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# EPIDEMIOLOGY AND SANITARY ACTION

## Table of contents

1. **Introduction** .................................................. 1

2. **Risk factors in the spread of communicable diseases after a disaster** .............. 2
   2.1 Social and psychological reactions ........................................ 2
   2.2 Communicable diseases .................................................. 2
   2.3 Population displacement ............................................... 3
   2.4 Food and nutrition .................................................... 3
   2.5 Disruption to health services and hygiene programmes .................. 3
   2.6 Shortage of diagnostic laboratories .................................... 3
   2.7 Inadequate vaccination cover .......................................... 3

3. **Establishing monitoring systems** .................................. 4
   3.1 Information sources for epidemiological monitoring in the event of a disaster ....... 4
   3.2 Diseases to be included in the monitoring system .......................... 4
   3.3 Data collection and analysis ........................................... 5
   3.4 Feedback to outlying units ............................................ 6

4. **Operational aspects of the control of communicable diseases after a disaster** ...... 7
   4.1 Investigations in the field to check rumours or reports of communicable diseases .... 7
   4.2 Validation of the results of epidemiological investigations and confirmation of diagnoses .... 8
   4.3 Monitoring activities during and after the recovery period .................. 8

5. **Controlling communicable diseases after a disaster** ................................. 9
   5.1 Environmental health .................................................. 9
   5.2 Vaccinations ....................................................... 10
5.3 Drug therapy ........................................ 11
5.4 Quarantine and isolation ............................... 12

6. The main elements of good management ........... 13
  6.1 Procedures to follow ................................ 13
  6.2 The sequence of emergency measures ............ 13

7. Action prior to a disaster to safeguard environmental health ............................... 15
  7.1 Emergency programme to safeguard environmental health .................................. 15
  7.2 Safety measures ...................................... 16
  7.3 Damage to buildings and infrastructure ............ 16
  7.4 Water and food contamination ...................... 17
  7.5 Disruption to energy supplies ....................... 17
  7.6 Organising the staff and the local population ...................................................... 18

8. Measures to be taken during and after a disaster ............... 18
  8.1 Standby period ....................................... 18
  8.2 Impact period ........................................ 19
  8.3 Post-disaster period .................................. 19
  8.4 Water supply ........................................ 19
  8.5 Environmental sanitation ............................ 21
  8.6 Accommodation centres .............................. 21
  8.7 Food hygiene ......................................... 22
  8.8 Anti-vector control ................................... 22
  8.9 Personal hygiene ...................................... 23
  8.10 General information for the population at large .............................................. 23
  8.11 Stabilisation period .................................. 23
  8.12 Submitting the inventory of requirements to the aid organisations .................... 24
  8.13 Receiving aid (donations) ........................... 24
  8.14 Aid distribution (donations) ........................ 24
  8.15 Setting up accommodation centres for displaced persons .................................. 24

9. Rehabilitation activities ................................ 24
  9.1 Restoration of on-going priority environmental health monitoring services .... 24
  9.2 Water quality ......................................... 25
  9.3 Food supplies ......................................... 25
1. Introduction

A great many natural disasters cause numerous deaths and have major social, epidemic, environmental and other consequences. In fact, the devastation of the environment brings about an abrupt change in living conditions, harms individuals and reduces the level of health amongst the population. Frequently, people are obliged to live in overcrowded circumstances and rudimentary hygiene conditions that may possibly trigger epidemics.

Every disaster is unique, in the sense that the region affected has distinct social, medical and economic characteristics. Disasters do, however, have some common features, the identification of which will enable emergency aid and the use of resources to be well planned. In this connection the following points must be taken into consideration:

- There is a relationship between the nature of a disaster and its effects on health, particularly with regard to injuries arising directly from it: as a rule, earthquakes cause more injuries requiring medical care than do floods and tidal waves.
- Some effects constitute potential but avoidable health risks. For example, population movements and other changes to the environment can increase the risk of diseases spreading. Generally, disasters do not, however, lead to epidemics.
- The real and possible risks to health in the wake of a disaster do not all materialise at once: They do so at different times and vary in significance within any one stricken region. The injuries are mostly the result of the cataclysm itself and they require immediate medical care, whilst the growing risk of the spread of diseases arises from the overcrowding and ill-health which appear only later.
- The food, shelter and primary care requirements resulting from the catastrophe are usually limited. In fact, displaced persons rarely leave without taking basic essentials with them. Furthermore, the victims generally recover quite quickly from the initial shock and take part spontaneously in search and rescue operations, transportation of the wounded and other emergency activities.

To be effective therefore, the management of emergency health-care operations must anticipate problems, recognise them when they appear and bring equipment that is suited to the job to be done when and where it is wanted. Transporting large amounts of equipment and personnel to the disaster zone is of less importance.

No country is safe from natural disasters. In the short term these entail loss of human life, and in the long term risk slowing down national social and economic development processes.

Preparation for disasters now forms a major element in national health policy. The best preparation for mitigating the consequences of natural disasters is to secure community participation in the health system.

This module has thus been prepared for the purpose of training the population at large in epidemiological monitoring following a disaster. The aim is to:

- draw attention to the consequences of disasters on people’s health
- provide the necessary information for monitoring and controlling diseases
- serve as a basis for drawing up national monitoring and disease control programmes within the local context

It has to be pointed out that this module, following as it does a series of publications on disasters, does not claim to be a scientific document of an academic nature. It has been prepared to enable the different disaster intervention agencies to anticipate and evaluate the epidemiological risks to the population, adopt preventive measures and if necessary be aware of the risks and act accordingly.
2. Risk factors in the spread of communicable diseases after a disaster

2.1 Social and psychological reactions

A major disaster is rarely followed by a reaction of general panic or total paralysis on the part of the survivors. There is more likely to be spontaneous but organised individual activity, in that the disaster victims tend to recover from the initial shock and set to work resolutely and with a clear goal in mind. In the first few minutes following an earthquake, the survivors often organise rescue operations and, a few hours later, form themselves into groups to ensure that the wounded are transported to first aid posts. Anti-social behaviour such as generalised looting occurs only in exceptional circumstances.

Rumours of all sorts may circulate, especially concerning epidemics. As a result the authorities sometimes have to undertake emergency activities such as mass vaccination against typhoid and cholera, without any real justification. Furthermore, the disaster victims may be reluctant to comply with the safety measures judged necessary by the authorities. The inhabitants of a region threatened by aftershocks or flooding usually react unfavourably to any request to evacuate the area even if their house has been or is at risk of being destroyed completely.

Two consequences arising from such behaviour are significant for those in charge of the rescue operations:

• Behaviour patterns can be modified and requests for aid kept to a minimum if, immediately prior to the launching of major relief operations, people are informed about how the situation is evolving.

• The people themselves will undertake most of the rescue activities and first aid (such as transportation of the wounded, construction of temporary shelters). The additional resources must then be used to address unmet needs.

Anxiety, neurosis and depression are health problems which crop up after a disaster. In this connection, mutual support amongst families and communities is an essential weapon in reducing the severity of such mental health problems. As far as is possible, every attempt must be made to preserve social, family and community structures. The use of sedatives and tranquillisers as part of the emergency aid process is extremely ill-advised.

2.2 Communicable diseases

Disasters do not usually cause outbreaks of infectious disease although, in certain circumstances, the risk of diseases is being passed on increases. The most frequently observed diseases are caused by faecal contamination of water and food and are, as a result, predominantly intestinal.

