

3. Predisaster activities

3.1 Introduction

Work done in advance of possible emergencies and disasters is an essential aspect of disaster management. It enables a reduction in the number and severity of disasters, through prevention and mitigation, as well as improved emergency response, through preparation and planning. A number of models have been developed to promote a programmed approach to predisaster activities, based on a systematic assessment of vulnerability, followed by vulnerability reduction through prevention and preparedness activities that are planned, managed, monitored and evaluated. The model presented here is illustrated in Figure 3.1.

Although prevention/mitigation and planning/preparedness are presented separately here, in practice they have many activities in common and should be regarded as interdependent and often overlapping aspects of the overall goal of vulnerability reduction.

The pre-condition for systematic vulnerability reduction is policy development, which ensures that disaster management activities are developed within a favourable policy framework.

3.2 Institutional arrangements

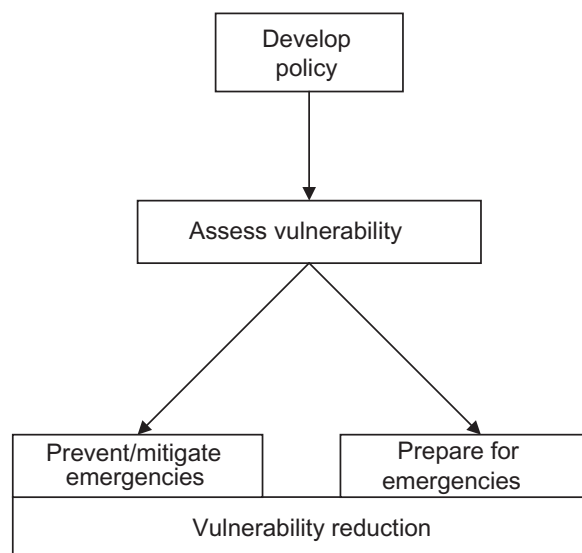
3.2.1 Policy development

Policy development is needed at national, provincial/district and local levels to ensure that common goals are set and common approaches are used. Without a shared disaster management policy that applies to all relevant sectors and all levels, prevention, preparedness and response are likely to be fragmented, badly coordinated and ineffective (World Health Organization, 1999a). Developing and monitoring policies for disaster management requires an active process of analysis, consultation and negotiation. This process should involve consultation among a wide variety of institutions, groups and individuals. These will include nongovernmental organizations, such as the national societies of the Red Cross or Red Crescent, and several governmental bodies, such as the ministries responsible for health, security, welfare, public works, etc. The resultant policies should reflect society's definition of the limits of acceptable risk and its commitment to protecting vulnerable populations. They should also result in a clear definition of the roles and responsibilities of all the partners in emergency management. Table 3.1 illustrates the range of issues in disaster-management policy development and gives recommended options for addressing them.

Certain aspects of policy development depend on learning lessons from previous disasters and emergencies. See Section 3.6.

3.2.2 National and subnational disaster organizations

Predisaster activities should be coordinated in each country at different levels by bodies that are concerned with all stages of the disaster, so that the overall goal of vulnerability reduction is pursued.

Figure 3.1 Vulnerability reduction¹

¹ Source: World Health Organization (1999a).

At national level, national disaster organizations (that may have a variety of names and that may be constituted in a variety of ways) should have the following features (Carter, 1991):

They do:

- provide a coherent approach to disaster management;
- serve as a common reference point for departmental activities;
- clearly allocate responsibilities;
- provide a basis for coordinated action;
- provide a setting within which to review and evaluate needs.

They do not:

- duplicate the normal government organization;
- act independently of government;
- seek to control other agencies;
- act outside its legal authority.

National disaster organizations are often composed of representatives from a range of government ministries and nongovernmental organizations that have a role to play in predisaster activities, disaster response and recovery.

At various subnational levels, similar coordination and response bodies may also exist. They require resources, access to information, and authority to be able to operate effectively.

3.3 Vulnerability and capacity assessment

3.3.1 The purpose and process of vulnerability and capacity assessment

The purpose of vulnerability and capacity assessment (VCA)—also commonly called risk analysis or threat assessment—is to identify hazards and their possible effects on communities, activities or organizations, and their capacity to prevent and respond to disasters. This is a vital early stage in the disaster-management process. Vulnerability assessment informs strategies for reducing the vulnerability of development programmes to disruption; it enables emergency prevention, mitigation and preparedness measures

Table 3.1 Policy issues and recommended options¹

Policy issue	Recommended option
1. Emergency preparedness and development planning	Emergency preparedness should be incorporated into all sustainable development objectives and projects.
2. National emergency law and other relevant, enabling legislation	A national emergency law is required with references to emergency management in other laws. Definition of “emergency” should be broad and the language of the law should be as simple as possible.
3. National emergency management organization	A national emergency management organization that is separate from other government agencies is preferable. Responsibility should also be decentralized to provincial government.
4. Responsibility and major mission of national emergency management organization	The mandate of the national organization and its provincial counterparts should cover all aspects of emergency management, including health.
5. Tasks of the emergency management organization	The organization should institutionalize emergency management in other organizations, rather than attempt to undertake all emergency management work itself. It should undertake a number of tasks, but maintain a generalist approach.
6. Community and provincial emergency preparedness	The national level should develop policy and standards for emergency preparedness at all levels of government. Provincial and community-level emergency preparedness should be developed according to the policy and standards.
7. Health sector emergency preparedness	Health sector emergency preparedness should be coordinated with other sectors, the national level developing policy and standards, and the provincial and community levels implementing programmes. Public, private, military and NGO health-service providers should be part of the same preparedness programme, as should each discipline within the health sector.
8. Involving other groups, management and citizens in emergency	All citizens should be involved in emergency management in some way, ranging from active participation in vulnerability assessment and emergency planning, to receiving information on emergency preparedness.
9. Managing resources	Resources for emergency management should be based on existing resources. Emphasis should be on training and information-sharing in emergency management in all sectors and at all levels.
10. Evaluating an emergency preparedness and response programme	Performance indicators for emergency management should be developed to suit the national, provincial and community environments.
11. Priorities in implementing emergency preparedness	Priorities should be based on either expressed or actual needs. This will require at least basic research into vulnerability and immediate needs.

