



*Photo: International Federation*

## Description

This chapter discusses the importance of improving water, sanitation, vector control and hygiene in emergency settings.

## Learning objectives

- To explain the relationship between the environment and water, sanitation and hygiene related diseases;
- To present standards and key indicators related water supply, sanitation and hygiene in emergencies;
- To provide basic information about control measures for improving environmental conditions;
- To discuss the importance of addressing long term needs of the community at the onset of the emergency and throughout its duration.

## Key Competencies

- To identify problems in the environment, water, sanitation and hygiene situation during an emergencies;
- To apply standards to water supply, sanitation and hygiene in emergencies;
- To install control measures for environmental health problems;
- To understand the long-term problems.

## Introduction

The United Nations has declared that access to safe water and sanitation is a human right that applies in times of peace and in emergencies. In emergency settings, people often leave their homes in search of safer surroundings. In many instances, the water, sanitation and hygiene conditions of new surroundings might not be adequate. In other instances, people might be left in their home surroundings but with destroyed or damaged societal and physical infrastructure including water, sanitation and health care systems.

People affected by emergencies often suffer from malnourishment, stress, fatigue and other ailments including injuries. These conditions, coupled with unsanitary living conditions such as substandard sanitation, inadequate water supplies and poor hygiene, make disaster-affected people especially vulnerable to disease. This chapter discusses the importance of improving water, sanitation and hygiene in emergency settings.

Few emergencies leave people displaced for only a short time. Most emergencies last years. Decisions made early in the emergency, therefore, often have long-term consequences. Since emergencies often result in years of displacement, this chapter focuses primarily on environmental improvements that address the longer-term needs of disaster-affected populations. This chapter also explores how these longer-term needs can be integrated into the immediate response to an emergency. In this chapter, *water* means water for domestic purposes and not agricultural or industrial purposes. The term *sanitation* is used in a broad sense and considers excreta disposal, vector control, solid and medical waste management and drainage. The term



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*hygiene* includes practices related to water hygiene (e.g. keeping water supplies safe), personal hygiene (e.g. washing hands), domestic hygiene (e.g. food hygiene) and environmental hygiene (e.g. keeping household environments free of excreta and solid waste).

## Survival and longer terms needs in an emergency

In the first days and weeks of an emergency, immediate measures to protect human life and health must be started quickly. It is critical to meet survival needs as quickly as possible. Once met, longer-term interventions aimed at addressing the needs of the population over months and possibly years must be addressed.

### *Box 8-1: Acute emergency phase*

**At the onset of an emergency, the aim is to protect life and health through rapid assistance that focuses on the following most crucial aspects of environmental health:<sup>1</sup>**

- Provide facilities for people to excrete safely and hygienically;
- Protect water supplies from contamination;
- Provide enough safe water for drinking, cooking and essential personal and domestic hygiene;
- Ensure that people have enough water containers to collect and store water cleanly;
- Ensure that people have the knowledge and understanding they need to avoid disease;
- Ensure that people have soap for washing their hands.

### *Box 8-2: Involving disaster-affected people early*

**As early as possible in the emergency, it is critical to:**

- Consult with the disaster-affected population to get a good understanding of their needs;
- Identify key community leaders who can help organise the community's involvement in water, sanitation and hygiene projects;
- Begin planning for and start implementing longer-term interventions in consultation and cooperation with the community.

## Vulnerable groups

Vulnerable groups are those individuals at greatest risk of disease or injury. There are many reasons why individuals or groups are vulnerable. Some might be vulnerable because they are given less priority for limited resources, or belong to an ethnic, social, religious or political minority or have greater difficulty accessing treatment and care. There is a strong correlation between poverty and vulnerability. Vulnerable groups can include women, children, older people, physically and mentally disabled people, people living with HIV/AIDS, infants and children who are already weak and sick. Those living in child-headed households are also frequently at higher risk for disease or injury. People who are either separated from or without access to the main focus of relief assistance are also vulnerable. In some situations, refugees or displaced people might be scattered among the host community. These individuals are particularly vulnerable because they might not receive the same assistance as those who are living in camps in settlements.

## Diseases related to water, sanitation and hygiene

This chapter focuses on diseases related to water, sanitation and hygiene. Unlike genetic diseases, which individuals are predisposed to, acquiring water, sanitation and hygiene related diseases are **controllable and preventable**. The spread of these diseases depends on environmental conditions and behaviour in the household and community. This section explores the relationship between water, sanitation and hygiene related disease and the environment.

### The link between disease and environment

Diarrhoeal diseases, acute respiratory infection, measles, malaria and malnutrition are the most common causes of death in emergencies (see Figure 8-1). All these causes of death are preventable. Measures used to prevent common diseases in emergencies are shown in Table 8-1. The majority of these preventive measures are related to environmental conditions: appropriate shelter and site planning, clean water, good sanitation, vector control, personal protection such as (insecticide-treated nets, personal hygiene and health promotion. These measures address conditions in the environment, known as 'risk factors' because they can cause disease. It is important to understand the relationship between disease and environmental risk factors because interventions must target risk factors properly. Table 8-1 provides an overview of environment-related diseases and environmental risk factors that contribute to disease. It is worth noting that although malnutrition is not an environment-related disease, it is linked to diarrhoea because malnutrition increases the severity of diarrhoea while diarrhoea can cause malnutrition.

Figure 8-1: Causes of death, Kohistan district, Afghanistan<sup>2</sup>

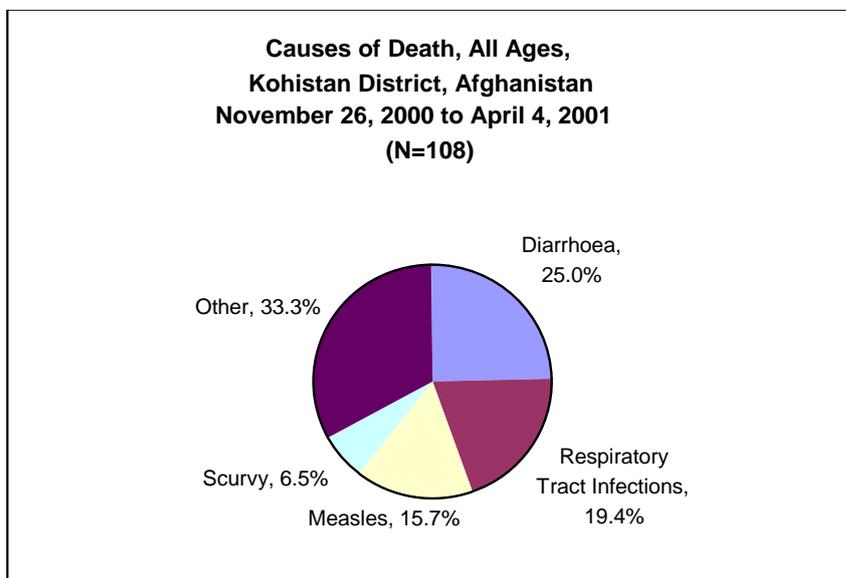


Table 8-1: Diseases targeted by preventive measures<sup>7</sup>

Preventive measure	Impact on spread of
Shelter, Site planning	Diarrhoeal diseases, acute respiratory infections
Clean water	Diarrhoeal diseases, typhoid fever, guinea worm
Good sanitation	Diarrhoeal diseases, vector-borne diseases, scabies
Adequate nutrition	Tuberculosis, measles, acute respiratory infections
Vaccination	Measles, meningitis, yellow fever, Japanese encephalitis, diphtheria
Vector control	Malaria, leishmaniasis, plague, Dengue, Japanese encephalitis, yellow fever, other viral haemorrhagic fevers
Personal protection (insecticide-treated nets)	Malaria, leishmaniasis
Personal hygiene	Louse-borne diseases: typhus, relapsing fever, trench fever
Health promotion	Sexually transmitted infections, HIV/AIDS, diarrhoeal diseases, and Infections during and after deliveries
Case-management	Cholera, shigellosis, tuberculosis, acute respiratory infections, malaria, Dengue, haemorrhagic fever, meningitis, relapsing fever

Table 8-2: Diseases affecting displaced populations in disasters<sup>27</sup>

Disease	Symptoms	Environmental risk factors	Health hazards
<b>Acute upper respiratory tract infections</b>	All symptoms of the common cold, fever and heavy coughing. Chest pain and pain between shoulder blades in pneumonia	Crowding, poor hygiene	Influenza and pneumonia may cause severe complications, especially in groups at risk
<b>Diarrhoea</b>	Watery stools at least three times a day, with or without blood or slime. Might be accompanied by fever, nausea or vomiting	Contaminated drinking water or food, or poor sanitation	Dehydration, especially in children, shown by dark colouration of urine, dry tongue or leathery skin
<b>Cholera</b>	Modest fever, severe, but liquid diarrhoea (rice water stools), abdominal spasms, vomiting, rapid weight loss and dehydration, rapid deterioration of condition	As for diarrhoea	As for diarrhoea
<b>Measles</b>	A disease of early childhood, characterised by fever and catarrhal symptoms, followed by maculopapular rash in mouth	Crowding, poor hygiene Very contagious	Severe constitutional symptoms, high case fatality rate
<b>Malaria</b>	Painful muscles and joints, high fever with chills, headache, possibly diarrhoea and vomiting	Breeding of <i>Anopheles</i> mosquitoes in stagnant water bodies	Disease may rapidly become fatal, unless medical care is provided within the first 48 hours

Disease	Symptoms	Environmental risk factors	Health hazards
<b>Dengue and Dengue Haemorrhagic Fever (DHF)</b>	High fever, headaches, pain in muscles and joints, red spots on skin	Breeding of <i>Aedes</i> mosquitoes in natural or artificial containers, filled with water	Dengue usually runs a mild course. DHF, however, is often accompanied by heavy haemorrhages, which may be fatal
<b>Meningococcal meningitis</b>	Infected persons may show no symptoms for a considerable time. When an epidemic is in progress, headache, fever and general malaise will suggest the diagnosis, which must be confirmed by lumbar puncture	Crowding	Often fatal if untreated at an early stage; neurological problems in survivors
<b>Shigella dysentery</b>	Diarrhoea with blood in the stools, fever, vomiting and abdominal cramps	Contaminated drinking water or food, or poor sanitation, poor hygiene	Case fatality rate may be high
<b>Typhoid fever</b>	Starts like malaria, sometimes with diarrhoea, prolonged fever, occasionally with delirium	As for diarrhoea, and contaminated foods	Without appropriate medical care, including antibiotics and surgery, may lead to fatal complications in a few weeks
<b>Viral hepatitis A</b>	Nausea, slight fever, pale-coloured stools, dark-coloured urine, jaundiced eye whites and skin after several days	Poor hygiene, contaminated foods and water	Long-term disabling effects
<b>Louse-borne typhus</b>	Prolonged fever, headache, body pains	Unhygienic conditions leading to lice infestations	May be fatal without treatment
<b>Diphtheria</b>	Inflamed and painful throat, coughing	Crowding, poor hygiene	A secretion is deposited in the respiratory tract, which can lead to asphyxiation
<b>Tetanus</b>	Muscle spasms, starting in the jaws and extending to the rest of the body over several days	Poor hygiene, injury	Fatal
<b>Rabies</b>	Fatigue, headache, disorientation, paralysis, hyperactivity	Bit from infected animal host	Fatal if untreated
<b>Relapsing fever (louse-borne or tick-borne)</b>	Acute high fever at intervals	Unhygienic conditions leading to lice or tick infestations	Often fatal in untreated persons, depending on immunity levels
<b>Heat stress</b>	Elevated body temperatures, nausea, vomiting, headache	Excessive temperatures	Risk of coma

*Box 8-3: Collaboration between health and water and sanitation sectors*

Interaction between the health and water-sanitation sectors is critical in emergencies because disease surveillance data from the health sector can steer water-sanitation interventions. These give those most vulnerable to disease the highest priority in the provision of water supply, sanitation and hygiene assistance.