The risk of an epidemic increases in proportion to the \textit{density} and \textit{movement} of the population, these being two factors which affect:

- the availability of water and food
- the likelihood of contamination
- the scope for maintaining or re-establishing regular hygiene programmes

It is worth noting that it is difficult to evaluate the effect of disasters on the incidence of communicable diseases, especially in developing countries. Several factors can play a part, depending on the epidemiological situation, the level of social and economic development and the extent of the health infrastructure.
2.3 Population displacement

Population exodus from the disaster areas can increase the risk of disease being passed on. Population displacement, for example, exposes people to diseases that are not prevalent in their own area. Likewise, these people can also be the means whereby communicable diseases are introduced into the area where they are offered refuge. Emergency aid is essential whenever populations are displaced.

2.4 Food and nutrition

There can be two reasons for food shortage following a catastrophe: either the destruction of food reserves in the stricken region or disruption of the distribution system which hinders access to food supplies. It is worth noting that it is unusual for earthquakes to be followed by a general food shortage serious enough to cause nutritional problems. Floods and tidal waves, however, often destroy harvests and food reserves. They also disrupt distribution systems and cause serious local shortages. Food distribution is then an urgent short-term need.

2.5 Disruption to health services and hygiene programmes

Disruption to essential health services (vaccination, anti-tuberculosis measures) and hygiene programmes (sewage, anti-carrier measures) is common when disasters occur. In developing countries such disruption increases the probability of diseases being passed on. The level of risk depends on the severity and duration of the disruption.

2.6 Shortage of diagnostic laboratories

Laboratories play a fundamental role in confirming cases of communicable diseases. The incidence of diseases can be wrongly estimated if it is based on chemical diagnoses by doctors.

2.7 Inadequate vaccination cover

The probability of the occurrence of diseases which can be prevented by vaccination depends on the proportion of the population with natural immunity and the proportion of vulnerable, non-vaccinated people. After a disaster hasty vaccination programmes must be avoided. What matters is to vaccinate the children before any disaster occurs, and then once a disaster has occurred, the risk of an epidemic depends on the level of vaccination coverage.
3. Establishing monitoring systems

Disease monitoring means primarily gathering information essential to the planning, execution and evaluation of health activities. Those in charge of monitoring programmes receive information from both official and informal sources, the basic medical and paramedical staff being the official sources of information.

3.1 Information sources for epidemiological monitoring in the event of a disaster

In order to set up a system to monitor communicable diseases and plan disease control after a major disaster, knowledge of the epidemiological situation prevailing in the stricken area prior to the disaster is necessary.

The first principle is to make maximum use of the monitoring data already available, and, on the basis of this, adapt the epidemiological monitoring systems to the conditions created by the disaster.

It is also important to emphasise the need to integrate post-disaster monitoring with activities carried out under normal circumstances.

As a rule, after a disaster the authorities in charge of emergency aid set up an independent monitoring and evaluation system.

It is, however, important for epidemiologists engaged in emergency aid operations to familiarise themselves with the epidemiology of the endemic diseases and to understand the national monitoring system. Since several weeks or months can elapse between a sudden disaster and the incubation of epidemics of communicable diseases, epidemiologists will have more than enough time to assimilate the available data and anticipate the problems.

Immediately setting up a monitoring system in a disaster area is pointless. The official information systems must be exploited to the maximum.

Even when the telecommunications systems are disrupted the information coming from the affected areas gets around quickly by official and unofficial means. An additional monitoring system can be organised with the help of emergency aid workers.

3.2 Diseases to be included in the monitoring system

Disasters bring particular problems. The number of diseases to be monitored must be limited. Surveillance must be more flexible and based more on a whole range of symptoms than on confirmed diagnoses.

Reliable chemical criteria are required for the diagnosis of the main communicable diseases, in order to reduce diagnostic errors and to allow comparison of the data provided by the monitoring units (fever + conjunctivitis + outbreaks of measles). The selection of diseases to be monitored, and the chemical criteria for the definition of notifiable cases must be worked out by the epidemiologist in the stricken country in collaboration with those co-ordinating the emergency aid.

Epidemiological monitoring at times of disaster often includes the notification of non-communicable diseases, burns, trauma and malnutrition etc., all of which are useful to the emergency aid organiser and make it possible to control the longer-term effects of disasters.

Forms based on chemical criteria are used to notify chemical syndromes and the non-communicable diseases. They provide additional information (for example, age) that is necessary to the monitoring process after the disaster.
3.3 Data collection and analysis

After a disaster, units on the ground must participate as fully as possible in the monitoring system. Motivating the units responsible for notification is essential. Those units in existence before the disaster must take part in the monitoring and also notify the diseases or syndromes for the purposes of specific post-disaster monitoring.

Emergency aid teams have to be aware of the importance of monitoring. They have to know the case definitions and have available an adequate number of notification forms. The epidemiologist must give monitoring instructions before the teams move into the field. In practice, however, and especially in connection with controlling rumours of epidemics, the monitoring system gets under way once the emergency aid teams are in position. The epidemiologist’s rounds in the field have an excellent psychological effect as well as they also enable information to be brought back and stimulate the notification process.

It is worth emphasising two aspects relating to data collection. Firstly, it is important to send regular reports, even if the unit has not seen any patient suffering from a communicable disease. A report confirming the non-existence of notifiable cases provides valuable information. It also affords an evaluation of the number of units participating in the monitoring system. Not sending a report can mean either the absence of disease or that the unit in question is no longer taking part in the monitoring, but there is no way of telling which it is.

Already a significant factor in communicable disease monitoring under normal conditions, speed of notification becomes vital after a disaster. Postal and telephone services are probably disrupted or working badly. As a general rule, it is best if the units communicate their information weekly by post. Immediate notification of abnormal conditions or of a suspected epidemic must be encouraged. Clear instructions have to be given to the staff in the field so that they are able to communicate with the epidemiologist at central headquarters.

The epidemiological services have to devise rapid means of conveying information when transport and communications are disrupted. This assumes that there are liaison officers within the emergency aid teams. The aid co-ordinator and the national authorities must be made aware in advance of the importance of the monitoring. Certain procedures have proved to be particularly useful when disasters occur, notably:

- a daily or weekly radio broadcast by the field units providing information on the incidence of communicable diseases and the distribution and collection of forms by the people who are distributing medication and/or food
- access to the security services’ communications network
- inclusion of the monitoring in the general report to the aid co-ordinator
- regular rounds in the field by the epidemiologist or the monitoring team

It is essential that the units responsible for registering notifiable diseases are aware of their responsibilities, that they analyre and assemble the information and draw conclusions from it.

Rather than fulfilling a bureaucratic function, the epidemiologist must be a leader and help the units responsible for registering notifiable diseases to work in a uniform and effective way. The epidemiologist must also be attentive to requests coming from the units in the field. They must be able to consult him on diagnosis, treatment, investigations in the field and measures to control communicable diseases. It is his job to supervise such activities.

If the monitoring is well organised, it is inconceivable that cases of measles or serious diarrhoea would be notified by post. When that happens, the situation becomes uncontrollable even before the epidemiologist has been warned about it.
As soon as they are received, the epidemiological unit must check all notifications. This practice enables an immediate response to rumours and unexpected notifications (for example: typhus, rabies) and a comparison of the notifications with those pre-dating the disaster. It also allows changes to be detected in the incidence of certain endemic diseases, such as diarrhoea or acute respiratory disorders.

Setting a deadline for weekly analysis of the reports is essential to enable evaluation and rapid responsive action.

To summarise, epidemiologists and emergency aid organisers must realise that, if they organise a really good post-disaster monitoring process, it will reveal an increase in the incidence of communicable diseases. Such an increase can be real or fictitious. Some reports may indicate an increase in the incidence of a disease and demand investigation in the field. Nevertheless, regardless of the analytical efforts made, it may be that no conclusion can be reached regarding a real increase.