¹ Source: World Health Organization (1999a).

to be carried out effectively; it facilitates rapid and relevant emergency response, based on an understanding of gaps in resources that need to be filled with external support; it provides information on likely damage and operating difficulties; and it provides a picture of the predisaster situation, to enable appropriate objectives to be set for recovery programmes.

The process of VCA may be carried out in a number of ways. The essential steps involved include the following (adapted from World Health Organization, 1999a):

- The *project definition* determines the aim, objectives, scope and context of the VCA, the tasks to be performed, and the resources needed to perform them.
- The formation of a representative *planning group* is essential to VCA and emergency planning. Without this group it will be difficult to gather the required information, obtain the commitment of key individuals, and allow the communities and organizations to participate.
- *Hazard identification and description* reveals and describes the hazards that exist in the community (although it is unlikely that all of the hazards will be discovered). The same hazards may manifest themselves differently in different areas and communities because there is an interaction between hazards, the particular community, and the environment.
- A *community and environment description* outlines the relevant information about the people, property or environment that may affect or be affected by the hazards. More hazards may be identified at this stage. Key aspects of communities' capacity to deal with disasters are identified at this stage.
- A description of *effects* is an account of community vulnerability—what is likely to happen in an accident, incident, emergency or disaster involving a single hazard or multiple hazards.
- *Hazard prioritization* determines the hazards that should be dealt with first, and those that can be dealt with later or ignored, on the basis of their likely effects and community vulnerability.
- *Recommendations for action* are the link between vulnerability assessment and other emergency management activities. Planning, training and education, and monitoring and evaluation should be based firmly on the results of the vulnerability assessment.
- *Documentation* of all results and decisions is necessary to justify the recommendations and any further emergency prevention and preparedness work.

Two key steps in this process—the identification and description of hazards and the assessment of community and organizational resilience—are described below.

3.3.2 Hazard mapping

The average frequency of occurrence and location of most extreme events can be determined with some degree of accuracy. While global maps of hazards, such as potential desertification, severe storms, and earthquake and volcanic activity, do exist, a more detailed approach is of more use to environmental health and disaster planners. Historical records, physical data and computer simulations allow the production of detailed city, subnational or national maps overlaid with zones of probable physical damage from such extreme events as landslides, floods, earthquakes, volcanic eruptions, storm surges and tsunamis.

The same approach can be taken with industrial accidents. Maps of the zones surrounding hazardous factories and the routes used to transport hazardous materials, plus data on seasonal wind velocity and direction, can be used to predict the scale of possible hazards and determine the method of evacuation or other emergency response if

leaks or explosions occur. Public and private records of past industrial activity can be a valuable resource for identifying the presence of physical hazards. For instance, Foster (1980) reported that officials in Warsaw, Poland used records to find 2 tons of cyanide in rotting barrels in an abandoned basement workshop. If it had leaked into the water supply, it could have killed most of the city's population.

3.3.3 Vulnerability analysis of water-supply systems

One set of management goals suggested for water-supply systems facing hazard risks (American Water Works Association, 1984) are as follows:

- to provide water for fire fighting;
- to prevent unnecessary loss of stored treated water;
- to develop and maintain adequate amounts of potable water;
- to restore the entire system as soon as possible.

To decide whether a water-supply system will be able to achieve these goals in an emergency, vulnerability analysis must also take into account the effect of a disaster on sources such as surface water (in the case of wildfires) and groundwater (in the case of industrial spills). The vulnerability analysis should be carried out systematically from the source, through the collection works, the transmission and treatment facilities, and finally the distribution system. The analysis should include possible damage to reservoirs and water mains. The effects of power failures, personnel shortages due to lack of transport or injury, and communications difficulties need to be considered.

3.3.4 Assessment of environmental health vulnerability

First, environmental health must be covered in the initial baseline survey of all the hazards and patterns of vulnerability affecting the society. This survey should be organized by geographical region and should also profile the vulnerability of different ethnic and socioeconomic groups. Disparities and priority needs in such areas as water supply, drainage, sanitation, refuse and waste disposal, housing, and food hygiene should be documented. The prevalence of vector-borne and contagious diseases by region and by socioeconomic group should also be integrated into comprehensive risk planning. Finally, the location and safety of industrial facilities in relation to settlements should be reviewed from the point of view of air, soil and water contamination, as well as the risk of radiation, fire, explosion and accidental poisonous emissions.