Disease surveillance shows where disease ‘hot spots’ are happening and where outbreaks are likely to occur or are starting. When the health sector communicates these hot spots to the water-sanitation sector, the crucial first steps for disease control can begin. Rapid assessments, preferably conducted in partnership between health sector personnel, water-sanitation professionals and community representatives can quickly identify key environmental risk factors that need immediate action. This prompt attention improves quick water, sanitation and hygiene. Targeting specific risk factors decrease a population’s risk from disease.

Under such scenarios, close cooperation and overlap between the health and water-sanitation sectors results in a fast response to outbreaks and potential outbreaks. Working together, the health and water-sanitation sectors can prevent and control better disease outbreaks saving many lives.

## Disease transmission

Illnesses related to water, sanitation and hygiene include the following:

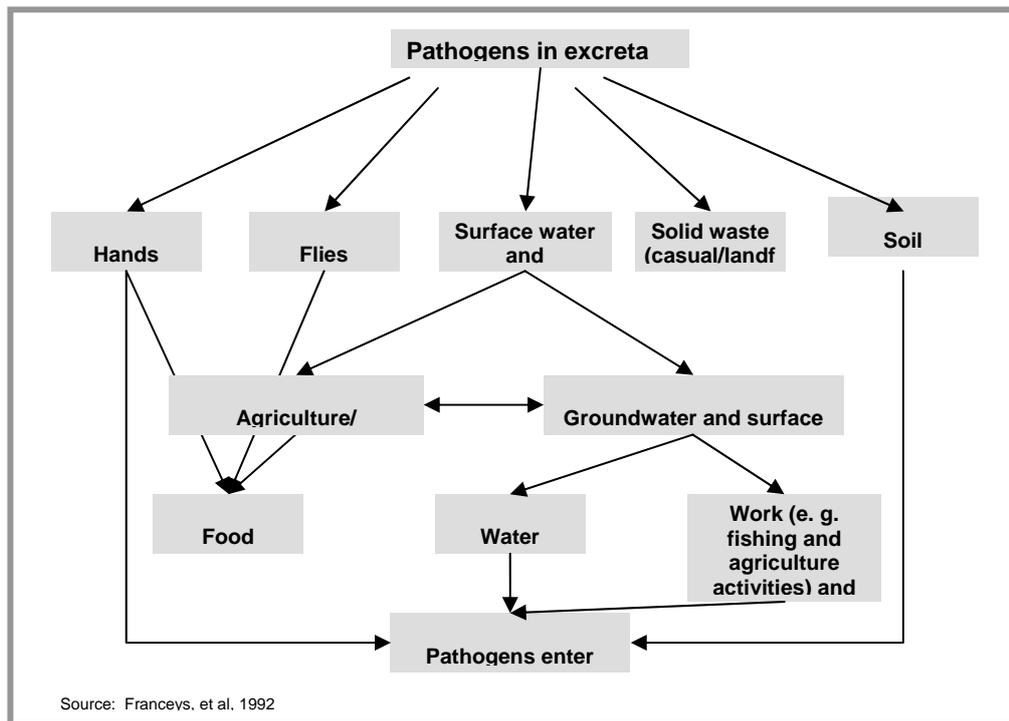
- Water-borne diseases occur when a disease-causing agent enter the body through drinking water;
- Water-washed diseases occur because of inadequate hygiene conditions and practices;
- Water-based diseases include those illnesses that are spread through a disease vector that lives in water;
- Food-borne illnesses result when disease-causing agents enter the body through food;
- Vector-born diseases are spread by means of insect or rodent vectors.

Diarrhoeal disease is of major risk factor in emergency settings because it can cause sickness and death among children. Most diarrhoeal diseases including viral gastroenteritis, cholera, Shigellosis, typhoid, polio and some forms of hepatitis being spread by faecal-oral means are often called faecal-oral diseases. Faecal-oral disease transmission occurs when faeces, which contain disease causing pathogens, from one person enters the mouth and is ingested by another person. Faecal-oral diseases can easily spread in overcrowded unsanitary conditions, which are typical of camps and settlements in emergencies. Factors related to faecal-oral disease spread include drinking water contaminated with faecal material (which can occur at the source, during transport or in the household), poor hygiene due to a lack of water or hygienic practices and poor food hygiene (e.g. contamination of food by dirty or unwashed hands or flies). Figure 8-2 illustrates faecal-oral disease transmission.



Water reservoir India.  
Photo International  
Federation

Figure 8-2: Transmission route for pathogens found in excreta



Vector-related diseases occur when vectors carrying disease pathogens from an animal, human or some other reservoir to another. Vectors are defined as any animal capable of transmitting disease pathogens from one host to another by its bite or bodily functions. Pathogens can be transmitted either mechanically (e.g. trachoma which is transmitted by non-biting flies) or after biological transformation (e.g. malaria parasites by mosquitoes). Each emergency can be characterised by different types of vectors and vector-borne diseases. Examples of outbreaks in emergencies include malaria (transmitted by *Anopheles* mosquitoes), epidemic typhus (transmitted by lice) and Dengue fever (transmitted by *Aedes* mosquitoes). Where malaria is endemic, it is one of the major causes of death in emergencies. In addition to transmitting diseases, some vectors can be considered a nuisance because of their painful bites, e.g. mosquitoes, biting flies, fleas, and lice. These nuisance vectors can contribute to the stress and discomfort of an already suffering population. Table 8-3 summarises vectors and vector-borne diseases that are common in emergencies.

Table 8-3: Vectors and diseases likely to be present in emergency settlements (adapted from Wisner and Adams, 2002)

Vector	Disease transmitted
<b>Mosquitoes</b>	
Anopheles	Malaria, filariasis.
Culex	Japanese encephalitis, filariasis, other viral diseases.
Aedes	Yellow fever, Dengue fever, Chikungunya, filariasis, other viral diseases.
Houseflies	Diarrhoea, dysentery, conjunctivitis, typhoid fever, trachoma.
Cockroaches	Diarrhoea, dysentery, salmonellosis, cholera.
Lice	Epidemic typhus, pediculosis, relapsing fever, trench fever, skin irritation.
Bedbugs	Severe skin inflammation.
Triatomid bugs	Chagas' disease.

Vector	Disease transmitted
<b>Mosquitoes</b>	
Ticks	Rickettsial fever, tularaemia, relapsing fever, viral encephalitis, borreliosis.
Rodent (mites)	Rickettsial pox, scrub typhus.
Rodent (fleas)	Bubonic plague, endemic typhus.
Rodents	Rat-bite fever, leptospirosis, salmonellosis, melioidosis.
Sand fly	Leishmaniasis

Acute Respiratory Infections (ARIs), which include pneumonia, bronchiolitis and bronchitis, are a major cause of death in emergencies. Contributing factors to ARIs are poor shelters, including poor clothing and footwear (chilling in infants), overcrowding and indoor air pollution (bad ventilation in shelters). Some studies suggest that hand washing might reduce the risk of respiratory infections.<sup>5</sup>

## Community involvement in disease prevention

The full participation of the community, its volunteers, Community Health Workers (CHWs) and extended health workers even in emergencies cannot be enough emphasised. Substantial work can be done at community level for the prevention and early detection of problems and diseases. The ultimate goal of water supply and sanitation programmes is to reduce sickness and death brought about by substandard environmental health conditions. For water supply and sanitation programmes to provide the highest possible level of benefit, it is ideal that beneficiaries be actively involved in the programme from beginning to end. Throughout this chapter, reference is made to community involvement. This term is not meant exclusively to describe the scenario where a community assists with the construction of latrines or where a community feels a sense of ownership for pipes and tanks. Community involvement is meant that the host population is given the opportunity to play an active role in water and sanitation projects throughout the project's duration, emphasising the representation of both men and women and, indeed, participation of vulnerable groups. Apart from constructing facilities, the role of the community can include ensured awareness of hazards, disease prevention and detection and preparedness to act. If people in the community contribute with ideas and decision-making, they will feel responsible for the health of their own community.

The ability of vulnerable groups to cope and survive might be seriously compromised in a disaster. It is important, therefore, that vulnerable groups be identified and given the opportunity to participate and influence water and sanitation projects to meet their and all other affected groups' needs. Emergencies also have an impact on resident or host populations as well as the refugee and displaced people. It is important that the needs of the host population be understood. The local economy can suffer because of the added demand upon it from refugees, displaced people and the host population alike. There might also not be equal access to basic services and survival needs such as food, water and health care. As emergencies progress, camps and settlements for the displaced stabilise, but the needs of the host population can be as great as and perhaps even greater than the needs of the displaced population. Therefore, it is important that response efforts include the disaster-affected host community.

## Important role of the community

Experience has shown that wide-ranging benefits result when communities actively involved in their own health and participate in water and sanitation projects. Using participatory approaches to engage the community has many benefits. Such approaches give community members the opportunity to build and strengthen problem-solving skills

and empower them to take action. While communities, initially, might have limited capability to respond, giving them the opportunity to be involved helps with their own recovery process (see the mental health chapter for additional thoughts on the community recovery process). Through community involvement, water and sanitation programmes and projects can gain a thorough understanding of the needs, concerns and values of the beneficiaries. The local skills and capacities that exist among the disaster-affected population can also be identified and strengthened. Strong community involvement is critical for projects being sustainable long after external assistance stops.

The following are the main principles of participatory approaches:<sup>27</sup>

- Communities can and should determine their own priorities in dealing with the problems that they face;
- The enormous depth and breadth of collective experience and knowledge in a community can be built on to bring about change and improvements;
- When people understand a problem, they will more readily act to solve it;
- People solve their own problems best in a participatory group process.

The community plays an important role in helping agencies formulate change strategies for effective behaviour. Effective hygiene programmes use community knowledge to understand what will motivate people to change their behaviour—behaviour toward using and cleaning toilet facilities, toward washing hands after using toilet facilities, etc. In fact, disease prevention and good health might not be a strong factor to make people want to change. It might instead be convenience, social status, the esteem of others and financial gain that are the driving forces behind change. Engaging and getting input from community members is the best way to fully understand these driving forces.