There are, however, three ways of evaluating the validity of observations.

### 3.4 Feedback to outlying units

Feedback is an essential element in post-disaster monitoring because it encourages the new units to collaborate in the system. It also encourages those who did not participate in the pre-disaster monitoring to do so in the post-disaster situation. When they arrive in the field, aid workers are not familiar with monitoring, and even if they are, many of them give priority to emergency care rather than to preparing daily or weekly reports.

Efforts to ensure feedback encounter many obstacles: limited diagnostic opportunities, not enough epidemiological personnel, communication and transport difficulties, and possibly limited access to facilities such as helicopters, radios and duplicating machines.

The main element in feeding back information to staff in the field consists of distributing the weekly reports. Since few aid workers have any basic knowledge of epidemiology, comments, documentation and illustrations must be attached to the reports.

A way of distributing the reports in the field has to be devised. For example, they could form part of the distribution of aid or personal mail to aid workers.

The weekly report brings more than mere information to the teams in the field. It is also aimed at the aid co-ordinator (it is a good idea to include a letter for him, or to visit him personally), the national authorities and the local representatives of voluntary agencies. The aid co-ordinator should take responsibility for distributing these reports to the media representatives and to the public.
4. Operational aspects of the control of communicable diseases after a disaster

The following major aspects must be considered:

- investigations in the field to check rumours or reports of communicable diseases
- access to laboratories for the confirmation of diagnoses and the validation of investigation results
- presentation of epidemiological information to the decision-makers
- monitoring activities during and after the recovery period

4.1 Investigations in the field to check rumours or reports of communicable diseases

Rumours and unconfirmed reports often abound after a disaster. During recent disasters, the fact that epidemiologists have immediately been involved as part of the emergency aid teams has enabled them to make some sense of rumours. There are two reasons for this. Firstly, a rapid analysis can be done before the situation gets completely out of control. Next, national authorities can be informed about how to understand and check rumours.

Epidemiological staff involved in emergency relief must expect rumours and reports, fanciful or not, and know how to respond to them. They must nevertheless take account of rumours coming from varied sources. The easiest to check are reports received directly by the epidemiological teams in the field or the epidemiologists during their rounds. The hardest are those spread by the media, or given directly to the political authorities.

The safest and most effective way to handle rumours, whatever their origin, is to set up a monitoring system. To confirm or quash a rumour, to assess the size of the problem it reveals, the epidemiologist and his team will endeavour to contact field units by radio. A denial will often assuage the curiosity of the media and reassure the political authorities and aid agencies, particularly if it is accompanied by the assurance that investigations will be repeated and information will be issued.

The field units taking part in the monitoring system have to realise that they must in future convey any rumour to the epidemiologist at central headquarters or to the co-ordinator. Avoiding the systematic denial of rumours inspires confidence and reassures the public. If the media are convinced that all rumours are checked out, they will delay publication of them until they have been discussed with the authorities.

In most cases, rumours of post-disaster epidemics are not confirmed. However, the epidemiological team must never dismiss rumours without consulting all the outlying units and without undertaking investigations on the spot, if necessary. It may be that rumours have to be categorised on the basis of the seriousness of the underlying health problem and its political implications, because there may be insufficient staff to check them all out. When the epidemiologist at central headquarters is not satisfied with the way in which the local staff checks rumours, he must immediately send a team out into the field. During the course of international emergency aid operations, it is the responsibility of the local epidemiologists to handle such investigations.
4.2 Validation of the results of epidemiological investigations and confirmation of diagnoses

When, in the course of investigating a rumour, the epidemiologist discovers patients with symptoms compatible with the suspected disease, he must take samples so that the diagnosis can be confirmed. These samples must be handled according to the rules and taken to a competent laboratory, where they will be examined as a matter of urgency. Laboratory tests must be carried out so that seemingly increasing symptoms or syndromes (for example, diarrhoea accompanied by high temperature) can be documented. This will allow appropriate public health measures to be taken and treatment guidelines to be defined.

For certain notifiable diseases, confirmation of the diagnosis by means of swabs taken from a sample of patients is essential. There are four reasons for this. In the first place, notifiable communicable diseases cannot always be firmly diagnosed on the basis of clinical criteria. There is a greater risk of wrong diagnoses in times of disaster, because doctors sent by other countries are not used to dealing with tropical or communicable diseases. Furthermore, local doctors in the disaster area can overlook recently imported diseases.

Next, public health laboratories are an essential element in controlling communicable diseases.

To determine the (necessary) treatment, it is essential that the agent responsible for an epidemic or a high incidence of a communicable disease is identified by laboratory analysis.

Lastly, a confirmed diagnosis constitutes a strong argument for justifying requests for special products, antibiotics, vaccines and serums, deciding how they are to be distributed and planning supply routes.

The diagnosis of internationally notifiable diseases, or those being monitored, requires systematic confirmation.

Common disorders (febrile diarrhoea) spread like epidemics. They too must be confirmed by examining a sample of the population. Laboratory diagnosis is less important in the treatment of individual cases. When there has been a disaster, the authorities will have to requisition hospital and private clinic laboratory services and establish priorities according to the diseases prevalent amongst the people, not according to isolated clinical cases.

4.3 Monitoring activities during and after the recovery period

After a disaster, when the situation is returning to normal, the authorities and the public worry less and less about the danger of epidemics. The initial keenness fades and many emergency aid organisations bring their activities to a close. Communication and transport, health services and the system for notifying diseases are progressively restored. However, the decision to discontinue intensive monitoring activities in connection with the disaster should be taken only after consultation with national epidemiological services.

In certain situations, for example in permanent refugee camps, such special monitoring will sometimes have to be maintained permanently.

In rural or remote areas, discontinuing intensive monitoring can lead to the end of all notification. In the rare cases where it has been tried, maintaining the monitoring has not provided the anticipated results. However, it must be recognised that such attempts have never been considered priorities and have received scarcely any support, economic or otherwise, from the authorities in the countries concerned or the development organisations.
5. Controlling communicable diseases after a disaster

The strategies for controlling communicable diseases that are effective under normal conditions are usually effective in disaster conditions as well. The twelfth and thirteenth editions of the manual “Prophylaxis of communicable diseases in humans” are very useful summaries, providing a synopsis of measures to be taken, disease-by-disease. Nevertheless, the situations caused by disasters often have distinctive characteristics, which will be dealt with in this chapter. For reasons of simplicity the chapter will be divided into four sections:

- environmental health
- vaccinations
- drug therapy
- quarantine and isolation

5.1 Environmental health

Post-disaster environmental health measures are aimed at maintaining minimum levels of hygiene, and involve disposal of excreta, the water supply, personal hygiene, food distribution, vector control, burial of victims and construction of shelters.

Lack of time, staff and resources mean that priorities have to be established. These will be determined according to pre-disaster conditions, cultural factors, the well being of the people and the risks to public health, such as an epidemic.

In general, environmental health efforts are in proportion to the pre-disaster level of health and hygiene. Emergency aid operations are of limited duration. The temporary aspect of emergency aid makes any attempt at installing permanent plumbing and toilet facilities or establishing water or food supplies impossible, if they have been seriously damaged during the disaster or were non-existent before it occurred. People living in rudimentary health conditions cannot be taught how to use latrines, wells or sanitary facilities correctly in so short a period of time.

Rural population that are routinely exposed to communicable diseases have a certain level of immunity. They run less risk, when sanitary facilities are lacking, of contracting a contagious disease than do the inhabitants of an industrialised community with water and electricity supplies. Environmental health problems in refugee camps, whether the country is poor or not, must always receive the closest attention.