Such baseline surveys can reveal who is more likely to suffer from an emergency directly related to environmental health as well as where this is most likely to occur. Such emergencies are not randomly distributed in social or spatial terms. For example, the population living near the chemical factory in Bhopal, India and the residents surrounding the Chernobyl, Ukraine and Three Mile Island, USA nuclear reactors were obviously at greater risk than people living further away. In Peru, the densely populated, poor neighbourhoods of the port city of Chimbote and of Lima were more likely to be affected by large numbers of cholera cases than sparsely settled areas in the mountains. Information on the use of survey data to avoid secondary hazards is given in Box 3.1.

3.3.5 Describing communities, their environment and the effects of hazards

The purpose of describing communities is to be able to understand their vulnerability to the hazards identified and mapped, and the likely effects of those hazards. These two factors depend to a great extent on the environment in which the community lives and works. The capacity of communities and local services and organizations to resist and survive disasters is a key determinant of their vulnerability.

Box 3.1 Using survey data to avoid secondary hazards

The environmental health baseline survey of hazards and vulnerability provides insight into who and which areas may be affected by secondary environmental health hazards that follow another disaster, such as an earthquake.

For instance, the survey might reveal that a zone of a city has only one water source and that this source is at risk of disruption by an earthquake. It is thus highly likely that residents of this zone could be in danger of water-related diseases or water shortages in the event of an earthquake.

Discussion at community level could then focus on: (1) the possibility of a back-up water supply; (2) strengthening and protecting the existing supply; (3) pre-positioning water tankers in such a way that this high-risk zone is the first to receive emergency water supplies.

Table 3.2 Principal community characteristics determined in vulnerability analysis¹

Demography	Culture	Economy	Infrastructure	Environment
Population and age distribution	Traditions	Trade	Communication networks	Landforms
Mobility	Ethnicity	Agriculture/livestock	Transportation networks	Geology
Useful skills	Social values	Investments	Essential services	Waterways
Hazard awareness	Religion	Industries	Community assets	Climate
Vulnerable groups	Attitudes to hazards	Wealth	Government structures	Flora and fauna
Health level	Normal food types		Resource base	
Education level	Eating habits			
Sex distribution	Power structures			

¹ Source: World Health Organization (1999a).

Table 3.2 Shows the principle community characteristics that determine vulnerability to a given hazard.

Information that describes the community and its environment is gathered in a number of ways, including government and commercial records, maps, academic publications and field studies, which may include surveys, observation and participatory techniques. One important aspect of community assessment is identifying marginalized groups to ensure that their voices are heard and their vulnerabilities and capacities are recognized. These groups are often the most affected by disasters.

Where the community is involved in describing itself for a vulnerability assessment, it is far more likely that participation in planning and emergency preparedness will be successful. A variety of assessment and planning tools may be used for participatory assessment and planning, including rapid rural appraisal, participatory rural appraisal, and participatory learning and action. They differ in important ways, including the degree of participation they enable, and the information, ideas and understanding they produce. Staff carrying out community-based VCA should be familiar with these tools and be able to choose and use the most appropriate one for the context and purpose of their work. For further information on VCA and participatory techniques in vulnerability reduction, see International Federation of Red Cross and Red Crescent Societies (1994) and von Kotze & Holloway (1996).

The information gathered may be mapped, together with information on hazards, to build up a picture of effects and vulnerability. Geographical information systems (GIS) are useful for spatial hazard analysis and mapping. These computer-based information systems allow several types of information from various sources—for instance, the loca-

tion of settlements and industrial hazards, the contact details for emergency staff, and short-range wind direction forecasts—to be combined and presented to give a complete and up-to-date picture of hazards, their possible effects and response protocols.

3.3.6 Ongoing monitoring of vulnerability

The distribution of hazards and people's vulnerability to them are affected by many economic and political decisions on development projects and investments, urban growth, rural-to-rural migration, and refugee influx, to name only a few. The work of comprehensive vulnerability assessment and reduction can never end. The possible impact on vulnerability of all such policy and project decisions should be monitored. Such vigilance should be the responsibility of national, regional and local emergency-management agencies. Project planners, urban designers and other professionals should systematically include vulnerability analysis in their routine work.

3.3.7 Environmental health review of development policies and projects

Human health has an important place in the environmental impact assessment of policies, plans and project proposals. Environmental health surveillance can contribute to the analysis of change by keeping track of the shifting spatial and seasonal patterns of human population in relation to disease vector habitats and industrial pollutant sources.

The provision of water, drainage, sanitation and other services often lags behind the spontaneous creation of new settlements (e.g. around new mines, forest settlements and logging camps, and refugee facilities). Timely identification of the hazards facing the populations of such settlements and possible measures for dealing with them should also be the work of environmental health personnel working in collaboration with the emergency agency.

For more complete information on hazard identification, community description, and hazard prioritization, see World Health Organization (1999a).

3.4 Prevention and mitigation

3.4.1 Reducing community vulnerability through long-term environmental health improvements

In poorer rural and urban areas of many countries, improvements in water supply and sanitation systems are connected with vulnerability reduction in several ways. First, they reduce the risk of epidemics of diseases such as cholera. Second, they improve the general health status of the population, making people more resilient when they have to face the additional stress of disasters. Third, water and sanitation projects organized on a self-help basis often strengthen cooperation within communities that can be used as the basis of other vulnerability-reduction activities, e.g. the community-based organizations responsible for water improvements may become the core of a community safety committee.

An additional degree of safety can be provided if those responsible for local water or sanitation initiatives are aware of hazards and engage in a discussion of vulnerability with community members as a routine part of planning new works. Many of the same problems arise as those faced by planners of large-scale water-supply systems, including watershed protection and alternative water sources for emergencies.