The aim of safe water supply and adequate sanitation is to **prevent** disease rather than treat disease. Disease prevention should be a concern of the entire community because when disease is not prevented, the entire community suffers negative effects. Conversely, when disease is prevented, the entire community benefits from the positive effects. A vast range of benefits, both health and non-health related, is gained from improving water supply and sanitation and thus, preventing disease.<sup>18</sup> These benefits affect not only the patient, but also a much wider sphere of influence including the patient's family, the patient's community, and the health sector. Benefits from avoiding illness including money saved on health services by the patient and the health care system and the availability of more time for the patient and family members to earn wages, go to school and focus on productive activities. As an example, a child's sickness might prevent a mother from spending as much time tending crops, earning wages, seeking firewood or hauling water as she normally would; therefore, household finances, food supplies and hygiene can all suffer. Children, particularly girls, may stay home from school so that they can help their mother with household chores that would otherwise go neglected. A father might miss work because of the needs of the family and sick children.

Organising new, perhaps temporary water and sanitation systems, maintaining or repairing an already installed water and sanitation facilities must be major considerations for all construction projects including those in emergencies. When facilities stop functioning, the disease-preventing benefits gained from those facilities diminish if no backup facilities are available. For proper long-term maintenance of facilities, it is critical that the community be involved in the project at the onset and throughout the project's duration. It is worth noting that although community members might have been involved in the construction of the facilities, this does not automatically mean that they are willing to take ownership and management of the facilities and fulfil the on-going maintenance



Building a latrine  
Photo: International  
Federation

needs that arise. The following points should be considered when community management in water, sanitation and hygiene projects is desired:<sup>10</sup>

- Do people in the community consider that the project responds to a priority felt need?
- Have all sections of the community been consulted? A thorough baseline data survey is necessary which identifies different groups in the community, their views about water, sanitation, health and their perceptions of the proposed project. Consensus will have to be reached on the location of installations;
- Have women been involved as far as possible in the initial discussions on the proposed project? Women are often the main water carriers and users. This might involve work on building up self-esteem and confidence among women and ensuring that men are aware of the necessity for involving women;
- Does the project have the support of the local government and community leaders? If respected community leaders are available they, rather than the agency involved, should lead the discussions;
- Have those involved in the community management and hygiene promotion aspects and those involved in the engineering components met to discuss how they can work together to achieve the goal of community management? If not, organise a short workshop to discuss the importance of this and to formulate strategies for inclusion;
- Try to ensure open and ongoing dialogue about the project. Always remain flexible and encourage suggestions from community members about how the project should proceed;
- If people do not attend meetings, try to find out why as soon as possible by discussing with people at places where they meet, e.g. at the water source. Find out if alternative arrangements can be made;
- Ensure that the issue of long-term maintenance is raised as soon as possible with community groups. Ask them how they intend to repair the system if it breaks down or what provisions they have made for this in the past. This might involve discussing with them about the need for user fees or other payments, who will administer and collect these fees, financial accountability and the need for further training in accounts and financial management. They will also need to identify who will actually do the maintenance and whether they need to be trained. Water committees can be set up;
- Maintenance issues should be discussed in an open forum in order to arrive at some consensus from all users;
- Different groups might have alternative plans for the same water points. Visits by community members to other successful or unsuccessful projects in the vicinity can be considered;
- Formal agreements and contracts should be drafted when discussions have been finalised;
- Formulate objectives, indicators and means of verification to evaluate the capacity for community management, level of participation and the degree of integration of software and hardware components to the satisfaction of the intended project beneficiaries;

This chapter will later discuss control measures for preventing disease spread. For these to be as effective, it is important that disaster-affected people including the most vulnerable be given the opportunity to be actively involved in contributing ideas and making decisions in the water and sanitation projects.

## Involving the community early in the crisis

Every effort should be made to work together with disaster-affected people including vulnerable groups and the affected host community as soon as possible and to give them the opportunity to play an active role in the design, implementation and management of water and sanitation projects. Opportunities should not be missed to build on existing knowledge and capacities for solving problems and taking responsibility for the health of their own community. Providing information to the community is just the first step; community members must be given the opportunity to share their ideas and guide and direct programmes from start to finish.

Emergency response activities typically start by assessing needs. Assessments collect and analyse information used to direct and define the relief response. It is important that local knowledge contributes to defining and framing the response efforts. A wide spectrum of community involvement in assessments, including women and those from various social and economic levels, provides an excellent opportunity for the needs of the entire population to be understood from a community perspective. As an example, families and communities must be consulted as early as possible in the planning of excreta disposal facilities so that valuable information about location, design, access, cleaning and the culturally appropriateness of the proposed facilities can be decided with those who will eventually use the facilities and be responsible for their upkeep.

### *Box 8-4 Participatory Hygiene and Sanitation Transformation (PHAST)*

The Participatory Hygiene and Sanitation Transformation (PHAST) approach is used to promote hygiene sanitation and community management of water and sanitation facilities. The approach encourages people to address and solve their own health-related problems and uses health awareness and understanding as the basis upon which people embrace lasting behaviour change toward water, sanitation and hygiene.

Recent efforts have been made to use a compressed version of PHAST in emergencies to engage disaster-affected populations early in the crisis. PHAST methodology has been applied to several emergency situations including Pakistan in 2005 by International Federation in coordination with UNICEF and in refugee camps in south-western Uganda in 2003 and 2006 by International Federation in response to cholera. In both these locations, not all seven steps of the PHAST programme were used, but rather a shortened version was adapted for the specific emergency.<sup>29</sup>

## Water and sanitation committees

It is important for sustainability that programmes encourage beneficiaries to participate in all stages and aspects of assistance actively. One way to foster active participation is to guide community leaders and members to form water and sanitation committees. Such water and sanitation committees play a critical role in the transfer of knowledge, training and maintenance responsibility and in promoting good hygiene behaviour. Water and sanitation committees must be made up of a wide cross-section of the community including women and members of other vulnerable groups. Members of water and sanitation committees should be genuinely committed to their community by giving their services free.

There are several social benefits associated with developing water and sanitation committees. Water and sanitation committees can help to strengthen community structures that are likely to be in disarray after the emergency. Water and sanitation committees also provide the community an organised way to take action toward improving their health and well-being.

Functions of a water and sanitation committee can include:

- Actively promoting hygiene and sanitation;
- Organizing community mobilisation for the construction and protection of water supplies;
- Active involvement in vector control;
- Establishing rules for appropriate use of water, particularly when water is scarce;
- Setting enforcement procedures for rules.

## Improving environmental conditions

When camps or communities hosting those displaced by a disaster become overcrowded, or traditional environmental health facilities in a village become damaged, living conditions can become unhygienic. In these situations, it might be difficult to prevent the transport or exposure of people to environmental hazards. Large-scale outbreaks of diarrhoea and other environment-related diseases are frequently reported among refugee and displaced populations, particularly during the acute emergency phase. These outbreaks may be a sign of insufficient efforts in controlling environmental hazards and monitoring the risk of disease outbreaks. Planners of emergency relief programmes must make environmental health control their top priority. Control measures should be started immediately and upgraded over time, based on urgency and available resources to achieve the minimum standards of services by the end of the acute emergency phase.

## Assessing environmental health conditions

To establish effective water, sanitation and hygiene programmes in humanitarian emergencies requires a good understanding of the relationship between human and socio-economic factors and the physical landscape. The need for a proper assessment to understand this relationship cannot be overemphasised. The epidemiology chapter of this book covers more detailed assessments.

Environmental control measures that have a rapid impact but also a long-term view should be selected. Programme designers should start thinking of the long-term needs during implementation. They should also achieve the minimum standards in emergency response within three to six months. Since maintaining a clean environment depends on the cooperation of the people affected, a representative group from the community should take part in every aspect of planning and implementing water, sanitation and hygiene programmes and projects. As stated previously, representative groups should always include women and a cross-section of people from various socioeconomic levels. Chapter three of this book discusses details of programme design and

management.

An assessment of the physical environment should be carried out as soon as possible after the disaster has occurred. Assessment results should identify environmental health priorities and provide enough information to design a programme quickly. Environmental health assessments should involve multiple sectors, water and sanitation, food, shelter, health services, local authorities and representatives from the disaster-affected population and local non-governmental organisations. Assessment teams must include individuals with local knowledge as well as previous experience of disasters in the country or region.



*Pakistan earthquake - The dry river bed adjacent to destroyed villages epitomized the destructive power of the quake. Two years later the water is flowing freely down the Kunhar and the shattered water supply infrastructure is being put back in place. Photo: International Federation*

Appropriately qualified personnel such as the environmental health technician or sanitation inspector should lead the assessment.

Assessment checklists are useful for ensuring all the key questions have been examined, but they must be adapted to the particular disaster situation. Box 8-5 contains a checklist for assessing health needs and local conditions and identifying local resources. Be sure to see the checklist included in the epidemiology chapter of this book for additional details.

*Box 8-5: Water supply and sanitation needs assessment checklist<sup>24</sup>*

**General**

- How many people are affected and where are they? Disaggregate the data as far as possible by sex, age, disability, etc.
- What are the people's likely movements? What are the security factors for the people affected and for potential relief responses?
- What are the current or threatened water- and sanitation-related diseases? What are the extent and expected evolution of problems?
- Who are the key people to consult or contact?
- Who are the vulnerable people in the population and why?
- Is there equal access for all to existing facilities?
- What special security risks exist for women and girls?
- What water and sanitation practices were the population accustomed to before the emergency?

**Water supply**

- What is the current water source and who are the present users?
- How much water is available per person per day?
- What is the daily/weekly frequency of the water supply?
- Is the water available at the source sufficient for short-term and longer-term needs for all groups in the population?
- Are water collection points close enough to where people live? Are they safe?
- Is the current water supply reliable? How long will it last?
- Do people have enough containers of the appropriate size and type?
- Is the water source contaminated or at risk of contamination (microbiological or chemical/radiological)?
- Is treatment necessary? Is treatment possible? What treatment is necessary?
- Is disinfection necessary, even if the supply is not contaminated?
- Are there alternative sources nearby?
- What traditional beliefs and practices relate to the collection, storage and use of water?
- Are there any obstacles to using available supplies?
- Is it possible to move the population if water sources are inadequate?
- Is it possible to bring in tank water if water sources are inadequate?
- What are the key hygiene issues related to water supply?
- Do people have the means to use water hygienically?

**Solid waste disposal**

- Is solid waste a problem?
- How do people dispose of their waste? What type and quantity of solid waste is produced?
- Can solid waste be disposed of on site, or must it be collected and disposed off site?
- What is the normal practice of solid waste disposal for the affected population? (Compost/refuse pit? collection system? bins?)
- Are there medical facilities and activities producing waste? How is this being disposed of? Who is responsible?