As regards environmental health, epidemiologists must realise that the priorities established by those in charge of emergency aid are not always directed at the control of communicable diseases.

The initial efforts of those in charge of environmental health are focussed on the construction of shelters, waste disposal, water supply and burial of corpses. They pay less attention to vector control, food safety and personal hygiene. Yet these are essential to prevent the transmission of infectious diseases. Implementing such measures after disasters, particularly in the poorest countries, is hampered by the absence of competent staff at all levels.

Human corpses and animal carcasses have rarely given rise to epidemics of communicable diseases after a disaster. Health problems aside, it is important to bury corpses in a manner which shows respect for the customs and practices of the local population. Besides, more often than not, the stench of rotting carcasses which have been inadequately buried, or not at all, soon becomes unbearable.
Environmental health measures taken to prevent the transmission of infectious diseases often fail for technical reasons. For example, water chlorination with or without filtering, is not an effective means of destroying protozoans such as Giardia lambia. Water purification tablets (such as Globaline and Halazone) destroy enteric bacteria, amoebas and certain viruses, but do not eliminate them all. The large-scale distribution of water purification tablets after a disaster has been shown to be ineffective amongst people unfamiliar with their use and is therefore not recommended as a routine measure. To swallow these tablets on the mistaken assumption that they are medicines is to risk accidental death. On the other hand, these products can be used successfully for purification purposes amongst better-informed groups such as emergency aid workers, the military, civil servants, etc.

Too often vector control measures are directed at harmful insects in general rather than the vectors of diseases which can be transmitted to humans. Pesticides are used on vegetation to eliminate troublesome mosquitoes (Gulex for example) rather than malarial (anopheles), dengue fever or yellow fever (Aedes aegypti) vectors. In areas where houseflies have acquired a certain resistance, excessive quantities of pesticides are sometimes used, when the collection and disposal of excreta and refuse would be much more effective.


5.2 Vaccinations

Formerly, when a disaster occurred, emergency vaccinations of the entire population against typhoid fever, tetanus and cholera were advocated, and mass vaccination campaigns were hastily organised. Nowadays such measures are considered dangerous. This change in attitude is based on scientific and practical arguments.

Nevertheless, in the minds of the public and politicians, mass immunisation remains one of the first steps to take after a disaster.

Consequently, it is sometimes difficult to withstand pressure of opinion.

The Pan-American Health Organisation (PAHO) has reviewed the scientific reasons for the inappropriateness of mass vaccinations. The reasons are as follows: epidemics of communicable diseases are rarely attributable to a disaster, even in non-vaccinated populations. The vaccines currently available require two or three injections at intervals of two to four weeks. Vaccines against typhoid, paratyphoid fever and cholera provide only partial and temporary protection (several months) - as yet there are no effective vaccines against the most common communicable diseases.

These include food poisoning due to bacterial toxins, salmonella, non-specific diarrhoea, infectious hepatitis and influenza in particular.

The clinical symptoms of infectious hepatitis can be relieved by gammaglobulin injections, but these prevent neither infection nor transmission. Also, this method is too expensive to be contemplated in developing countries.

Influenza vaccination must be given only to the elderly, patients suffering from debilitating chronic conditions staff providing basic services. It should be given before the illness surfaces in the community. Vaccination against influenza affords a high level of protection provided that the antigen is specific.

Gammaglobulins and anti-influenza vaccine are not recommended for mass vaccination after a disaster.
Experience has demonstrated that vaccination campaigns are difficult to organise immediately after a disaster. Furthermore, they compromise the general relief effort without bringing any appreciable benefit. To be effective, mass vaccination requires advance planning. Communications and transport have to be provided and the people have to be present. These conditions cannot always be met immediately after a disaster. The investment required is disproportionate to the results and detrimental to other activities. Furthermore, certain vaccines, particularly those that are sensitive to heat (yellow fever, measles and poliomyelitis) are difficult to handle and store. This can result in waste or even the use of ineffective vaccines.

Primary vaccination of young children must be considered whenever people are accommodated in camps for more than thirty days. Older children must be given boosters at the correct time. As regards the strategy and the age groups to be vaccinated, the instructions in the extended vaccination programme (PEV) must be followed. This provides procedures for vaccination against diphtheria, pertussis, tetanus, poliomyelitis, measles and tuberculosis (by means of BCG). Refrigeration must be available to make the evaluation of immune coverage possible.

Vaccination can be given at the same time as the health check when individuals are admitted to a camp. It can continue as part of primary health care. In camps, vaccination must be limited to vulnerable groups, i.e. young children and women of childbearing age. These people will be vaccinated against tetanus only.

Older children and adults must not be systematically vaccinated. For the most part they are actually already protected because they have natural immunity. This strategy enables the logistical problems associated with mass vaccinations to be lessened.

Nevertheless there are certain exceptions. Isolated population groups rarely exposed to diseases such as measles, poliomyelitis and influenza must be protected. This applies in particular to the inhabitants of small islands or groups of mountain-dwellers when they are moved to camps.

Vaccination can be useful amongst aid workers, to protect them from diseases endemic in the disaster area (poliomyelitis vaccine, measles vaccine and immune serum globulin). Vaccinating aid workers means that key staff is protected. The required vaccinations for volunteer aid workers from industrialised countries are the same as those recommended for other international travellers. Generally these are completed before departure for the disaster area. If it is not possible to complete the vaccinations in time, second or booster doses are administered in the field.

Manuals on vaccination practice and refrigeration can be obtained from PAHO and WHO.

5.3 Drug therapy

Large-scale distribution of anti-infection medication to disaster victims is not recommended. The scientific justifications for this are as follows:

- antibiotics are ineffective against viral illnesses such as influenza, hepatitis and colds
- no antibiotic administered on its own provides protection against bacterial illnesses or rickettsia
- to prevent infection, antibiotics have to be taken indefinitely
- anti-infection medication can cause allergic reactions and secondary toxic effects which may even lead to death
- uncontrolled use of antibiotics can end in the development of resistant microorganisms, in particular relating to enteric bacteria.
Furthermore, as regards antibiotic resistance transmitted by plasmids, this is not restricted to the antibiotic administered but extends to many other antibiotics. Finally, there are more compelling reasons for avoiding the widespread use of anti-infection medication, and these are the logistical and manpower constraints already mentioned in connection with mass vaccination after a disaster.

For these reasons, the prophylactic administration of antibiotics or sulphonamides for diarrhoea and routine antibiotic therapy for simple infections is inadvisable. Malnutrition and multiple intestinal parasitoses, rife in the tropics, are often cited as reasons for giving infants antihelminthic drugs. Unfortunately one of the cheapest antihelminthic drugs, piperazine, is of limited use against Ascaris lumbricoides. Broader-spectrum antihelminthic drugs, such as thiabendazol and mebendazol, cause toxic reactions which are too serious for indiscriminate use to be recommended amongst asymptomatic subjects, and they are also much too expensive.

As a general rule, we do not resort to drug prophylaxis for malaria in regions where it is prevalent. The local population is actually immune, and administering medication could reduce this immunity. Besides, community-scale drug prophylaxis cannot be maintained once the emergency aid teams have gone. Large-scale curative treatment is also inadvisable amongst displaced people when they come from holoendemic areas. It has been demonstrated that eliminating subconscious infections reduces acquired immunity and makes patients more vulnerable to illness when they return home.

Mass administration of single parenteral doses of penicillin in communities where there are cases of framboesia (Treponema pertenue) is justified because it is the only universally accepted indication for mass drug therapy. Nevertheless in emergency situations, logistical constraints, excess work for the health services and manpower shortages make such an undertaking difficult.