Traditional means of water purification and traditional rules for segregating water uses (stock watering, bathing, drinking) may assist in reducing vulnerability. They can often provide the key to low-cost improvements and the basis for local level emergency planning.

On-going public education in household water treatment (filtration, chlorination, boiling, storage, etc.), oral rehydration therapy, breastfeeding, food hygiene, hand-

washing, the use of latrines, waste disposal, drainage and vermin control will all strengthen the community before any emergencies occur and also play an important role in an emergency.

In unplanned, unserved or underserved urban neighbourhoods, refuse and waste management is also important, as is storm drainage. Such activities provide opportunities for self-help, especially in communities where money and labour are in short supply because of the struggle to make ends meet. Environmental health staff may assist by providing technical advice or preparing and promoting proposals for improvement.

Where water is provided by water vendors, it is important to identify the source of this water and to determine how vulnerable to damage or contamination it is. Where possible, community discussions with water vendors about their own plans in the event of an emergency can considerably reduce vulnerability.

Where a nearby industrial plant contaminates an urban neighbourhood or poses a risk of accidents, an even more difficult process of negotiation will be necessary. Intervention by the municipal authorities or other legally authorized governmental bodies is then necessary. Data collected by environmental health personnel can be vital to the successful resolution of such a conflict of interests.

3.4.2 Environmental safety regulations

Legal and administrative controls can play a significant part in reducing environmental health risks during some emergencies. For example, regulations specifying the conditions under which hazardous materials must be transported and stored can include some provisions governing protection from disasters. This can sometimes reduce the risk of uncontrolled discharges during a sudden large-scale emergency. Environmental quality and industrial safety rules are very important in this regard. However, without adequate inspection and vigorous enforcement, their effectiveness will be reduced.

The international transportation of toxic wastes and the relocation of polluting industries from industrial to developing countries may present great hazards, and some countries can ill afford to pay for industrial and environmental health inspection.

Zoning and land-use planning are another area where rules and regulations can dramatically reduce risks. However, these are difficult to enforce where poor people have no choice about where to live or how to earn a living. Related, but more specialized regulations govern the location and/or design of essential facilities, such as schools and hospitals.

Building codes, such as wind-loading codes or earthquake-resistant standards for new buildings, have been very effective in reducing the loss of life and property in extreme events. For example, in Darwin, Australia, the 1974 tropical cyclone destroyed only 3% of buildings engineered to wind-resistant codes, as opposed to 50–60% of non-code constructions (Smith, 1992).

3.4.3 Reducing the vulnerability of environmental health infrastructure

Vulnerability may be reduced through the location, design and maintenance of environmental health infrastructures. Hazard mapping may reveal quite straightforward risks, e.g. a water-treatment plant sited in a flood plain, on an earthquake fault, or next to a chemical facility, and may be used to identify priority locations for hazard-mitigation measures, such as flood-control dykes and avalanche-deflection walls. However, the decision concerning the appropriate action to take in such cases may not be equally straightforward. Decision criteria may include the cost of relocating or protecting the facility and the risk that damage to sewage-treatment plants will pose a threat to health.

For further information on the protection of health facilities, see Pan American Health Organization (1993).

3.4.4 Protecting other facilities

Laboratories should be protected from disasters so that they are immediately available during relief and recovery activities for testing water, soil and other materials for contamination, and for the analysis of biological samples as part of epidemiological surveillance. Although priorities for protection should include water-supply systems, waste-treatment plants and laboratories, other installations are by no means unimportant.

Adequate storm drains can contribute to flood mitigation. If they are blocked by landslides or other disasters, they should be repaired so that flooding does not occur as a secondary hazard. Sanitary landfills and facilities for waste storage, collection and disposal can produce significant secondary hazards if they are flooded or burned during a disaster, or if they are so unstable and improperly sited that they contribute to a mass debris flow. The water supplies and sanitary facilities of hospitals and health centres should be examined for possible weaknesses in emergencies. Cost-effective ways of strengthening them may exist. Part of the general hospital or health-centre plan, to which environmental health managers should contribute, should be the provision of alternative arrangements for water, power and heat if centrally supplied services are interrupted.

One example of international support for such a review of infrastructure for vulnerability reduction is UNESCO's Educational Buildings Programme. This has helped to develop prototypes for, among others, schools resistant to earthquakes (in Armenia and Nepal), schools resistant to severe tropical storms (in Costa Rica and Viet Nam) and schools on stilts to avoid flooding (in Bangladesh and Sri Lanka).

3.5 Preparedness and planning

3.5.1 The national emergency planning process

This section is concerned with planning to respond to disasters, rather than planning to mitigate or prevent them.

The overall context of environmental health planning is the national health policy on emergencies. See Section 3.2 on policy development. Annex 1 provides an overview of a national emergency planning process. Plans developed at each level should relate to plans at other levels, to produce a hierarchy of coordinated plans from national to local levels. This is illustrated in Figure 3.2.

