence of these steps, perhaps analysing resources before potential problems, or describing the management structure before describing roles and responsibilities.

Planning group review

A planning group is essential to developing appropriate emergency plans.

> "Well-prepared (emergency) plans specify what will be done, where, when, and by whom, to meet the specific demands of emergency conditions. Such plans can be developed only by representatives of operating departments and non-government groups with emergency missions. Paper plans prepared by the emergency program manager working alone, with little participation by operating departments, are of little value. In an actual emergency they will not be used. The development of a written plan, therefore, is not an end in itself. A written emergency plan does not guarantee that actual operations will be effective. But the process of planning that leads to the development of a written plan is extremely valuable. This is because the officials who are responsible for emergency operations have spent time determining which official will do what and how operations will be coordinated." (*3*)

Some criteria for selecting members of a planning group follow. These people should be:

- aware of the emergency management roles of their organization;
- actively involved in preparedness, responses, or recovery;
- of sufficient seniority to commit their organization to planning group decisions;
- capable of contributing to the planning group's work.

These criteria represent desirable attributes, but it is unlikely that every planning group member will fulfil them. The planning group should be small enough to be functional, and will generally include only one representative from each organization. The appropriateness of members of an *existing* planning group can be assessed in the same way.

Potential problem analysis

Introduction

The planning group should be briefed on the results of the vulnerability assessment, consider the recommendations of this assessment, and begin planning.

Potential problem analysis (*4*) is a technique for identifying preventive strategies and response and recovery strategies for problems that could arise in a given situation. Its value is that it systematically breaks down a problem into its components. Applied to emergency management, it can lead to innovative and effective strategies. The technique involves:

- identifying a hazard or hazardous situation;
- listing potential problems;
- determining causes;
- developing preventive strategies;
- developing response and recovery strategies, and trigger events for these strategies.

Preventive strategies are ways of reducing the probability of the problem, thereby reducing susceptibility. Response and recovery strategies are ways of reducing the seriousness of a problem that does occur, thereby increasing resilience.

At least two things are required to initiate a response or recovery strategy: a trigger event, and a person or organization responsible for initiating the strategy. The trigger event should indicate when the strategy is required; it could be an alarm, a warning, or the emergency itself. The responsible person or organization should be capable of initiating the strategy and the responsibility should be predetermined. To take a simple example, when flood water (hazard) reaches the 2-metre level at a particular bridge (trigger), a landowner (responsible person) contacts three neighbours so that they can move their animal stock to higher ground (response strategy).

A potential problem analysis can be performed by one person alone, but much better results will be obtained by a planning group. The planning group will also have a greater commitment to the strategies if it has been involved in their development.

How to perform a potential problem analysis

Consider a fire in a multistorey hospital as an example for a potential problem analysis. A vulnerability assessment on this hospital would reveal many of the potential problems that can be explored. Those that may be identified by a planning group might include:

— smoke, causing visibility problems;
— toxic smoke and fumes, causing lung damage to occupants;
— people trapped by smoke and flames;
— death due to smoke and flames;
— fire damage to property;
— water damage to equipment from sprinkler systems;
— threat of fire to adjacent buildings.

The results of a potential problem analysis can be recorded in tabular form (see Table 22).

Table 22. **Sample potential problem analysis**[a]

Hazard

Potential problem	*Cause*	*Preventive strategies*	*Response and recovery strategies*	*Trigger events*

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The next step is to consider causes in order to develop appropriate and effective preventive strategies and response and recovery strategies. The example can be extended with the potential problems relating to smoke. Some sources of smoke problems include:

— smoke caused by the ignition of garbage or other material that should have been removed;
— toxic smoke caused by burning of synthetic materials in furnishings;
— smoke caused by continued supply of oxygen to fire;
— smoke and fumes caused by applying an extinguishing agent inappropriate for the type of fire.

Listed below are some examples of preventive strategies for the smoke problem:

— reduce quantity of synthetic furnishings in the building (usually not cost-effective but worth considering);
— ensure appropriate housekeeping to reduce the amount of combustible material available (material that is not for immediate use in a given room should be stored in dedicated areas; garbage should be removed regularly);
— develop systems for reducing air flow to a fire (e.g. automatic or manual shut-off of air conditioning, closing of doors and windows);
— educate building occupants about the dangers of smoke and the best means to avoid it (e.g. staying close to the floor when leaving a building);
— train building occupants in the use of fire extinguishers.

Some possible response and recovery strategies include:

— shut off air conditioning as soon as fire is discovered (this may reduce the amount of oxygen that reaches the fire and the smoke produced);
— close all doors and windows;
— leave building in an organized manner;
— use fire extinguishers that are appropriate for the type of fire.

The trigger event and responsible person for setting in motion the response and recovery strategies must be determined by the planning group and documented.

Each of the other potential problems should then be considered in turn.

The technique of potential problem analysis is a powerful tool for developing emergency management strategies. It will produce the best results when used by a planning group because input comes from people with a variety of backgrounds and points of view. Members of the group will also inspire each other to develop new ideas. Equally important, since the group will be responsible for implementing the preventive and response and recovery strategies, is that group members should be involved in and committed to developing the strategies.

An interesting feature of potential problem analysis is that the same set of strategies for different potential problems will keep recurring. This is to be expected. The number of strategies for dealing with any complex set of problems is finite and many of them will be applicable to quite different problems.

Table 23. **Using the outputs of a potential problem analysis**

Output	*Use*
Possible preventive strategies	Add to existing prevention programmes
Possible response and recovery strategies	Determine whether existing resources will support a particular strategy Ensure that responsibilities for strategies have been assigned Develop further strategies for use in response and recovery
Trigger events	Ensure that trigger events are part of the alerting and warning system

Using the outputs of a potential problem analysis

The outputs of a potential problem analysis can be used in various ways (see Table 23), most of which are later steps in the planning process.

Resource analysis

Introduction

The vulnerability assessment describes the vulnerability of a community and the effects of hazards and recommends certain actions. The potential problem analysis suggests some response and recovery strategies. It is now necessary to determine what resources can be applied

A "resource", as the term is used in this manual, is anything of value or use in emergency management, including people, training, equipment, facilities, materials, and money.

Why analyse emergency management resources?

There are a number of reasons for analysing emergency management resources. One is to ensure that possible preparedness, response, and recovery strategies can be supported by the appropriate resouces Another is to ensure that preparedness is coordinated There are many possible preparedness strategies, and a number of organizations will potentially be involved. The act of analysing resources will provide these organizations with shared information and goals, and will lead to greater coordination without which many organizations may well be poorly or inappropriately prepared It is also crucial to know which resources are available for use in emergencies and who is responsible for supplying them

How to perform a resource analysis

In a resource analysis, the following questions are asked (in the order given):

- What are the possible or proposed strategies?
- What resources are required?
- What resources are available?
- Who is responsible for these resources?
- What is the difference between the requirements and availability?
- If there is a shortfall, who is responsible for correcting it?
- Is the use of the resources in this area cost-effective?