**5.4 Quarantine and isolation**

The manual entitled “Prophylaxis of communicable diseases amongst humans” summarises quarantine and isolation measures for patients and contacts. The CDC (Center for Disease Control, Atlanta, USA) guide entitled “Isolation Techniques for Use in Hospitals” deals with methods for reducing the spread of diseases in hospitals. Unfortunately, in Latin America and the Caribbean, programmes for controlling hospital infections are rudimentary and cannot, as a general rule, even under normal conditions, reach the standards laid down in this guide. Following a disaster, it may be that disruption to the water and electricity supplies makes compliance with even basic safety measures difficult (washing hands, disinfecting, identifying bacterial strains).

In Latin America and the Caribbean the level of infection in teaching hospitals reaches 50% under normal circumstances. In the paediatrics sector the prevalence of gastro-enteritis has been recorded as exceeding 100%. So a child not suffering from diarrhoea on admission will have had at least one attack before leaving hospital. Those in charge of international emergency aid must be aware of the lack of effective programmes for controlling hospital infections when they evacuate victims to hospitals. A regional programme to combat hospital infections is currently being implemented by PAHO.
6. The main elements of good management

6.1 Procedures to follow

When a disaster occurs, appropriate measures have to be taken to prevent environmental degradation, maintain operational health services and ensure normal living conditions for the community. Steps must be taken to safeguard environmental health before and immediately after the disaster and, as far as possible, during it. At all times, allocating priority to these measures depends not only on what is technically possible and on available resources, but also on the capacity of each measure to restore pre-disaster conditions.

In deciding how to proceed, account has to be taken of the priority areas, and decide on an order of priorities in respect of sanitation and the availability of staff. Determining the priority areas is largely dictated by the presence or absence of the disease risk in the areas sheltering disaster victims. Particular attention must be paid to peripheral areas around urban centres and temporary accommodation centres.

Absolute priority must go to the services essential to maintaining individual well-being in vulnerable areas and to engaging the active collaboration of all.

Some services are essential and must be ensured:

- adequate shelter for displaced persons
- sufficient drinking water and easy access to it
- facilities for the disposal of effluent and excreta
- food safety measures to prevent contamination
- people in disaster areas must be protected from diseases spread by vectors through the use of anti-vector control and drug prophylaxis

Lack of skilled health care staff can limit emergency intervention after a disaster. Therefore it is essential that local experts participate. Because of their knowledge of the pre-disaster conditions and of the social and economic conditions of the disaster areas and, even more important, their experience of working in conditions similar to those prevailing in the disaster-hit areas, they are generally better prepared for dealing with emergency situations. Foreign experts often cannot meet these requirements, and their inexperience can undermine the success of emergency relief work. It is well to be aware of this when engaging foreign experts.

6.2 The sequence of emergency measures

Planning environmental health measures must be done in three major phases which will be described here, together with recommendations as to when to implement the measures and the duration of each phase. This will, however, vary according to the situation created by each disaster.

**The first phase:** consists of measures to be taken before the disaster and designed to create and maintain a state of readiness for dealing with a disaster. It must be developed in vulnerable areas in particular, i.e. areas which have already experienced disasters and those where there is potential for disaster.

**The second phase:** begins when the disaster occurs and generally finishes seven days later. Environmental health protection measures are implemented, if possible during the disaster and immediately afterwards. This phase is broken down into two sub-phases: immediate measures, implemented in the first three days after the event and reinforcement measures, undertaken as soon as the first are completed.
The third phase: is the restoration and rehabilitation of the environment. Defining rehabilitation measures must be done as soon as the second phase measures are being implemented. As with the preceding phase, the third phase measures break down into two parts: short-term measures aimed at restoring basic health conditions and environmental health services to pre-disaster levels, and long-term reconstruction measures consisting of all the stages necessary to improve the environment and the functioning of the environmental health services, which take much more time.

All the measures in phases 2 and 3 should be undertaken in the three weeks following the disaster, apart from the long-term reconstruction work. A schedule for completion of such measures is suggested in Table 1.

The matrix (Table 1) can be used to help prioritise response activities in an emergency. It describes the needs of victims (not agencies) for the various stages in an emergency in those cases where there has been significant population displacement in a developing country. The time frame indicates the maximum time it should take to have the basic elements of particular service in place. In a developed country, the time frame will probably be shorter and may contain different emphasises, but the needs will be basically the same.

Table 1

<table>
<thead>
<tr>
<th>Stage</th>
<th>Time-frame</th>
<th>Services</th>
<th>Health sector Priorities</th>
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| Immediate      | First 24 hours | Search and rescue (SAR)  
Food  
Water  
Public information | Triage  
First aid  
Acute medical and surgical services |
| Short-term     | One week    | Security  
Environmental health services  
Energy (fuel, heating, light) | Epidemiological surveillance  
General curative care services  
Control of diarrhoea and acute respiratory diseases  
Nutritional surveillance  
Care of the dead  
Providing Vitamin A supplements and measles vaccination may sometimes be priority in this phase |
| Medium term    | One month   | Protection (legal and physical)  
Transport  
Communication | Restoration of preventive health care such as EPI, MCH, etc.  
Health information system |
| Long term      | Three months | Education  
Agriculture  
Employment  
Social services  
Environmental protection | Rehabilitation  
Training  
Health information and health education programmes |
7. **Action prior to a disaster to safeguard environmental health**

Most natural disasters are unforeseen and the period of warning, during which preventive measures may be possible, is very short, or non-existent. At best, using present-day technological means, we can predict an imminent disaster no more than a few days in advance of the event.

Often, warning signs are evident only moments before the disaster is unleashed and, as a result, the only effective way to react is to establish a preventive strategy in vulnerable areas.

The first aim of environmental health measures prior to a disaster is to eliminate, or at least reduce, the risks of destruction to the environment in the areas which will be affected. For this to succeed, during the standby period, an action plan must be established in order to monitor environmental health, take routine steps to safeguard environmental health and develop an education and information programme for the health care staff and the entire population.

7.1 **Emergency programme to safeguard environmental health**

Effective responses to disasters depend in large measure on planning emergency operations to safeguard environmental health. Once completed, this planning should, as a general rule, be reviewed every 5 to 10 years. A revision will probably be necessary in the light of experience acquired after a disaster. There is little point in an emergency plan consisting of pious hopes: it must consist of a clear, simple and logical decision as to who does what, when using the available resources as soon as a disaster strikes.

The plan must indicate the guidelines and priorities to be followed, whilst avoiding tedious descriptions of the functions and roles of each individual, not with the intention of minimising the role of individuals within the organisation but because, more often than not, individual roles do not materialise until a decision has been taken on the best way to use the available resources in the individual circumstances of each disaster.

The general plan consists of a guide explaining how to co-ordinate all the work to be undertaken by the staff of the various environmental health and other services as soon as an impending disaster is announced (or one has occurred). Within this framework, individual plans have to be worked out for water supplies, the road network, etc. The overall disaster management plan can then be drawn up by combining these individual plans.

The overall plan has seven basic components. The first is an estimate of the extent of the damage an area would suffer were it to experience a certain type of disaster. The three subsequent components demonstrate how to estimate the resources which would still be available after the disaster, how to calculate the needs of the stricken communities and finally, how to meet these needs with the available resources. In order to determine the emergency work to be undertaken during the standby period, if there is one, immediately after the event and finally in the rehabilitation phase, it is helpful to base plans on an inventory of supplies, equipment and staff and on an estimate of the extent of the destruction.