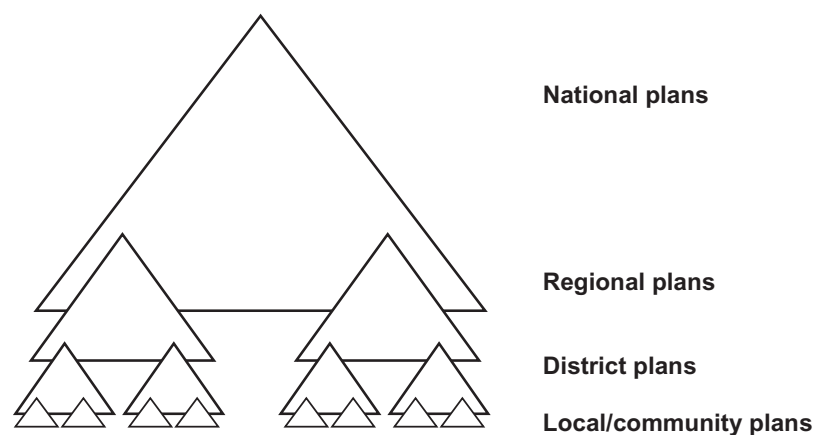
In addition to participating in overall health, water supply, and sanitation sector planning for emergencies, those in charge of water-supply and waste-disposal systems should also be responsible for the planning process within their own facilities. Each water-supply and waste-disposal institution in a country (or district) should carry out a review of its resources (both human and material), and of the vulnerability of the components of its system to various hazards, and prepare plans for temporary repairs.

In the case of emergency shelters and temporary settlements, alternative planning options at the national/regional level will be based on scenarios for a variety of situations and involving different numbers of shelters and settlements, their locations, the numbers of people accommodated, and the resources available and required. There should also be a well-understood and agreed method of assessing people's immediate environmental health needs and for satisfying them with whatever resources are available. For more information on assessments, see Chapter 4.

All agencies dealing with environmental health should know before an emergency occurs how the following tasks are to be carried out:

- liaison with other health departments/organizations and with the appropriate emergency coordinating body;

Figure 3.2 The hierarchy of disaster-management plans



- the evaluation of immediate public health conditions and risks;
- the evaluation of damage to public sanitary installations and the provision of advice on remedial measures;
- the evaluation of shelter and food needs;
- the mobilization of personnel and equipment;
- emergency action to control or eliminate environmental health hazards (often secondary to the immediate hazard);
- the emergency restoration of water-supply and waste-disposal systems, etc.;
- reporting on conditions and on the measures taken.

With the aid of a plan that provides guidance on these points, environmental health staff in an area should be able to provide information on the following:

- the location and magnitude of known damage;
- any structural or functional damage to water-supply and waste-disposal systems, etc.;
- the size and location of populations with inadequate water, shelter, and sanitary facilities;
- the repair resources available;
- estimates of repair times;
- estimates of special needs for environmental health at hospitals and other institutions;
- local capacity for disaster response.

3.5.2 A general model for disaster-preparedness planning

National, regional, district, and local emergency plans share many general characteristics so that the sequence of planning steps shown below will apply to all of them.

1. *Identify the hazards and estimate their effects*

This is the process of vulnerability assessment, as described in Section 3.3.1.

2. *Assess the likely needs*

This involves making a preliminary list of everything that will have to be done before, during and after the emergency. It may be helpful to assess needs in terms of percentages, e.g. *X%* of the people affected will need assistance with shelter, *Z%* will have to be provided with food, etc. This assessment should be done by considering local capacity and the extent to which additional external resources will be required to respond to unmet needs. Where several types of emergency

are expected, estimates should be tabulated to compare probable needs. The different types of needs should then be quantified, according to likely numbers of people affected. The main types of need to consider are early warning, clothing, health care, evacuation, food, sanitation, shelter and water.

3. *Discuss the needs*

This step involves including as many people as possible in the planning process. They are likely to think of things which may have been overlooked (e.g. specific cultural factors) and make constructive suggestions for improvements.

4. *Determine the operational procedures and review existing priorities* (see step 9)

This step provides the framework for emergency operations. When planning for a range of emergencies, hazards should be prioritized, so that initial planning is concentrated on the most serious potential emergencies. The fundamental policies on which the plan is based should be set out, e.g. minimizing the effects of the emergency; public participation in the planning process; self-reliance; adequate treatment of all victims; phasing out; planning principles which should be highlighted; and the overall framework of the plan. Goals should be set and approved by the highest appropriate authority; this will help to provide a stable management environment when an emergency occurs. Responsibility should be delegated wherever possible, to give maximum scope for individual initiative. A plan that seeks to control everybody and everything from one central point is a poor one and will almost certainly fail.

5. *Assign the responsibilities*

The pattern of responsibilities will have started to emerge during the previous steps. This is the time to clarify them so that everybody is clear about who is responsible for what. They can then prepare their own plans to meet their respective responsibilities. To facilitate coordination, all individuals should be encouraged to work out how to do their jobs, drawing on their own initiative and special expertise, and to discuss their intentions beforehand.

A useful tool for defining roles and responsibilities for planning and action is stakeholder analysis. This is a participatory process that aims to:

- identify and define the characteristics of key stakeholders;
- assess the manner in which they might affect or be affected by the programme/project outcome;
- understand the relations between stakeholders, including an assessment of the real or potential conflicts of interest and expectation between stakeholders;
- assess the capacity of different stakeholders to participate.

For further information on stakeholder analysis, see DfID (1995).

Box 3.2 Responsibility for environmental health in disasters and emergencies

There is seldom a single environmental health manager responsible for emergency planning. In most countries, particularly in urban areas, numerous local government bodies and private enterprises are responsible for environmental health infrastructure and services, with little coordination between them.