**Excreta disposal**

- What is the current defecation practice? If it is open defecation, is there a designated area? Is the area secure?
- What are the current beliefs and practices, including gender-specific practices, concerning excreta disposal?
- Are there any existing facilities? If so, are they used, are they sufficient and are they operating successfully? Can they be extended or adapted?
- Is the current defecation practice a threat to water supplies (surface or ground water) or living areas?
- Do people wash their hands after defecation and before food preparation and eating? Are soap and other cleansing materials available?
- Are people familiar with the construction and use of toilets?
- What local materials are available for constructing toilets?
- Are people prepared to use latrines, defecation fields, trenches, etc.?
- Is there sufficient space for defecation fields, pit latrines, toilets, etc.?
- What is the slope of the terrain?
- What is the level of the groundwater table?
- Are soil conditions suitable for on site excreta disposal?
- Do current excreta disposal arrangements encourage vectors?
- Are there materials or water available for anal cleansing? How do people normally dispose of these materials?
- How do women deal with menstruation issues? Are there appropriate materials or facilities available for these issues?

**Vector-borne diseases**

- What are the vector-borne disease risks and how serious are these risks?
- What traditional beliefs and practices relate to vectors and vector-borne diseases? Are any of these either useful or harmful?
- If vector-borne disease risks are high, do people at risk have access to individual protection?
- Is it possible to make changes to the local environment by drainage, scrub clearance, excreta disposal, refuse disposal, etc. to discourage vector breeding?
- Is it necessary to control vectors by chemical means? What programmes, regulations and resources exist for vector control and the use of chemicals?
- What information and safety precautions need to be provided to households?

**Drainage**

- Is there a drainage problem (e.g. flooding of dwellings or toilets, vector breeding sites, polluted water contaminating living areas or water supplies)?
- Is the soil prone to water logging?
- Do people have the means to protect their shelters and latrines from local flooding?

There are various techniques for gathering assessment information and these should be carried out in a systematic way. Key people can be interviewed first followed by a review of existing records. Afterwards, existing water and sanitation systems should be inspected. A rapid survey can be organised to collect information from a sample of the displaced population. The goal is to ask as few questions as possible about the key topics. Figure 8-3 provides an example of a questionnaire for assessing water consumption and latrine coverage.

Figure 8-3: Example of a survey questionnaire

**Household water survey**

Date: \_\_\_\_\_

Interviewer: \_\_\_\_\_

Location: \_\_\_\_\_

Household number: \_\_\_\_\_

1. *Introduce yourself and explain the purpose of the survey.*

---

2. *Ask the person who collects water for the household:*  
How much water did you and other family members collect yesterday (for all purposes)? \_\_\_\_\_

3. How many water vessels do you have? Number \_\_\_\_\_;  
Estimate total volume \_\_\_\_\_

4. a. How many members are there in your family? \_\_\_\_\_  
b. How many of them consumed water yesterday? \_\_\_\_\_

5. Does your family have a latrine? \_\_\_\_\_

6. How many other families share the latrine? \_\_\_\_\_

7. Do you own livestock? \_\_\_\_\_  
If yes, what kind of livestock and how many?  
\_\_\_\_\_

After the assessment, all the information should be analysed and presented in a way that allows for transparent and consistent decision-making. For example, average water consumption and latrine coverage can be calculated using data from the above questionnaire shown in the following (see Box 8-6).

*Box 8-6: Calculations drawn from questionnaire*

$$\text{Average Water Consumption} = \frac{\text{Total amount of water collected}}{\text{Total number of family members present}}$$

While family members often do not divide water equally among members, this will give planners an approximate water consumption average.

$$\text{Latrine Coverage} = \frac{\sum \text{Number of latrines}}{\text{Total number of families interviewed}}$$

- Give the family credit for ½ or ⅓ of a latrine, depending on their sharing habits with other families.

The assessment helps relief planners determine whether external resources are needed, depending on the national standards for water supply, sanitation and vector control of the host country. Box 8-7 provides an example outline of conclusions for an environmental health assessment report.

*Box 8-7: Conclusions of an environmental health assessment*

- Main hazard affecting the disaster situation (human excreta, vectors) should be stated.
- Current measures to control the hazard (note whether they are adequate).
- Immediate and future actions if necessary should be outlined, using a phased approach. Actions may include the following environmental health interventions:
- Setting up temporary defecation areas until other solutions are available to improve the general hygiene.
- Providing sufficient quantities of quality water and restoring damaged water systems.
- Reducing the vector and rodent populations to acceptable levels.
- Promotion of safe hygiene practices at household level including reinforcing ‘hand-washing’ at critical times.
- External resources required (technical skills, chemicals, equipment or spare parts, staff to organise culturally and technically appropriate defecation facilities or areas).
- Further investigations if necessary (e.g. by a road, water or sanitation engineer).

## Standards and key indicators

The minimum standards and key indicators presented in this chapter are taken from ‘The Sphere Project, Humanitarian Charter and Minimum Standards in Disaster Response.’<sup>24</sup> Standards represent the ideal to be strived for in emergencies while key indicators are used to measure progress toward the standards. Measuring this progress is important for identifying gaps and for monitoring and evaluating work accomplished. This chapter highlights important points about key indicators, but is not meant to duplicate all the detailed explanations in the guidance notes provided by the Sphere Project. The key indicators, therefore, presented in this chapter should be read in conjunction with the Sphere Project guidance notes for each key indicator.<sup>24</sup>

Standards that are common to all sectors (water-sanitation, food, shelter and health) are highlighted below. See ‘The Sphere Project’ for key indicators and guidance notes for these standards.<sup>24</sup>

- Participation: the disaster-affected population actively participates in the assessment, design, implementation, monitoring and evaluation of the assistance programme;

- Initial Assessment: assessments provide an understanding of the disaster situation and a clear analysis of threats to life, dignity, health and livelihoods to determine, in consultation with the relevant authorities, whether an external response is required and, if so, the nature of the response;
- Response: a humanitarian response is required where the relevant authorities are unable or unwilling to respond to the population's protection and assistance needs on the territory over which it has control and when assessment and analysis indicate that these needs are unmet;
- Targeting: humanitarian assistance or services must be provided equitably and impartially based on the vulnerability and needs of individuals or groups affected by disaster;
- Monitoring: the effectiveness of the programme's response to problems is identified and changes in the broader context are continually monitored to improve the programme or to phasing it out as required;
- Evaluation: there is a systematic and impartial examination of humanitarian action, intended to draw lessons to improve practice, policy and to enhance accountability;
- Aid worker competencies and responsibilities: aid workers must possess appropriate qualifications, attitudes and experience to plan and effectively implement appropriate programmes;
- Supervision, management and support personnel: aid workers receive supervision and support to ensure effective implementation of the humanitarian assistance programme.

This section discusses standards, key indicators and controls measures for the following:

- Excreta disposal;
- Water quantity;
- Water quality;
- Hygiene;
- Food safety;
- Vector control;
- Solid waste management;
- Drainage.

## Excreta disposal

Among the first priorities in an emergency must be containing and disposing human faeces which must not contaminate the environment including drinking-water sources and, thus, lead to the spread of disease. Appropriate facilities for defecation are vital to people's health as well as their dignity, safety and well-being.

### Standards and key indicators for excrete disposal

The following are minimum standards for excreta disposal facilities (toilets and/or latrines):<sup>24</sup>

- Toilets are installed in sufficient number to allow for acceptable use;
- Toilets are installed sufficiently close to dwellings to allow for rapid and safe use at all times of the day and night; and
- Toilets are sited, designed, constructed, and maintained so that they are comfortable, hygienic and safe to use.

To measure progress toward excreta disposal standards, key indicators have been developed which corresponds to the above standards on excreta disposal (see Box 8-8 and Box 8-9).

*Box 8-8: Key indicators for access to toilets and number of toilets<sup>24</sup>*

- A maximum of twenty people should use each toilet;
- Use of toilets is arranged by household(s) and/or segregated by sex;
- Separate toilets for women and men are available in public places (markets, distribution centres, health centres, etc.);
- Shared or public toilets are cleaned and maintained in such a way that they are used by all intended users;
- Toilets are no more than fifty metres from dwellings;
- Toilets are used in the most hygienic way;
- Children's faeces are disposed of immediately and hygienically.

*Box 8-9: Key Indicators for design, construction, and use of toilets<sup>24</sup>*

- Users especially women must be consulted and approve of the location and design of the toilet.
- Toilets are designed, built, and located to have the following features:
  - Designed in such a way that they can be used by all sections of the population, including children, older people, pregnant women, and the physically and mentally disabled;
  - Sited to minimise threats to users, especially women and girls, throughout the day and night;
  - Sufficiently easy to keep clean to invite use and do not present a health hazard;
  - Provide a degree of privacy in line with the norms of the users;
  - Allow for the disposal of women's sanitary protection, or provide women with the necessary privacy for washing and drying sanitary protection cloths;
  - Minimise fly and mosquito breeding;
  - All toilets constructed to use water for flushing and/or a hygienic seal have an adequate and regular supply of water;
  - Pit latrines and soakaways (for most soils) are at least thirty metres from any groundwater source and the bottom of any latrine is at least 1.5 metres above the water table (during high water table season);
  - Drainage or spillage from any defecation system must not run towards any surface water source or shallow groundwater source;
  - People wash their hands after defecation, after contact with children's faeces, before feeding themselves or children and before food preparation;
  - People are provided the tools and materials for constructing, maintaining, and cleaning their own toilets if appropriate.

## Basic excreta disposal concepts

In humanitarian emergencies, establishing a sanitation system for large, displaced populations should be among the first priorities. Epidemiological studies in developing countries have shown that use of latrines or other excreta containment facilities provides greater protection against diarrhoeal diseases than any other environmental health measure. Although the type of facility varies between settings and cultures, several basic concepts always apply and are presented below.

The purpose of a sanitation system is to contain human excreta at the moment of defecation so that it is not free to spread throughout the environment. Getting as many people to use excreta containment facilities as often as possible is the goal of all sanitation programmes. Sanitation workers should clearly communicate to the affected population how essential it is for everyone to defecate every time in the excreta containment facilities. Whatever the circumstances, an appropriate sanitation programme must be developed that considers the following:

- In some cultures, there is need to build separate latrines for men and women and special latrines for children;
- In some settings, latrines might be needed at places of work or public gathering areas (markets, health facilities, etc.).

People's excreta poses little hazard to themselves. Faeces from one's family members might be less hazardous than other people's because families are more likely to have common immunological histories as a result of exchanging pathogens on an ongoing basis. Where possible, different households should not share latrines or toilets, because latrine cleaning and maintenance is an unpleasant task in virtually all cultures, having a latrine for every household helps maintain clean facilities. However, the health benefits of having enough latrines for each family must be balanced against the time, effort, and expense of building them.

Mortality and morbidity rates among displaced populations in the first days and weeks of a crisis are often many times higher than for the same population once it has settled. Providing some type of sanitation facilities during the first days of a crisis is critical for preventing outbreaks of diarrhoeal diseases. Some latrines should be built either before the population arrives at a site (which is rare) or defecation fields should be established immediately following their arrival. A proper site must be reserved for defecation fields at the outset of a crisis. These fields must be away from water sources but not too far from the dwellings that discourages people from using them.