The three last components of the emergency plan are put in place after the disaster has struck. These stages together form the complete emergency plan. This plan must contain a schedule of priority services to be provided and, meeting the specific needs of a community (e.g. food, shelter, water and first aid, before measures relating to individual health). It must indicate the best way to use the resources available and finally, allocate individual tasks to the environmental health services staff. It must be stressed that the plan should not be worked out until measures already taken have been evaluated.
Before continuing, it may be useful to review the priority measures described above:

- to provide shelter suited to the prevailing climate, and ensure that its location does not impede the environmental health services or disturb the general environment
- to provide minimum quantities of clean drinking water
- to arrange for the disposal of human excreta and other liquid and solid waste from the immediate surroundings of the accommodation area and store it somewhere where it will present no human risk
- to control carrier populations so that they cannot spread disease and do not contaminate food supplies
- to ensure that food preparation methods do not contribute to the spread of disease

Finally, the emergency plan must indicate clearly how information is to be passed on during the standby period and how aid workers are to be given the necessary protection and accommodation. These personnel will have to be given all the appropriate vaccinations and, for their protection, be provided with adequate clothing and proper sanitary arrangements. Those in charge will be told the correct way to use equipment and supplies.

### 7.2 Safety measures

Taking safety measures involves several activities, ranging from selecting the right measures to implementing those previously decided, during and after a catastrophe. Three stages are essential for optimal planning of this range of activities:

- review all possible consequences of the disaster
- from amongst the safety measures available, decide on those capable of relieving the effects of all types of disaster
- examine the measures which are appropriate for certain types of disaster or which are applicable only in certain local conditions

An examination of the human effects of disasters on environmental health demonstrates that damage to buildings and infrastructure, water and food contamination, disrupted power supplies and transport problems are the most likely and will constitute the critical elements in any state of emergency. All the measures to address each of these problems will now be discussed.

### 7.3 Damage to buildings and infrastructure

Any natural catastrophe can destroy or seriously damage buildings and infrastructure: buildings, water supply system (such as pipes, pumping stations, water collection systems and dykes), supporting walls, electricity pylons, roads and piers. This damage, as well as injuring those nearby, totally or partially disrupts the vital services they provide to the community.

One of the principal means of reducing or eliminating the effects of a disaster will be to anticipate the damage and to plan modifications to existing installations. Structures can be reinforced to withstand the impact of a disaster. Machines, equipment and reservoirs can be more securely fixed and have better foundations. Alternative solutions will have to be considered: for example, to prevent breakdowns in the water supply in terms of equipment and its functioning, plant can be set up in a place where the water collected can be chlorinated. Finally, adopting standard rules and procedures will optimise preparations for any type of disaster.
Damage to buildings and infrastructure can also be reduced by better use of data bases and planning of standard projects: a study of the meteorology, topography, hydrology and geology of the sites to be chosen will enable planners to avoid dangerous situations. Vitally important plant and structures will then be able to be built on sites less likely to be affected by the impact of disasters. Along the same lines, structures, equipment and supplies will be protected using specific methods: for example, the capacity of reservoirs can be increased by one 1 or 2 times to provide supplies in emergency situations.

7.4 Water and food contamination

Water and food contamination is one of the most serious public health consequences of a disaster. It can occur at the supply source, during transport, at the treatment point and during storage or distribution. Damage to buildings and infrastructure is the principal source of contamination.

Unless he suspects chemical contamination of the water and food, the first concern of the person responsible for the action plan is to avoid microsociological (and possibly chemical) contamination of water and food. Food can be analysed only if there is a research laboratory in the disaster area. Analysing foodstuffs is more difficult than analysing water, because it requires more advanced technology.

An initial test for food contamination can be carried out in the field.

If the usual sources are polluted, and to avoid contamination, new sources of water and food supply must be sought. If the water supply is disrupted, alternative solutions for water treatment and distribution must be sought. If possible from an economic point of view, the water must be drained at source or the level reduced as soon as possible, and strong diluents used to reduce the levels of contaminants therein. Means of controlling pollution around the supply source must also be arranged.

7.5 Disruption to energy supplies

Damage to electrical cables and infrastructure and destroyed equipment are the most common causes of disruption to energy supplies during and after a disaster. Such a disruption:

- aggravates the problems encountered by basic utilities services
- interrupts pumping and treatment of water and fuel
- prevents refrigeration, which is essential for the safe storage of food and it disrupts the delivery of treatment in the hospitals

In order to deal with such disruptions, non-electrical equipment must be provided to ensure a limited supply of energy (for example, using the forces of gravity for water distribution), along with alternative supply systems, either electrical or auxiliary, for vital plant and machinery such as in pumping stations, water treatment and distribution centres and hospitals. Mobile generators are preferable to fixed sets.

Sufficient fuel reserves for 3 to 5 days must be provided for auxiliary generators. Finally, these auxiliary generators must be capable of taking over from the existing installations and equipment so that, in the event of a breakdown in supply, a total disruption of services may be avoided.
7.6 Organising the staff and the local population

In disaster-prone regions, adequate training for the health staff and the local population is essential when developing a preventive strategy. Any environmental health service, whether public or private, must develop training programmes for emergency procedures. Such programmes must consist of a course which is aimed at all staff categories and which focuses on emergency measures in the event of natural disasters. This must be a very general course, indicating what may happen, what can be done by each individual and how. It should be given at least once a year so that new staff receives training. This training should conclude with a more detailed course aimed at staff selected to perform the more important functions in emergency situations. A preparatory programme of practical exercises, repeated from time to time, must also be included so that staff can practise implementing emergency measures. The training can be broadened to include special courses on emergency situations, lectures, seminars, books and articles relating to natural disasters. In emergency situations, educating the public is the most important factor. The aim is to obtain their support in preparing for disasters in vulnerable areas. The success of the emergency work undertaken depends in large part on the understanding and co-operation of the community. Operational problems are more easily resolved if people are aware of what is expected of them and understand the emergency measures which will doubtless have to be taken.

8. Measures to be taken during and after a disaster

Emergency measures to control environmental health during the second phase are divided into three periods and are succeeded by a reinforcement period.

- The first period, called the **standby period**, lasts only a few hours or days.
- The second, called the **impact period**, is of several days’ duration, depending on the assessment made of the disaster.
- The third, called the **post-disaster period**, lasts for four or five days after the disaster. The reinforcement period may also last for three or four days.

Particular measures are vital within each period.

8.1 Standby period

As soon as the disaster is forecast and imminent (assuming, of course, that the alarm can be given), emergency measures must be taken to control environmental health. In the threatened areas, the aims of those responsible for environmental health are to protect the population, maintain a preventive state of emergency and provide water, food, shelter and clothing to the population.

Among the specific measures to be taken during this period, there is the task of informing and mobilising environmental health staff. There must be an inventory of the available resources in terms of health personnel, equipment and supplies to respond adequately to the situation. Water and food supplies and waste disposal systems must be protected from the impact. The local inhabitants must also be informed of the steps to take for their own safety, by instructing them, for example, to store water in clean containers such as baths.

If the disaster unfolds slowly, as happens with floods or hurricanes, the conditions under which particular measures are taken must be listed and distributed. Amongst these, we shall take particular note of those that determine the setting up of emergency shelters in
accommodation centres or new structures, the use and additional provision of resources, and finally, the procedures for requesting aid.

8.2 Impact period
Steps taken during this period are aimed at securing safety and accommodation for displaced persons. Special attention must be given to arranging accommodation centres for displaced persons. Environmental health specialists must be included in the teams which select the locations for these centres and decide on their design and layout. This is particularly important because once people are settled in it is difficult to ask them to move again. The areas selected to accommodate displaced persons must be carefully examined to establish that essential environmental health services can be ensured and that the arrival of refugees will not be problematic for the local health service or that of adjacent areas. When a catastrophe is prolonged, its progression must be monitored. Damage must be evaluated and staff must list the priority measures required to control foreseeable problems.