It is not only professional sanitary engineers and public health workers who must be involved in emergency planning. All community health, humanitarian and development workers should be part of the planning process, together with community representatives. Focal points for emergency planning should be clearly defined, but should not necessarily be the local authorities.

6. *Make an inventory of local capacity and available resources*

Few jobs will be completely self-contained and resources will have to be shared. All common resources needed for an emergency response, including human resources, materials, transport, special equipment (e.g. earth-moving, water-purification) and money should be listed in the inventory. Local capacity should be included in this inventory.

7. *Review steps 2–5*

This is the time to compare needs with resources and to create reserves. It is usually helpful to tabulate. Shifts and rest periods should be taken into account in human resources planning.

8. *Identify critical areas*

These are the areas where potential responses will be subjected to the greatest strain and which need strengthening beforehand. They are also the areas which need monitoring most closely when the plan is implemented.

9. *Confirm priorities*

The priorities identified in Step 4 and discussed in subsequent steps need to be confirmed in the light of an understanding of both needs and resources. Priorities can change with time.

10. *Finalize the plan*

A rigid format is not essential. What matters most is that the plan should be easy to read, though where more than one plan is required it will obviously be helpful if there is a standard layout. A suggested simple format is:

- *Situation.* A brief description of the hazard, its likely effects, the needs arising from it and the planning assumptions.
- *Aim.* A clear and concise statement of the aim of the plan.
- *Concept of operations.* A brief description of the overall policies, framework and goals of the plan.
- *Allocation of responsibilities.* A clarification and assignment of roles and tasks (as determined in Step 4).
- *Coordination.* Reporting procedures, channels of communication and arrangements for establishing and effecting appropriate coordination.
- *Annexes.* The main part of the plan should be as simple as possible. Details can be given in annexes, including diagrams showing coordination procedures and supporting plans prepared by individual departments to meet their respective responsibilities.

It may be helpful to write parts of the plan in the form of:

- *Standing operating procedures.* These are routine procedures to be followed in certain circumstances, such as for the handling of warnings, or the procedures to be used in emergency operations centres during an operation.
- *Standing orders* containing long-term organizational and administrative details.
- *Checklists and emergency operating procedures.* These may make the total plan more bulky, but it will not be necessary for everybody to read the whole plan; what they need to know is how they fit into the overall concept and the details of those parts of the plan which are directly applicable to them. Supporting plans should stand on their own. All paragraphs should be numbered for easy reference.

11. *Practise the plan*

The planning process is in itself a very valuable learning experience. As time passes, however, familiarity with the problem and the plan will fade. Plans should therefore be reviewed, updated and practised regularly so that the people who will be responsible for implementing them are brought up to date. Simulations can help to identify weaknesses in plans, which can then be remedied before

the event. It is probably better to republish a whole plan than attempt to issue amendments.

12. *Evaluate the plan*

If an emergency occurs and the plan is implemented, the effectiveness of its implementation should be evaluated so that lessons can be learnt and applied.

The planning process is a valuable learning experience that should be used to develop the skills of individuals and organizations (see Chapter 16 for further information on human resources development).

For further information on planning methods, see Pan American Health Organization (1982, 1983); Carter (1991); Natural Disasters Organization (1992); and World Health Organization (1999a).

3.5.3 Strategic plans and operational plans

Strategic plans are essential to ensure that disaster prevention and emergency preparedness take place within the overall framework of the disaster-management cycle. They also enable monitoring of governmental and private-sector policies and activities to encourage them to take long-term vulnerability into account.

Operational plans are specific plans prepared for dealing with future events that may be uncertain in timing, magnitude, location and effects. In such plans, therefore, the emphasis is on preparedness for response. They may include measures such as establishing communications and management information systems; stockpiling or identifying materials and equipment; identifying routes and sites for evacuation; or identifying and notifying personnel so that the emergency response may be rapid and effective. It is essential that operational plans are practised and revised, to ensure they remain appropriate to the hazards identified. Practising operational plans is a useful training exercise (see Chapter 16).

3.5.4 Participatory methods in planning

Participatory planning must involve people from the start of the planning process. It is not enough simply to ask them for their opinion of a plan that has already been drawn up. This means listening to people in the communities concerned with disaster management plans. This is not always easy because planners and people in the community often have different priorities and perceptions. For example, an environmental planner may think that improving drainage in an informal urban settlement is most important, while the residents of this poor neighbourhood may view the prevention of crime or malnutrition as more urgent. Drainage, or at least the health problems and possible flood risk produced by poor drainage, is probably one of the priorities of residents as well, but not the first priority. A flexible and community-responsive planning process will sooner or later have to consider drainage, but will reach that point in a roundabout way. The

Box 3.3 Community risk assessment: a powerful training tool

Representatives of a small town, urban neighbourhood or rural community are invited to join planners in the visual inspection of the area that they inhabit. Existing hazards and vulnerabilities are discussed. A highly localized risk analysis is produced in this way, and local participants also discuss the appropriate response to those risks. Past disasters are recalled. Lessons of other people's experience are discussed. In this way, the locality studies itself. A core group of knowledgeable and motivated volunteers is developed, who can help to train others in the community, possibly on a paid basis.

best starting point for locally-based strategic emergency planning in this case might be a neighbourhood proposal for street lighting (as a means of reducing crime) or for a community garden to be created in vacant land (as a means of reducing malnutrition). Once the residents' priorities are recognized and they feel more in control of their environment, there will probably be greater public support for improving drainage.