Young children pose a particular concern for excreta control programmes. Children experience a disproportionate amount of diarrhoea compared to other members of the population; they, therefore, shed the most hazardous faeces. Their defecation habits are particularly difficult to control. The solution to this problem involves two steps:

- First, educate child-care providers about proper handling of children's faeces and the importance of washing their own hands after cleaning children and handling children's faeces;
- Second, child-friendly latrines must be made available. Child-friendly latrines are not dark (perhaps even have no walls) and have a squat hole that is smaller than an adult latrine's.

The habits and beliefs of the displaced people will determine what structures and materials are most appropriate. Most latrine/toilet options perform the primary task of containing excreta whether they are above-grade barrels, pit latrines, or solar-heated composting toilets. It is best to let the displaced population match the proper hardware and educational inputs according to their own beliefs and habits. Letting displaced populations design and construct sanitation facilities, especially if each household can construct latrines for itself, can help to assure that facilities will be used and maintained properly.

## Excreta disposal during initial response phase

During the first days of the emergency, toilets/latrines might not be available; therefore, immediate short-term solutions for excreta disposal are needed. Such solutions include open defecation fields or trench defecation fields. It is important that open and trench defecation fields and all other excreta disposal facilities be constructed away from water sources and downhill from settlements (to avoid excreta-contaminated runoff from reaching the living environment after rainfall). For technical details on proper construction of open and trench defecation fields and other excreta disposal systems including simple pit latrines and Ventilated Improved Pit latrines. See the inter agency manual 'Excreta disposal in emergencies'<sup>31</sup> or 'Emergency Sanitation: Assessment and Programme Design.'<sup>15</sup>

Throughout the emergency, hand-washing facilities should be made available along with excreta disposal facilities. In addition, education on the importance of hand washing for disease prevention should also be provided. See the hygiene section for more details.

At the emergency's onset, fifty people per toilet/latrine is usually the target if meeting twenty people per toilet/latrine is not possible. The ultimate goal is one latrine per family which helps to ensure that latrines are kept clean. For ensuring cleanliness, family latrines are preferred over communal latrines. Cleanliness is one of the many factors to be considered when deciding whether to install communal or family latrines. Other factors include speed of construction, technical quality, construction costs, maintenance costs, technical possibilities, access, security and development issues (Table 8-4).

Table 8-4: Advantages and disadvantages of communal and family latrines<sup>1, 16</sup>

Factor	Communal	Family
<b>Speed of construction</b>	Can be constructed fast by well-trained and well-equipped teams although rate of construction limited by number of staff and equipment.	Can take considerable time to train families initially, but large numbers of latrines might be built quickly.
<b>Technical quality</b>	Quality of design and construction easier to control but innovative ideas from users might be missed.	Potential for innovative ideas of users, but more difficult to ensure good location and construction.
<b>Construction costs</b>	Use of materials can be easily controlled but labour must be paid for.	Construction labour and some materials might be free, but families might not have the time or the right skills.
<b>Maintenance costs</b>	Maintenance, repair and replacement costs are easier to predict and plan, but staff is required to clean and maintain facilities in long-term.	Users take responsibility for cleaning and maintenance but recurrent costs are less predictable.
<b>Technical possibilities</b>	Heavy equipment and specialised techniques might be used when necessary (e.g. rocky ground).	Families might not be able to dig in hard rock or build raised pit latrines where the water table is high.
<b>Cleaning and hygiene</b>	Users do not have to clean latrines, but these are often dirty and a greater mix of users increases the risk of disease transmission.	Latrines are often cleaner but many users might prefer not to be responsible for construction, cleaning and maintenance.
<b>Access and security</b>	Latrines might be less accessible and more insecure, particularly for women.	Latrines are often more accessible (closer to dwellings) and safer.
<b>Development issues</b>	People might lose or not acquire the habit of looking after their own latrine.	People keep or develop the habit of managing their own latrines.

## Long-term plan for excreta disposal

Early in the emergency, consideration should be given to a master long-term plan for excreta disposal for the camps and settlements particularly if population growth or expansion is likely. Location of dwellings is important because dense concentrations of dwellings can lead to long-term problems with excreta disposal facilities and other health-related concerns. A minimum surface area of 45 m<sup>2</sup> should be available for each person.<sup>24</sup> Besides initial space requirements, excreta disposal facilities also require replacement areas, which are needed when initial facilities fill up or fail. Although replacement areas might not be needed until many months into the crisis, they should be identified and reserved early in the emergency.

Understanding the needs of the community is important to the success of sanitation programmes. Every effort should be made to have community members shape and guide programmes. The spectrum of ways the community can be involved is wide and could include many things such as construction of facilities; contributing ideas; making decisions or taking responsibility for installed facilities. Many aspects of excreta disposal, including those listed below, benefit from community input, guidance and decision-making.

- It is vital that community input is sought on the best methods and messages for convincing people why and how to properly use and maintain latrines;
- Community feedback is needed on whether families have the necessary knowledge, tools and materials for constructing, maintaining, cleaning and properly abandoning old facilities;
- Input from community members on existing hygiene practices steers promotion programmes aimed at the need and use of child-friendly disposal facilities and the proper disposal for child faeces by burying or disposing of it in a latrine/toilet;
- Community members provide critical information about facility locations being close enough to dwellings so that assaults on women and children are less likely;
- Consultation with community members from vulnerable groups e.g. women, older people, disabled people, people living with HIV/AIDS etc. can ensure that their needs are being adequately met.

## Options for excreta disposal

The following factors should be considered when selecting sanitation systems:

- Acceptance—cultural factors are considered in the design;
- Access—the population has access to latrines;
- Use—the population is educated on proper latrine use;
- Maintenance—proper maintenance of latrines is organised;
- Drainage—the latrines are protected from surface water drainage.

Listed below are brief explanations of different types of disposal facilities that are typical to emergencies. For more details on excreta disposal facilities see ‘A Guide to the Development of on site Sanitation’<sup>12</sup> and ‘Emergency Sanitation, Assessment and Programme Design.’<sup>15</sup>

### Defecation Fields

In arid and semi-arid climates, reserving specific areas for defecating can be an acceptable means for keeping people separate from their excreta. In all settings and climates, defecation fields might be a necessary choice in the first days of an acute emergency. To provide optimal health protection, defecation fields should have the following characteristics:

- Defecation areas should be located away from water sources to prevent contamination of the source and be located downhill of dwellings to prevent contamination of living areas with excrement after rainfall;
- Defecation areas should be close enough to the population so that they will be used even in the evening hours;
- Defecation areas should be clearly marked so that people understand where they are suppose to defecate;
- Because the need for privacy varies between cultures, local representatives should be consulted to determine if separate facilities for males and females are mandatory or if screens are adequate.

Defecation fields should be managed so that some areas are used for a day or two and then closed as unused areas are opened. If the defecation field is on a slope, it is wise to start using a strip at the bottom that runs across the slope (not up and down) and then move up. People can be guided to the open portions of the defecation zone either by ropes or tapes, screens which provide some privacy or by gangplanks. Whatever mechanism is used to guide people, it should be moved periodically to prevent them from having to wade through areas with excessive faecal contamination.

### Trench Latrines

A communal type of latrine is often used when sanitation facilities are needed quickly and defecation fields are not appropriate. The fastest and easiest type of communal latrine to construct is a trench latrine. This is simply a trench measuring about 0.5 to 1m in depth and width and of varying length. Such a trench can be dug very quickly with a backhoe. A board or logs are placed across the trench so that people can squat over the void and defecate. Most often, the dirt from the trench is left in a pile beside the latrine and a thin layer of soil is shovelled on top of the excreta on a daily basis. This acts to reduce odours and control flies. It also causes the trench to fill quickly. Therefore, depending on the number of people served per trench and the size of the trenches, digging new trenches will be necessary every few days. Because a trench latrine can be dug fast and easily, it allows a large population to be served by many facilities quickly.

### Barrel Latrines

A barrel latrine is an option in places where the water table is high, the soil too hard to dig or the weather is cold and therefore need indoor latrines. Typically, there are two designs:

- The first type uses the bottom half of a 200-litre metal barrel. A piece of plywood or other material with a squat hole in the middle is placed over the top of the barrel to serve as a platform. People step onto the platform to defecate into the barrel. When the barrel is approximately half filled, the platform is removed and the barrel is taken to a dumpsite and emptied, and then brought back for reuse. Some military manuals suggest pouring gasoline into the barrel and burning the contents. This is only recommended when sanitary disposal is not possible (e.g. where there is a very high water table) and should only be used with great caution;
- The second type of barrel latrine uses an entire 200-litre barrel as a collection vessel. However, because a 200-litre barrel is more than a mere high, a platform with steps must be built so that people can get above the barrel and defecate into it. The barrel is periodically emptied as with the half-barrel design.

### Pit Latrines

The most commonly selected sanitation option for displaced populations is the pit latrine. A pit latrine is a wide hole in the ground that is covered by a platform with a squat hole to defecate through. Designs vary from a simple latrine made with a hole in the ground with two logs across it, to elaborate composting latrines that separate faeces and urine and have a vent to make them odour free. Most areas throughout the world have a local latrine

design that usually has a superstructure with walls to provide privacy. Preferably, each household or family will usually build culturally appropriate latrines if they are given the proper construction materials and some guidance. As mentioned earlier, the key point is for everyone involved to understand that the goal is for as many people as possible to use a latrine with as little sharing as possible. It is important to note that pit latrines are not an option where the water table is high or the soil is shallow or hard.

### Pour flush latrines or flush toilets

Toilets that are flushed with a bucket of water or those that flush on their own are the norm in many parts of the world, but they are rarely appropriate during a complex emergency. A pour flush toilet is a basin with a water trap at the bottom and a pipe to carry sewage to a soak-away pit or sewer. The water trap (a tube that curves up from the bottom of the basin a few centimetres above the bottom and then curves downward again) causes the basin to hold between 200ml and two litres of water. After defecating in the basin, two to five litres are poured onto the basin. This causes the waste to be flushed away. The advantage of this system is that it is relatively clean and odour free. However, the disadvantages of pour flush latrines are greater. Not only do such designs use large amounts of water, but they also require a sewage collection system that is expensive and time consuming to build. Where piped water or other plentiful water sources are available, water-flushing options might be suitable.

## Water quantity

One of the major goals of water supply programmes is to provide **enough water** to meet drinking, cooking and hygiene needs. In this chapter, personal hygiene needs include bathing, hand washing. Domestic hygiene needs are related to the upkeep and cleaning of the household environment including the cleaning of water storage containers, cookware and utensils. Providing enough water to meet hygiene needs is very important because diarrhoeal disease that is a major cause of death in emergencies often occurs where hygiene is poor. Adequate quantities of water are needed to keep up good hygiene practices and thus lower the risk of diarrhoeal diseases.

In developing countries, providing people with **increased amounts** of water is more effective in protecting against faecal-oral pathogens than providing them with **cleaner** water. At least fifteen litres per person per day is needed to maintain human health. While the availability of water is influenced by the situation, more water can almost always be obtained with more resources (more wells, trucks or pipes). Since obtaining water in arid areas is expensive and the relationship between water quantity and health is not well understood, there is a tendency not to invest enough in water infrastructure when other demands seem more serious. Therefore, monitoring the availability of water during emergencies is an essential component of a public health programme.