8.3 Post-disaster period
As soon as the intensity of a disaster’s impact diminishes, and emergency aid work can begin, there are five objectives to fulfil:

- to provide the people with sufficient quantities of drinking water
- to provide safe and healthy shelter for the disaster victims
- to protect water and foodstuffs from faecal contamination
- to ensure that the disaster victims are protected from diseases transmitted by vectors endemic in the stricken area

Achieving these objectives will depend greatly on the evaluation of the effects of the disaster, on health conditions and environmental health services. Therefore a prior awareness of the state of the health services and other basic services is necessary. Special attention must be given to public water and food supplies, disposal of excreta and solid waste, housing and energy systems. An inventory must be made of all available resources, in terms of base personnel, equipment, supplies and logistics, for use in meeting immediate needs. Enquiries must be made regarding population movements within and around the confines of the disaster area to identify particularly vulnerable areas (increased risks of disease and other consequences of high population density). For example, we have to be aware of which areas have been partially or totally evacuated and where the disaster victim and aid worker centres are located.

Specific environmental health protection action to be taken immediately after a disaster will now be discussed in detail.

8.4 Water supply
An adequate supply of safe water is vital when a disaster occurs, because drinking water is essential to life and water is one of the principal means by which disease is transmitted. So, whilst it is extremely important to provide adequate supplies of drinking water after a disaster, it is also important to ensure that the water in the stricken areas is suitable for drinking. Distributing drinking water to victims, aid workers, hospitals and health centres is a priority. Then water will be distributed to peripheral urban areas and highly populated rural areas, and finally to remote rural areas. Only afterwards is water for washing and laundry to be distributed.
Operational distribution systems should provide the population with drinking water. However, private water sources should be sought out (power stations, breweries and similar establishments) as well as springs, fountains, rainwater tanks and new structures such as recently sunk wells. All water supply sources must be analysed in order to eliminate any risk of infection and poisoning from the water. If new sources of water are used, the advice of a specialist (health engineer) is required.

If faecal or chemical contamination of water is suspected, it must be analysed in a laboratory. Sources that will be suspect are those located near sewage exits, chemical factories, rubbish dumps, abandoned mines and any other dangerous place, unless a specialist who is familiar with local conditions decides otherwise.

Water distributed to victims must retain its quality right up to the point of consumption: to ensure this, all supply sources must be purified (especially surface water), including the water feeder structures (wells, reservoirs, rainwater tanks) in disaster areas. It is not necessary to systematically purify undamaged supply sources – this would be a waste of staff and already scarce material. Some educational guidelines about health should suffice to persuade people to make less use of suspect water supplies. Ensuring that water is drinkable entails a broad range of measures. First of all, the presence of Escherichia Coli or large nitrate concentrations must be detected as soon as possible. The detection of Escherichia Coli shows that the water has been contaminated by human excrement and that needs immediate safety measures and purification. Large nitrate concentrations are particularly dangerous for children, who require special protection.

After a disaster, the purification process requires residual chlorine to be added so that the chlorine content in the distribution system is adequate. This enables pathogens which have entered the system as a result of poor water treatment to be destroyed, and enables us to detect when contaminated water has penetrated the distribution system. The dangers implicit in unsatisfactory collection and storage of water are thus reduced.

Experience tells us that it is dangerous to put too much chlorine in drinking water. It is important to ensure that no residual chlorine remains in the water, particularly that supplied via the public network. Before beginning chlorination by the addition of tablets or by bleaching, the programme should be checked by a hygienist if possible.

Continuous monitoring of the water must be established or immediately restored. At this stage of the emergency, checking the residual chlorine content in the public water supply on a daily basis is sufficient.

Increasing the water pressure makes it possible to compensate for loss of pressure resulting from ruptured pipes and to monitor contamination. The importance of adequate water pressure in multi-storey buildings must not be overlooked.

In the stricken region, if it has not been possible to chlorinate the water because the chlorination plant has been destroyed, it can be purified by boiling or by adding tablets, pills, powder or purifying solutions, but these methods are effective for small quantities only. If they are available on the spot, mobile water purification units can be used during the disaster. These units purify small quantities of water and are not worthwhile if they have to be shipped out. They are expensive, and when sent by ship they take up space which would be better kept for medicines, medical equipment, food and clothing.

A chlorinated compound (calcium or sodium hypochlorite) applied in the recommended concentrations and for the recommended time must be used to purify large volumes of water supplied to accommodation centres and other refugee camps and to the inhabitants of disaster areas.
Containers used for transporting and storing water must be protected from any contamination. Care must be taken to ensure that mosquitoes cannot establish larval breeding grounds in them. Containers supplied by commercial water distribution companies, dairies, breweries and other industrial and agricultural enterprises must not be used until they have been washed and disinfected. As a matter of principle, drinking water must never be put in containers which have held petrol, chemicals or wastewater.

The final step which can be taken to ensure water quality is to get the public water supply system back into working order. All piping, tanks, wells and other reservoirs must be cleaned and disinfected.

### 8.5 Environmental sanitation

Sanitation measures are necessary to avoid water and food contamination which is most often caused by human excreta. Such procedures also prevent the development of larval breeding grounds for disease vectors. The greatest care must be taken with the disposal of excreta: poor disposal not only leads to contamination of the water and foodstuffs but also attracts flies and other pests which are carriers of disease. Adequate systems for disposing of solid waste, including rubbish containers, must be provided, and adequate arrangements must be made in refugee centres for rubbish collection, transport, incineration and burial. Wastewater must be properly drained away. Lastly, the municipal rubbish collection and waste disposal services must be restored.

Latrines must be dug, or if that is impossible, mobile latrines provided in order to properly dispose of excreta in accommodation centres and aid workers’ complexes. Latrines must be provided in highly populated areas when the sewage disposal system has been destroyed. The people will be given tools and the necessary equipment to dig them and a hygienist will indicate how this should be done. Users will be taught the correct way to look after latrines.

As soon as the excreta disposal systems are in place, the public sewerage system must be dealt with. First, mains and sewers must be cleaned and flushed out. Blocked drains cause flooding in the streets and cellars in heavily populated areas. Then the piping, sewers, sewer outflows and treatment plants must be repaired. Tankers can be used to empty the overflow from septic tanks in public buildings set aside for the victims, the injured and the aid workers.

### 8.6 Accommodation centres

From the outset of the emergency relief operations, evacuees will be rehoused, provided that the premises used do not pose a danger to environmental and public health. Immediately after a disaster people usually seek shelter in the homes of parents or friends.

In some cases, before providing more permanent locations, temporary shelters have to be distributed. Some public buildings – schools, covered markets, churches and hotels – are often chosen to provide temporary shelter because they can easily be transformed into dormitories and usually have proper plumbing and toilet facilities (water supply, drains, wash-basins, etc). Some even have kitchens and dining halls.

It must be emphasised that once they are settled in, it is difficult to ask evacuees to move again. This is something that must be borne in mind when accommodation centres are being set up.

Two or three days after the disaster, more permanent locations may have to be made available. Priority must be given to settling displaced persons. To reduce the demand for accommodation, people must be encouraged and helped to stay with their families or their friends. Their return home must be facilitated as soon as possible. If the means and mate-
materials are available, people must be given what they require to build shelters on their own plots of land. Nevertheless, wherever they are rehoused, water, food and suitable waste disposal facilities must be available.