Beginning with the priorities and perceptions of the community, good will and the credibility of the planning process can be established. The neighbourhood group developed around these initial projects can then turn its attention to other issues including hazard reduction and emergency preparedness. Once a neighbourhood or community group has been established, it can play an active part in both disaster prevention/mitigation and emergency preparedness.

The same group of participatory techniques used for vulnerability assessment can be used for community-based planning for emergencies. See Section 3.3.5.

3.6 Institutional learning and memory

One of the keys to improving emergency preparedness is the ability of organizations and individuals to learn from previous disasters and to incorporate that learning into practice. However, many of the lessons are *not* learned, mainly for two reasons.

First, staff turnover in government at all levels is such that some staff may never experience certain types of disasters. Elections and other changes in government reinforce the effect of retirement and transfer and disrupt the continuity of administrative experience. Second, there is often a desire to re-establish the "normal" state of affairs as soon as possible after an emergency. Even when institutional changes that would prevent future disasters are clearly needed, these can be overlooked in the rush to re-establish "normality". Nevertheless, there are things that can be done to ensure that lessons are learned.

3.6.1 Evaluation of emergencies and disasters

It may be possible to make the periodic review of emergencies and disasters a governmental responsibility, to ensure that experience is shared with the various ministries concerned and to keep politicians and legislators up to date with current hazards and preparedness measures. It must be emphasized that whatever the institutional form that this body takes, it must have support at the highest level or the institutional memory of disasters can still be lost in the "noise" of competing bodies (such as those concerned with economic growth, national security, etc.).

One way to ensure that the evaluation lessons become included in practice is to integrate national experience into professional training curricula.

3.6.2 Vulnerability analysis of major projects

A related, but broader, challenge is to institutionalize the thorough appraisal of past and present investment policies as they affect vulnerability to hazards. Sometimes, where a major project requires large-scale population resettlement, there is some public assessment of the effects of such resettlement on health and livelihood. Often these effects are not mentioned in the public record or have been defined as "external" to the financial calculation justifying the investment. Some major projects have effects on vulnerability that are of long duration, and those employed in them should be considered more vulnerable to hazards and included in the high-vulnerability category, at least until investigations prove the contrary. The records kept should include a detailed account of how such large-scale changes in the landscape came to be made, what the expected benefits were, and what the present consequences are.

3.6.3 Using rules and regulations concerning environmental health and hazards

The institutional memory of disasters can also take the form of the body of rules and regulations that have grown up in response to known hazards. Environmental health activities normally take place within a comprehensive framework of rules and regulations. Usually, this framework has grown out of years of experience and analysis, and contributes substantially to public safety.

The activities of environmental health staff will often be defined by regulations that indicate the types of monitoring they must perform, the levels of service expected, and the actions to be carried out when specific problems are identified.

The health and safety of environmental health staff themselves is also being given increasing emphasis in many countries, as well as the safety of the public when environmental health activities are being carried out. For example, the safe storage and use of chemicals employed in vector control are governed in most countries by legal provisions or administrative regulations.

3.7 Warning indicators

3.7.1 Early warnings

An extremely important component of preparedness, prevention and mitigation is the capacity to obtain and use early warnings of impending hazards or threats. There are limitations and obstacles to the timely forecast of extreme events, however, and a number of factors can also limit the effectiveness of warnings in influencing public behaviour (see Box 3.4). Both sets of constraints must be borne in mind by environmental health managers.

Warning systems vary greatly, as does the amount of forewarning that they give. Warnings must give sufficient time to enable environmental health preparedness and prevention activities to be carried out.

3.7.2 Slow-onset hazards

In the case of slow-onset hazards, such as drought and certain outbreaks of plant, animal and human disease, there is often a long warning time. Meteorological services are increasingly capable of reliable forecasts of climate patterns several months to one year in advance. The 1997–1998 El Niño event, which affected climatic conditions worldwide from June 1997 until April 1998, was predicted in early 1997. However, lacking specific thresholds or marker events, authorities often wait until the process is far advanced before action is taken.

Box 3.4 Risk perception

The perception of risk is not universally the same. It can vary from culture to culture, by socio-economic class and even by individual. For example, many farmers live on the slopes of active volcanoes or in the flood plains of rivers because they perceive the balance of benefits to risks as favourable. However, some risks are not consciously chosen, but simply thrust upon people because information is not made available and there is no public discussion. In other cases, people may be aware of risks, but believe that they have no alternatives to their present behaviour. For example, the urban poor may live on steep slopes prone to landslides during heavy rain or in ravines prone to collapse during earthquakes, but may believe that they have nowhere else to live. It is especially important in complex societies containing many cultures and socio-economic interests to ensure that a thorough discussion of risks by representatives of all groups is an integral part of the counter-disaster planning process.

Environmental health indicators, in combination with routine activities carried out by veterinarians, nutritionists and epidemiologists, can be used to provide early warnings of some of these slow-onset hazards. Some African countries have systems for early warning of famine, which are linked to nutrition surveillance. In Botswana, for example, monthly returns from weighing and measuring children in well-baby clinics are automatically screened for anomalies. These data, together with crop and livestock data, are used to trigger a variety of timely drought-response measures, including supplementary feeding, public works as a form of income supplement and the exemption of affected families from paying taxes (Walker, 1989).