## Water sources

As previously mentioned, the chronic phase of emergencies can last several years. Therefore, it is important that decisions made early in the emergency about water supply consider the likelihood that the disaster-affected population will need dependable water supplies for years to come.

In this section, we refer to the different types of water sources that people use for their water supply. water sources fall into three general categories:

- Rainwater, generally though pure, is not reliable or a sufficient source to provide for a large displaced population. It is rarely considered during complex emergencies;
- Surface water from lakes, ponds, streams and rivers is accessible, easily collected, reliable and plentiful. Its disadvantage is its being microbiologically unsafe, therefore requiring treatment;

- Groundwater from wells, springs, etc. tends to be of a higher microbiological quality (having undergone natural soil filtration underground). However, it is relatively difficult to extract. More technology and energy is needed compared with other water sources to bring underground water to the surface. A spring is a location where groundwater naturally flows upward to the earth's surface.

The following factors are important when selecting the type of water sources for emergency situations:<sup>17</sup>

- Acceptable yield—existing demand on the source, present yield, predicted future and seasonal yield;
- Requirements to obtain an acceptable quality—current water quality problems, predicted future and seasonal water quality problems, treatment process required;
- Management, legal, security or socio-political and cultural constraints;
- Technical and operation and maintenance requirements—protection, abstraction method and structures, treatment, transmission distance and method, supply storage, distribution;
- Resources and logistical restraints—material and equipment resources, human resources, logistical;
- Time of set-up;
- Ease of Operation and Maintenance (O&M);
- Impacts of development—on aquifers, existing users and local population, on vegetation and erosion and on water treatment and waste disposal;
- Costs—capital, O&M.

Box 8-10 provides guidelines for the maximum number of people per water source assuming access is available for eight hours per day.<sup>24</sup>

*Box 8-10: Guidelines for maximum people per water source<sup>24</sup>*

250 people per tap	Based on a flow of 7.5 litres/minute
500 people per hand pump	Based on a flow of 16.6 litres/minute
400 people per single-user open well	Based on a flow of 12.5 litres/minute

## Standards and key indicators related to water quantity

The following are minimum standards for water supply quantity and related aspects of quantity including access and water use facilities and goods:<sup>24</sup>

- All people have safe and equitable access to a sufficient quantity of water for drinking, cooking, personal and domestic hygiene;
- Public water points are sufficiently close to households to enable use of the minimum water requirement;
- People have adequate facilities and supplies to collect, store and use sufficient quantities of water for drinking, cooking, personal hygiene and to ensure that drinking water remains safe until it is consumed.

Key indicators for measuring progress toward water quantity standards are presented in Box 8-11 and Box 8-12.

*Box 8-11: Key indicators for access and water quantity<sup>24</sup>*

- Average water use for drinking, cooking and personal hygiene in any household is at least fifteen litres per person per day;
- The maximum distance from any household to the nearest water point is 500 metres;
- Queuing time at a water source is no more than fifteen minutes;
- It takes no more than three minutes to fill a 20-litre container;
- Water sources and systems are maintained so that appropriate quantities of water are consistently available.

*Box 8-12: Key Indicators for water use facilities and goods<sup>24</sup>*

- Each household has at least two clean water collecting containers of ten to twenty litres, plus enough clean water storage containers to ensure there is always water in the household;
- There is at least 250g of soap available for personal hygiene per person per month;
- Where communal bathing facilities are necessary, that sufficient bathing cubicles are available with separate cubicles for males and females, and that they are used appropriately and equitably;
- Where communal laundry facilities are necessary, that there is at least one washing basin per 100 people, that private laundering areas are available for women to wash and dry undergarments and sanitary clothes;
- The participation of all vulnerable groups is actively encouraged in the location and construction of bathing facilities and/or the production and distribution of soap, and/or the use and promotion of suitable alternatives.

## Factors affecting water accessibility

Several factors affect whether a household has enough water. Enough water at the tap or hand pump is a primary concern, but it is not the only concern. The accessibility of water must also be considered. Factors affecting accessibility include security, equal sharing of water, distance to water points and supplies for storing and collecting water.

- Security is important for all users to have safe access to water points. Water supplies should be sited so that hauling and retrieval does not expose people, especially women and girls who typically haul water, to the risk of assault;
- Equal share to water supplies. All segments of the community, particularly the most vulnerable, must have an equal share of water supplies;
- Distance to water points. Water points should be sited sufficiently close to dwellings to ease hauling efforts;
- Supplies for collecting and storing. An adequate number of containers must be available for collecting, storing and using water at the household level. Containers must be of sufficient condition so that they do not contribute to the risk of disease;
- Continuity issues. Water supply should be available at appropriate times including peak use times as in the morning hours when people wake up and during evening hours in preparation of meals and washing.

## How much water is enough?

The amount of water a person needs for daily activities and maintain good health depends on many factors including the climate, the type of excreta disposal facilities used, people's habits and cultural practices, foods eaten and practices in food preparation. Table 8-5 provides an overview of basic water needs for the survival of a single person.

*Table 8-5: Simplified table of basic survival water needs per person<sup>24</sup>*

Survival needs: water intake (drinking and food)	2.5 to 3 litres per day	Depends on: the climate and individual physiology
Basic hygiene practices	2 to 6 litres per day	Depends on social and cultural norms
Basic cooking needs	3 to 6 litres per day	Depends on: food type, social as well as cultural norms
Total basic water needs	7.5 to 15 litres per day	

## Ensuring adequate water supplies

During the acute emergency phase, water consumption should be estimated weekly. Often, the utility company or relief organisation providing water to a displaced population has these estimates. It is important to clarify that water consumption means **what people receive** not what the **water team produces**. Disagreements can arise between 'production' and 'consumption' estimates because:

- Water can be lost or wasted during pumping and transport;
- Lack of water containers can prevent people from collecting enough water.

Surveys or household interviews that document the amount of water collected at watering points or people's actual use of water are preferable to simply dividing the amount of water produced at a well or a plant by the number of people served. Cholera outbreak investigations have repeatedly shown that not owning a bucket (and thus, not being able to haul adequate quantities of water) puts families at an increased risk of illness or death. Therefore, not only should the average water consumption be fifteen litres per day or more, but there should not be anyone in the population with very low water consumption (less than seven litres per day). All families should also be provided with suitable water containers for daily collection and storage of water.

When investigating water use, attention should be given to vulnerable groups, particular those who have difficulty hauling water including the elderly, disabled and people living with HIV/AIDS and other diseases. People living on the perimeter of the camp or settlement should also be included in all water use investigations because the distance they must travel to water points and other factors might contribute to their having a lower water consumption.

## Water quality

Drinking water safety is an important public health issue in emergencies. Of particular concern is the risk of water-borne diseases from water contaminated with faecal and other pathogens. Individuals affected by emergencies are often more vulnerable to disease because of malnourishment, stress and fatigue. Because of this increased vulnerability, it is important that water supplies are of good quality. At each point throughout the water supply chain from the source, through transport and to storage at the household, consideration must be given to keeping water safe. Often, safe water is produced but then often contaminated during transport or during its storage.

When choosing a water source, a source requiring little or no treatment is preferred as long as it can provide sufficient quantities of water. However, treatment of some water sources is necessary to bring water supplies to acceptable quality standards. Special consideration must be given to the long-term affordability, simplicity and reliability of the source and the treatment process required.

When emergencies occur, populations might have to relocate to places with only unprotected water sources. Unprotected water sources are more easily contaminated than protected sources. The use of unprotected sources poses a greater risk for disease than protected sources. When densely populated camps and settlements with inadequate excreta disposal are located near unprotected water sources, contamination is likely to occur. In emergencies caused by natural disasters, water quality is often a major concern. Floods might contaminate water sources such as wells, boreholes and surface water with faecal matter from overflowing latrines and sewers. In earthquakes and mudslides, faecal contamination can enter damaged water lines from damaged sewer lines. During droughts, scarce water can force people to use water from unprotected sources.

## Standards and key indicators for water quality

The following is the minimum standard for water quality:<sup>24</sup>

- Water is palatable and of sufficient quality to be drunk and used for personal and domestic hygiene without causing significant risk to health.

To help measure progress toward this standard, key indicators corresponding to this standard are presented in Box 8-13.

### *Box 8-13: Key indicators for water quality<sup>24</sup>*

- Sanitary survey indicates a low risk of faecal contamination;
- No faecal coliforms per 100ml at the point of delivery;
- People drink water from a protected or treated source in preference to other readily available water sources;
- Steps are taken to minimise post-delivery contamination;
- For piped water systems or for all water supplies at the time of risk or presence of a diarrhoea epidemic, water is treated with a disinfectant so that there is free chlorine residual at the tap of 0.5 mg per litre and turbidity is below five Nephelometric Turbidity Units (NTUs);
- No negative health effect is detected due to short-term use of water contaminated by chemical or radiological sources and assessment shows no significant probability of such an effect;
- Water collection and storage containers have narrow necks and/or covers or other safe means of storage, drawing, handling and are demonstrably used.

## Assessing quality

Monitor water safety during emergencies. Sanitary inspections are one way to assess water supplies for deficiencies that could lead to contamination. A sanitary inspection is an on site review of water supply systems. They are used to identify actual and potential sources of contamination. The results of sanitary inspections should be used to direct action to correct contamination risks. WHO Fact Sheet<sup>2.1</sup> 'Sanitary Inspections,' provides details forms and diagrams for conducting sanitary inspections.

As well as sanitary inspections, water testing is another method to assess water quality, which is usually measured by the presence of specific groups of micro-organisms. This

indicates the possible presence of faeces. Because human faeces typically contain tens of millions of bacteria per gram, even the smallest trace of faeces in water is often detectable by bacterial monitoring. Faecal coliforms are a category of bacteria that match the characteristics of bacteria found in the stool of warm-blooded mammals. Other indicator bacteria such as *E. coli*, faecal streptococci or total coliforms, are maintained by the same premise: absence implies safe water.

Under ideal circumstances, no faecal coliforms should be present in water supplies. This ideal should be strived for in emergencies. In reality however, water supplies can contain varying levels of faecal coliforms. It is important to be able to identify the level of pollution in water supplies. Guidelines for water quality are provided in Table 8-6.

Table 8-6: Guidelines for water quality<sup>14</sup>

Faecal coliforms (per 100 mls of water)	Water quality
0-10	Reasonable quality
10-100	Polluted
100-1,000	Very polluted
1,000+	Grossly polluted

The above table shows that the result **no faecal coliforms in water** is a good indication that there are **no** faecal-oral bacterial pathogens present, whereas finding **low** levels of faecal coliforms in water does not mean that the water is dangerous. It is important to note that contaminated water sources should not be closed until sources that are more favourable become available.