Providing shelter under canvas for displaced persons should be considered only as a last resort. Buildings under construction can sometimes be used to provide temporary shelter for refugees.

8.7 Food hygiene

Following a natural disaster the locally available food may be damaged or contaminated. When there has been flooding, polluted water is usually the contaminant. Sometimes it is disease-carrying insects, or unhygienic handling, the latter particularly when mass supplies of food are involved. Food can be spoilt in various ways:

- power cuts jeopardise refrigeration
- food may come into contact with untreated water
- products may be fraudulently adulterated
- out-of-date supplies may be used

Using damaged or contaminated food leads to poisoning and infections which may have serious health effects. Locating the whereabouts of food reserves and checking their quality can avoid such outcomes. First of all, perishable foods must be checked for contamination, especially when they come from areas where there have been power cuts. But it goes without saying that all food must be inspected. Food testing (using laboratory services) is difficult in disaster areas. Despite everything though, it is possible to carry out valid inspections using very simple pieces of equipment such as those which measure phosphate content.

An environmental health specialist must inspect all food production and distribution premises damaged in the disaster, and this must be done before moving on to inspect the food itself. This same specialist will also inspect mass food distribution premises.

To avoid the consequences of damaged and contaminated food, people must be made aware of the steps they should take to ensure the quality of household food. People must know which foods are safe and how to prepare them.

8.8 Anti-vector control

Stagnant rainwater or untreated water in reservoirs, on the surface of the soil and elsewhere creates unhygienic conditions due to the accumulation of debris and solid waste and the proliferation of insects and rodents. This is how diseases such as malaria, yellow fever, typhus, tularaemia and diarrhoea spread. In addition, food reserves may diminish and other pests may appear.

The aim of emergency operations is to control diseases spread by vectors, especially where these diseases were already prevalent. Environmental health controls must be strengthened by other health measures (for example, drug prophylaxis to prevent malaria).

It is almost impossible to eliminate rodents and houseflies in the wake of a disaster. Environmental sanitation and individual hygiene measures are the only ways to combat this problem. Food and water must be put out of the reach of rodents and flies. Rubbish and waste must be collected and destroyed as soon as possible.

Several steps have to be taken to control vectors in emergency situations after a disaster. An anti-vector control expert must supervise these operations, if possible with experience in disaster areas.
Both the anti-vector specialists and the people at risk must work to eliminate larval breeding grounds. The people must be told how to get rid of such breeding grounds and how to protect themselves against vector-transmitted diseases.

The authorities must take all necessary steps to eliminate breeding grounds - filling in marshland, drainage, land reclamation etc. Larvicides will be used to treat large areas of surface water, because this is easier. Eliminating such stretches of water consumes too much time and energy.

Monitoring of accommodation centres and highly populated areas will enable us to locate future mosquito larval breeding grounds, and must focus on the principal vectors of diseases which are endemic in the area. For example, where malaria is prevalent monitoring will be focussed on anopheles larval breeding grounds, anopheles being the mosquito which transmits malaria.

Such measures enable us to reduce the number of times insecticide needs to be sprayed. However external treatment remains the best way to combat adult insects. If this treatment is necessary, locally available equipment will be used. The use of sophisticated equipment is not recommended because its level of performance does not justify the cost.

If, in areas affected by flooding, it proves necessary to treat the insides of the houses, this must be started immediately. Flooded dwellings must be treated first. However, before deciding to treat the inside of houses, it is worth noting that in tropical regions, people live outside and spraying with insecticides will not be a particularly effective means of significantly reducing contact with the vectors.

Finally, the spread of typhus must be controlled by disinfecting displaced persons as soon as they arrive in the accommodation centres and other emergency premises. In more permanent locations, baths and washing facilities must be installed to prevent typhus.

8.9 Personal hygiene

Personal hygiene is often neglected in emergency situations, mainly in overcrowded places such as accommodation centres for refugees. The incidence of disease may actually increase due to lack of hygiene. Giving refugees the opportunity to wash and to look after the premises they are occupying makes them pay attention to hygiene. Promiscuity in the dormitories must be avoided. Sufficient water must also be given to those not living in accommodation centres and who have no other means of obtaining any. The population must be informed and motivated so that people take on board the general rules of personal hygiene and protect themselves from the risk of disease.

8.10 General information for the population at large

In addition to the specific information we have just described, the public must also be informed of the following points: the location and type of health resources and environmental health services available, where displaced people have been accommodated and the contact details of the authorities so that emergencies can be reported. Such information will enable people to take stock of emergencies, reduce disruption and make the emergency measures more effective.

8.11 Stabilisation period

A few days after the emergency period, environmental health measures must be reinforced. This includes drawing up an inventory of the required emergency aid and submitting it to the aid organisations that receive the aid and distribute it and finally, setting up accommodation centres.
8.12 Submitting the inventory of requirements to the aid organisations

When comparing normal needs with the results of earlier investigations, one or several inventories need to be drawn up, relating to technical personnel, equipment and supplies. These inventories must be submitted to the representatives of national and international organisations, with priority being given to needs which can be met from the country’s own resources.

8.13 Receiving aid (donations)

As soon as it is received, all aid must be compared with the inventory of needs so that the latter can be met. The quality of equipment and supplies must be checked, and this may require the assistance of a local expert such as a chemist or engineer. To avoid damage and wastage, care must be taken to handle equipment and supplies correctly.

8.14 Aid distribution (donations)

A list of the areas to receive priority aid must be drawn up. Aid distribution must be based on a correct estimate of needs to avoid over-provision. If aid is not properly shared out, there is the risk of its being wasted.

8.15 Setting up accommodation centres for displaced persons

In all accommodation centres for displaced persons there must be an adequate supply of drinking water, food and essential sanitation. Health teams must be assigned to each centre. Their responsibility will be to organise health services and to give hygiene training to the people housed there. Such teams may include volunteers, provided that an environmental health technician supervises them. These teams will draw up and circulate procedural rules for the environmental sanitation of sites.

In conclusion, displaced persons must be encouraged to return home as soon as possible after the danger is past, even if they have to be provided with materials to build temporary shelters on their own plots of land.

9. Rehabilitation activities

Some rehabilitation work can be undertaken only on a long-term basis. Other work must be done during the actual emergency period and immediately afterwards. Environmental health rehabilitation measures will begin as soon as possible during the emergency phase: immediate reorganisation of services, restoring environmental health monitoring to its usual level, appraisal of the emergency plan, which should begin as soon as it is implemented.

9.1 Restoration of on-going priority environmental health monitoring services

As soon as environmental health services are functioning again, the main on-going environmental health monitoring activities must resume. The aim here is to ensure that there is no risk of an epidemic and to gauge the progress of work undertaken during the emergency and rehabilitation phases.

We shall discuss only the priority activities, but in certain cases specific environmental health monitoring programmes may have to be drawn up, either for the short or the long term. This work is described in order of importance.
9.2 Water quality

Routine residual chlorine testing must begin immediately after the disaster. This will enable the concentrations of Escherichia Coli and nitrates to be determined. When the municipal water supply is repaired, routine tests will be carried out as follows: tests to establish the concentration of chlorides, sulphates, magnesium, dissolved solutes and pH. A significant variation in the concentration of chlorides can indicate contamination of the water by human excreta. Surface levels of magnesium and dissolved solids must be monitored because these elements can have a laxative effect if they are present in too high a concentration.

9.3 Food supplies

The source and quality of water used in food preparation must be checked on an on-going basis, as must the premises where food is handled and prepared, sanitary installations, the hygiene of food storage facilities (including refrigeration) and the waste disposal system.