3.7.3 Hazards with moderate warning time

A number of hazards have an intermediate range of warning times. Those responsible for environmental health should be among the first to be informed by the authority issuing the alert or provisional warning, in advance of any public announcement. An effective communication system should be established and the readiness of supplies, equipment, transport, communications and personnel should be confirmed.

There may also be specific actions that managers can take to increase the level of protection of vital facilities or to prepare for possible evacuation. For instance, a volcanic eruption can usually be foreseen by a few days, if not as long as a few weeks or even months in advance, and the affected population can be evacuated in good time. Ash fall from volcanoes can contaminate and clog water-storage facilities and treatment plants and, with sufficient warning, steps can be taken to protect water supplies from this hazard.

Heavy snowfalls can be forecast with moderate accuracy a few days in advance. If access to isolated areas is likely to be difficult, managers can confirm that the local environmental health services are well supplied with spare parts, chemicals, etc.

Slope stability studies can signal an acute risk of avalanches or mudslides as a result of predicted heavy rain. Fairly straightforward models can then provide at least several days' warning. Such hazards can destroy or harm vital facilities that have not yet been moved to safer sites following a review of location. Steps may have to be taken to evacuate these facilities and confirm the readiness of back-up facilities.

Many meteorological hazards have warning times measured in hours or days. Flash floods in semi-arid and arid watersheds are perhaps the most sudden form of meteorology-related hazard. Other river flooding takes place more slowly; where there is a dense hydrographic network of stream gauges connected by telemetry, models allow quite reliable flood warnings to be given many hours in advance. Following a flood warning, standing orders for low-lying facilities, such as water- and sewage-treatment plants, should be implemented (e.g. removal of vital records to upper stories, protection of electrical equipment, sand-bagging of entrances, etc.). A careful review of the area most likely to be affected by the flood may reveal the existence of a population in danger of being cut off. If so, efforts should be made to pre-position water tankers on higher ground in the area concerned.

Cyclones can be detected by weather satellites in the form of small cells several days in advance of landfall. However, the communication of this information has been problematic. First, cyclones can change their course unpredictably. In 1977, the landfall of the storm that devastated the Indian state of Andhra Pradesh was not in the area expected, even though the storm itself had been tracked for days. Second, a warning system may not be understood or believed by the people at risk. See Section 4.2.1.

3.7.4 Warning of industrial accidents

Advance warnings of large-scale accidents in industry, transportation, etc., are limited by the nature of the events concerned. For example, in Bhopal, India, there was no advance warning of the cloud of methyl cyanide that descended on the residents. In the case of the explosions in the sewer system of Mexico's second largest city, Guadalajara, in 1992, citizens had been complaining for several days to the authorities about the smell of petrol.

Frequent inspections of high-risk factories and, for example, bridges and dams can reveal structural weaknesses. There is often reluctance to shut down key facilities, however, because of the costs involved and, in some cases, a misplaced reliance on a tendency to overdesign. Environmental health workers often have a role to play in the inspection of potentially hazardous industrial plants and in liaising between the factory management and the public.

3.7.5 Warning of refugee movements

Civil unrest or war in one country should alert the relevant authorities of neighbouring countries that an influx of refugees is possible. Several weeks' or even months' warning may be provided. Arrangements can then be made to receive and accommodate refugees, especially where there has been a prior history of cross-border movements and where food, medical supplies, blankets and tents or tarpaulins have been stockpiled (United Nations High Commissioner for Refugees, 1999).

If any generalization is possible about the full range of warning systems, it would be that social and political receptivity to warnings lags behind the technology that provides them. Often the warning messages are passed from one government agency to another without ever being transmitted to the population who need them. It is also fair to say that community participation in warning systems has not been adequately fostered. In addition, existing national warning systems often involve the provision of information by a variety of government departments or even by nongovernmental agencies, other countries (in the case of international river systems and refugee movements), or international agencies (especially regarding weather forecasting and famine early warnings). Integration of this information in a timely and concise way is vital if the decision to issue a warning is to be effective.

3.8 Further information

For further-information on:

- health assessment of projects and investments, see: Lee (1985), Birley (1991, 1992, 1995);
- urban development and health, see: World Health Organization (1987a), Hardoy & Satterthwaite (1989), Tabibzadeh, Rossi-Espagnet & Maxwell (1989), World Health Organization (1991a), Bradley et al. (1992), World Health Organization (1992b), International Institute for Environment and Development (1993), Satterthwaite et al. (1996), United Nations Commission on Human Settlements (1996);
- rapid appraisal in health planning, see: White (1981), Werner & Bower (1982), Annett & Rifkin (1989), Organisation Mondiale de la Santé (1989), Scrimshaw & Hurtado (1989), Manderson, Valencia & Thomas (1992), von Kotze & Holloway (1996);
- rapid appraisal in environmental management, see: Hope & Timmek (1987), Raintree (1987), Chambers, Pacey & Thrupp (1989), Cullis & Pacey (1992), Hiemstra, Reijntjes & van der Werf (1992), and Kumar (1993);

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- hazard mapping, see: Foster (1980), United Nations Office of the Disaster Relief Co-ordinator (1991), Smith (1992), Collins (1993), de Lepper, Scholten & Stern (1995), Waugh (1995);
 - community emergency preparedness, see: World Health Organization (1999a);
 - warning systems, see: United Nations Office of the Disaster Relief Co-ordinator (1984), Drabek (1986), United Nations Office of the Disaster Relief Co-ordinator (1986), Walker (1989), Dymon & Winter (1993).