Water quality testing can be performed by a competent local laboratory or by using field-testing kits (e.g. the Oxfam/Del Agua Kit). Field test kits are expensive and require trained people to use them and interpret results. Testing of faecal coliforms must be done within one hour of sampling if the water sample is kept at ambient temperature or within six hours if the sample is kept between 4 °C and 6°C.

When water supplies are disinfected by chlorine, it is better to test for free available chlorine than to test for faecal coliforms. Levels of free available chlorine between 0.2 mg/l to and 0.5 mg/l at distribution points indicate appropriate disinfection levels.

## Minimum water quality standards

Table 8-7 summarises core water quality features.<sup>16</sup> These features provide information about water acceptability and treatment requirements. Additional information about water quality analysis and secondary features, which determine the chemical quality of water, can be found in 'Emergency Water Sources, Guidelines for Selection and Treatment'<sup>17</sup> and 'Guidelines for Drinking-Water Quality'.<sup>14</sup>



A Sri Lanka Red Crescent Society volunteer checks the chlorine content of water during the tsunami operation.- Photo: Christoffer Regild International Federation

Table 8-7: Core tests for drinking water quality<sup>16</sup>

Test	Why the feature is important	Suggested guideline levels (maximum)		
		Survival	Longer Term	
			Minimum recommendation	WHO guidelines (1993)
<b>Turbidity</b>	Acceptability to the consumer and determines treatment requirements (reduces effectiveness of disinfection)	20 Nephelometric Turbidity Units (NTU)	10 NTU	5 NTU 1 NTU for disinfection
<b>Odour</b>	Acceptability to the consumer and can indicate the presence of other pollutants	No restriction	Acceptable to the consumers	Should be acceptable to consumers
<b>Colour</b>	Acceptability to the consumer and can indicate the presence of other pollutants	No restriction	Acceptable to the consumers	15 True Colour Units (TCU)
<b>Conductivity</b>	Acceptability to the consumer (taste), corrosion and encrustation	No restriction	1,400 $\mu$ S/cm	1,400 $\mu$ S/cm (from 1000mg/l Total Dissolved Solids (TDS))
<b>pH</b>	Effects treatment requirements, corrosion and acceptability to the consumer (taste)	No restriction	6 to 8 for coagulation with aluminium sulphate <8 for disinfection	Preferably < 8.0 for effective disinfection with chlorine
<b>E.coli</b>	Indication of the possible presence of pathogens	Always aim to disinfect supplies If this is not possible then: <1,000 thermotolerant coliform (E.coli) / 100ml	Always aim to disinfect supplies If this is not possible then: <10 thermotolerant coliform (E.coli) / 100ml	0 thermotolerant coliform / 100ml

## Keeping water safe along the supply chain

The water supply chain is water that is taken from its source and transported before eventually being stored for use or consumption. Along this delivery chain, potable water must be protected from contamination by human and animal faeces, urine or any other hazardous material. It is important that water sources be kept as safe as possible from contamination. Good construction practices are vital for ensuring safe water quality. Such practices include:

- Protecting water sources from runoff and other contamination by constructing rainfall runoff trenches and embankments and by ensuring that the top of wells are sealed against runoff;
- Constructing latrines far away from water sources (thirty metres minimum);
- Keeping wells protected with fencing or low walls;

- Keep areas near the well as clean as possible by removing refuse or stagnant water;
- For open wells, eliminate contamination from buckets by installing hand pump or other sanitary means of abstraction;
- Protect spring water so that it can be collected without contamination by building a spring box which is a collection basin with an outflow pipe placed at or just below the point where the water comes to the surface.

While water sources may differ in water quality, it is how water is handled and stored by consumers that will finally determine whether the water is safe for drinking. Studies have shown that dipping hands into household storage buckets causes considerable contamination and that water quality declines over time after the water is initially collected. The best way to keep water safe in the household is to add a chlorine residual to the water (see the next section on water treatment for details on chlorine residuals). This means that in unsanitary settings or during times of outbreaks, it might be necessary to chlorinate otherwise safe groundwater. Additional measures for keeping water safe include hauling it in only clean containers and using only containers with narrow-neck openings to prevent hands and other objects from entering the container and contaminating the water. In addition, containers used for storing water at the household should be covered and have narrow-neck openings.

## Treatment options by source type

Treatment of water supplies retrieved by buckets and through piped distribution systems is discussed below.

### Bucket collection

When people collect water directly from water sources in buckets, the only treatment that can be done easily is chlorination. Health workers or volunteers can chlorinate water at the point of collection or in the home. Ideally, enough chlorine should be added to the bucket so that after thirty minutes there is still at least 1.0 mg/l of free chlorine in the water. Typically, an initial dose of 2.5 mg/l of chlorine will be sufficient to react with the organic material in the water and leave an adequate level of chlorine residual. Free residual chlorine is the hypochlorite ion form of chlorine that is lethal to most bacteria and viruses. People should wait for thirty minutes after chlorination before consuming the treated water in order to allow disinfection to occur.

### Pipe distributions

Drawing water from a surface water source and distributing it through a piped system can dramatically improve its quality. Generally, three steps should be taken to purify water at surface water plants and to ensure it remains safe until it reaches the consumer:

- Settling removes solids (through sedimentation) and protozoa e.g. giardia. Purification is often speeded up by adding coagulants such as aluminium sulphate (alum) and flocculation which is gentle stirring to encourage the formation and settling of heavy colloidal particles called flocs;
- Filtering through sand removes particulate matter including microbes (e.g. bacteria, amoeba);
- Disinfecting with chlorine deactivates all major water-borne bacteria.
- Within a piped system, chlorine levels are typically adjusted to ensure that 0.2 to 0.5 mg/l of free chlorine is in the water at the tap level where it is consumed. For systems with many breaks along the distribution pipes or during times of diarrhoea outbreaks, aim at having 0.5 to 1.0 mg/l of free chlorine. Attendants for water treatment plants can be trained to perform a simple test for free chlorine levels by using a pocket size chloroscope (chlorine comparator kit). Note that although boiling of water is the surest method of water sterilisation, it is not appropriate for large-scale water treatment because about one kilogramme of wood is needed to boil one litre of water.

Removing solids by coagulation and filtration greatly improves the chlorine's effectiveness. Therefore, these three measures are not simply multiple barriers, but when combined produce a synergistic effect on water quality.

It is not enough to focus on water treatment methods because shortcomings in the distribution system are the main cause of major water-borne outbreaks. Sometimes piped water systems break down. The resulting drop in pressure allows contaminants to get into pipes through cracks, which during times of constant pressure only allow water to seep outward. The process of drawing contaminated water into potable water pipes is called cross-contamination. During times of armed conflict, electrical outages, explosions and the inability to conduct routine maintenance make the problem of cross-contamination particularly serious. Two things can be done to prevent this process:

- Increase the pressure in the water pipes by increasing the rate of pumping into the system, by cutting down on water waste, or by closing off sections of the distribution system;
- Increase the level of residual chlorine because cross-contamination occurs sporadically along the distribution system. The level of chlorine residual must be kept high throughout the entire pipe network. Levels of residual chlorine should be increased until there is free chlorine virtually everywhere (at least 95% of locations).

*Box 8-14: Disinfection of hand pump and piped distribution schemes*

At the emergency's on-set, future disinfection needs must be an important factor in planning water system projects in camps and settlements. In the long-term, disinfection of water supplies might be required to protect against outbreaks or in response to actual outbreaks. Although water sources might be of good quality, disinfection will be needed to protect the quality of water during transport and storage to the household.

Two options for water supply systems in camps and settlements are piped distribution systems and hand pump schemes. For piped distribution systems which might include a motorised well pump, storage facilities, distribution pipes and tap stands to deliver water, disinfection is typically straightforward. With proper training, a single water attendant can effectively chlorinate several systems in a camp or settlement. Appropriate concentrations of chlorine are mixed with water in the storage tank and a one-hour contact time is allowed before valves are opened allowing water to flow to tap stands.

Compared to a pipe distribution system, disinfecting water from hand pumps has several disadvantages. First, hand pumps must be disinfected, one jerry can or container at a time by attendants placed at each hand pump. Chlorination of hand pumps is very labour-intensive and costly if community volunteers are unavailable. Water attendants also must be present at all times when the hand pump is operational to ensure that all water supplied from them are chlorinated. Finally, people might or might not allow one hour of chlorination water contact time before using the water.

For these reasons, pipes systems are more appropriate from a disinfection viewpoint over hand pump schemes in large camps and settlements when the disinfection of water supplies is highly anticipated.

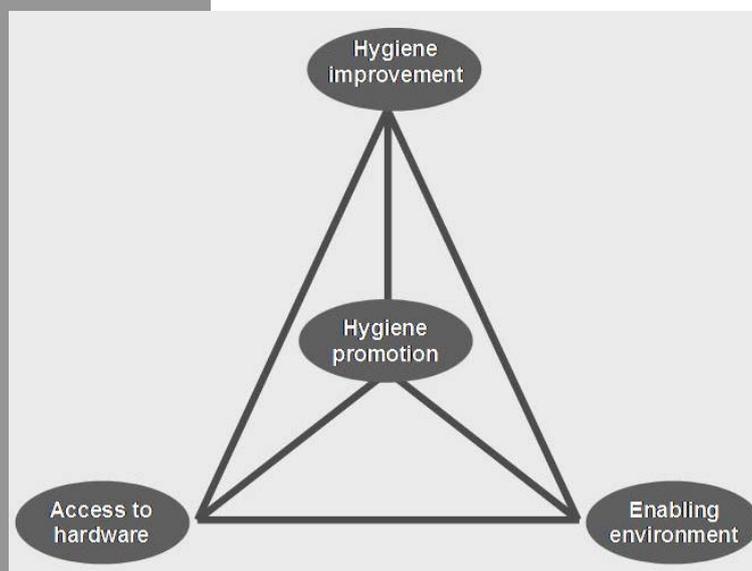
## Chlorination

Groundwater from wells and springs is usually safe for drinking without chlorination. When household water contamination is high or when the groundwater is of poor quality however, water disinfection might be necessary. As with surface water, buckets can either be chlorinated as the water is collected or people can be equipped to treat the water at home. Many agencies have chlorinated wells as a public health measure. This is done by shock chlorination and pot chlorination.

**Shock chlorination:** Shock chlorination is conducted by adding 20ml of 1% of chlorine solution for each litre of water in a well and allowing it to sit unused for a number of hours.<sup>35</sup> The first water drawn from the well after the disinfection period is discarded. Normal use of the well can then be resumed. Shock chlorination does not mean that the water given to people for their homes is chlorinated. After the first few hours of use after treatment, there will be little or no residual chlorine in the drawn water. Shock chlorination can eliminate a temporary threat to water quality of a well, e.g. in newly dug wells or for groundwater that has been contaminated by people or an unusual event (such as a major rainstorm).

**Pot chlorination:** The chlorination pot is usually a vessel, such as a one litre plastic bottle with a few holes punched in it. This vessel is filled with a chlorine powder and gravel mixture and placed in a larger vessel (such as a four litre milk jug or a clay pot) which also has a few holes punched in it. The chlorine disperses from the double-layered pot slowly. The number and size of holes determines the dose of chlorine released into the well. The pot chlorination method protects against a continuous source of contamination in the groundwater. It also counteracts any new contamination in the well, and provides a protective chlorine residual in the water that people use. Unfortunately, operating this type of system effectively needs extensive monitoring. The ideal target dose of free chlorine in water drawn from a well is 0.5 to 1.0 mg/l. The number and size of holes in the vessels must be tailored to match a specific well volume and withdrawal rate. The first water drawn in the morning will have an offensively high level of chlorine. If a well has certain periods of very high use, the dose might become too low. Therefore, the pot chlorination method is not widely used. This method is particularly unsuitable during the acute phase of a crisis when lack of time and attention can prevent proper monitoring and adjustment of the chlorine levels.

## Hygiene



In previous sections, we discussed the importance of improving water and excreta disposal facilities in emergencies settings. Poor hygiene can contribute to excessive maternal and neonatal death and other diseases. Constructing hygiene facilities and making them available does not guarantee they will be used or that they will be used properly. Hygiene promotion tries to ensure that people gain the greatest health benefits possible from these facilities through the proper use and maintenance of the facilities and by improving hygiene practices.

Hygiene Promotion is the planned, systematic attempt enabling people to take action to prevent or mitigate water and sanitation related diseases. It also provides a

practical way to facilitate community participation and accountability in emergencies. It involves ensuring that optimal use is made of the water, sanitation and hygiene enabling facilities provided. Previous experience shows that facilities are frequently not used in an effective and sustainable manner unless hygiene promotion is carried out. Access to hardware combined with an enabling environment and hygiene promotion make for hygiene improvement.<sup>34</sup>

Hygiene promotion encourages healthy choices in life, a healthy way of life. It is important to understand what motivates people to make healthy choices and what motivates them to change their behaviour. In fact, a desire for good health is often not the

primary motivating factor for change. Instead, other factors such as convenience, social status, the esteem of others and financial gain might be the driving forces behind change.

It is important to explain several the commonly used terms.

**Health promotion** aims at preventing disease and promoting positive health by enabling people to have increased control over their physical, mental and social well being.

**Hygiene promotion is a part of health promotion**, but also focuses on the prevention of water and sanitation related diseases. Hygiene promotion seeks to understand and build upon existing knowledge, practices and resources in the community. The goal of hygiene promotion is for people to develop safe hygiene practices. From a participatory viewpoint, hygiene promotion focuses on people identifying their own hygiene practices and behaviours and developing ways to improve them and reduce their risk to disease.

**Hygiene education** is the teaching of hygiene information. For example, hygiene education can include information about how disease is spread and how people can stop this spread. This message-based approach to disease prevention might be appropriate in certain circumstances e.g. when people want this type of information, but this type of approach does not generally lead to positive behaviour change. Successful hygiene promotion programmes use broader types of approach including social marketing, participatory learning and peer influence.

## Standards and key indicators for hygiene promotion

The following is the minimum standard for the design and implementation of hygiene promotion programme:<sup>24</sup>

- All facilities and resources provided reflect the vulnerabilities, needs and preferences of the affected population. Users are involved in the management and maintenance of hygiene facilities where appropriate.

Key indicators for hygiene promotion and for personal hygiene have been established to help measure progress toward this standard (Box 8-15 and Box 8-16).

### *Box 8-15: Key indicators for hygiene promotion<sup>24</sup>*

- Key hygiene risks of public health importance are identified.
- Programmes include an effective mechanism for representative and participatory input from all users, including in the initial design of facilities.
- All groups within the population have equitable access to the resources and facilities must continue to achieve the hygiene practices that are promoted.
- Hygiene promotion messages and activities address key behaviours and misconceptions and target all user groups. Representatives from these groups participate in planning, training, implementation, monitoring and evaluation.
- Users take responsibility for the management and maintenance of facilities as appropriate and different groups contribute equitably.

### *Box 8-16: Key indicators for personal hygiene<sup>24</sup>*

- Each person has access to 250g of bathing soap per month.
- Each person has access to 200g of laundry soap per month.
- Women and girls have sanitary materials for menstruation.
- Infants and children up to two years old have twelve washable nappies or diapers where these are typically used.
- Additional items essential for ensuring personal hygiene, dignity and well-being can be accessed.

## Is effective hygiene promotion possible in emergencies?

Hygiene promotion is often seen as too time consuming to implement in an emergency. Many emergencies are also 'hardware driven' meaning that focus is on constructing water supplies and excreta disposal as a first and, perhaps, only priority. Further encouraging this hardware focus is that the water-sanitation sector as a whole might measure success by the number of water systems and latrines installed without including or emphasising hygiene-related indicators in the monitoring process. All these factors contribute to hygiene promotion being too often ignored during emergencies.

However, it is important to note that hygiene promotion can be effective early in an emergency if community mobilisation is made stepwise and integrated in other services. After the first stages Pakistan earthquake 2005, the IFRC and the Pakistan Red Crescent Society introduced hygiene promotion quite early as an integral part of an emergency. Rosenstock, Strecher and Becker show that changes in behaviour can occur rapidly in situations where people feel they are at risk or changes are made to the environment such as setting up convenient hand-washing stations.<sup>34</sup>

Emergencies leave people displaced for years, often many years. Time shortages, are major obstacles to hygiene promotion activities particularly during the first weeks of an emergency. Despite the obstacles however, minimum aspects of hygiene promotion must be established with emergency water supply and excreta disposal facilities. For example, investing in a few participatory sessions about improved hygiene behaviour early in an emergency can provide substantial benefits months and even years later.

Providing disaster-affected populations including vulnerable groups, the opportunity to be actively involved in programmes throughout the project cycle (assessment, design, implementation, monitoring and evaluation) is an important aspect of strengthening people's capacities to deal with emergencies in the long-term and ensure the sustainability of designed structures.

### *Box 8-17: Hygiene promotion in Uganda during an emergency<sup>32</sup>*

During an outbreak of cholera in western Uganda in June 2006, 100 Ugandan Red Cross Society volunteers were mobilised to do assessments and conduct a shortened version of the Participatory Hygiene and Sanitation Transformation programme that reduced the seven steps to three and the time from four months to six weeks. Household visits were done in 5,335 homes and 700,000 people were reached through radio promotions. By the end of the campaign, the death rate due to cholera had dropped from six cases to nil.

Several key principals in hygiene promotion are presented below:<sup>8</sup>

- Target a small number of risk practices. For controlling diarrhoeal disease, the priorities for hygiene behaviour change are likely to include hand washing with soap or a local substitute after contact with stools and the safe disposal of adults' and children's stools.
- Target specific audiences that can include mothers, children, volunteers, teachers, shopkeepers, doctors, nurses, clinic staff, older siblings, fathers, opinion leaders or other groups. Identify who is involved in childcare and who influences them or takes decisions for them.
- Identify the motives for changed behaviour. Motives often have nothing to do with health while behaviour might be driven by disgust, nurture or status. For example, people might be persuaded to wash their hands so that their neighbours will respect them, so that their hands smell nice or because they are caring for a child. People often do not know their own motives; consumer research, therefore, requires patience and skill.

- Hygiene messages need to be positive. People learn best when they laugh and will listen for a long time if they are entertained. Programmes that attempt to frighten their audiences will alienate them. There should, therefore, be no mention of doctors, death or diarrhoea in hygiene promotion programmes.
- Identify appropriate channels of communication. Understand how the target audiences communicate. For example, what proportion listens to the radio, attends schools, social or religious functions or goes to the cinema? Using traditional and existing channels are easier than setting up new ones, but they can only be effective if their nature and capacity to reach people are understood.
- Decide on a cost-effective mix of channels. Several channels giving the same messages can reinforce one another. There is always a trade-off between reach, effectiveness and cost. Mass media reaches many people cheaply, but the messages are soon forgotten. Face-to-face communication can be highly effective in encouraging behaviour change, but tends to be very expensive per capita.
- Allocate enough resources. Marketing professionals have a rule of thumb that at least six contacts with the message (home visits, sightings of a poster, etc.) are needed to introduce a new product or practice and still more to ensure it is sustained.
- Hygiene promotion must be carefully planned, executed, monitored and evaluated. At a minimum, information is required at regular intervals on the outputs (e.g. how many broadcasts, house visits, etc.), and the population coverage achieved (e.g. what proportion of target audiences hear a broadcast). The programme should be integrated with others. Indicators of the impact on the target behaviour must also be collected.
- Use a community approach. To reach more people, consider integrating services with other activities that attract people, such as food distribution, clinics, relief goods distribution, or mobile clinics. Shopkeepers can also be trained to be part of the distribution of soap, Oral Rehydration Salts or other hygiene items.

The two most important practices for hygiene promotion programmes are safe excreta disposal and hand washing with soap after contact with excreta (adult, child or infant).<sup>10</sup>

Hygiene promotion should not just raise awareness, but also empower people to take action.<sup>34</sup>

- People need to be able to clean themselves after defecating. If anal cleansing is done with paper or sticks, these materials must be readily available in or near the latrine. If anal cleansing is done with water or with people's hands, water and soap must be made available at the latrines.
- Hand washing at appropriate times—before cooking, before eating or before feeding children, and after using the latrine or cleaning children—has been shown to be a protective against faecal-oral illnesses.
- Soap provides protection from diarrhoeal illness independent of any educational programme that might accompany it. Therefore, providing soap must be a priority where diarrhoeal diseases are likely to occur.
- Promotional messages should be short and focused. All messages and pictures in a promotional campaign must promote ways that are known to prevent the specific health threat at hand.

Hygiene promotion should engage and be concerned with all subsets of society including community leaders, women, clinics, children (schools and child spaces), men (men's groups) and workers (work environments). Hygiene promotion should seek to improve the use and maintenance of facilities and improve hygiene practices throughout the camp or settlement and into neighbourhoods of the host-population. Certain groups within society might need additional supplies of bathing and laundry soap. For example, people with incontinence problems i.e. difficulty holding urine, mobility disabilities such as the elderly or disabled, those living with HIV/AIDS and associated diarrhoea should be given additional quantities of bathing and laundry soap to meet their special needs. The need for non-food items should be carefully assessed and appropriate materials purchased locally and distributed in a manner that community members feel comfortable with.<sup>33</sup>

Children hold a special place in hygiene promotion as both a target group and as a vehicle to lasting change. Children are a target group because those aged under five are highly vulnerable to diseases resulting from poor water and sanitation. As a vehicle to lasting change, children who learn and practice good hygiene habits often keep these good habits into adulthood and pass them to their own children and they often positively influence their parents, too.

## Approaches to hygiene promotion

Before discussing ways of promoting behaviour change, it is important to understand a number of fallacies or untruths related to hygiene promotion (Box 8-18). It must be recognised that changing behaviour is not easy and that information alone is generally not enough to produce positive behaviour change. Outside experts must also design hygiene promotion programmes, which, however, must be designed with expertise and input from the community. Behaviour change should focus on a few specific hygiene practices that might be contributing to disease spread rather than many practices. Finally, for hygiene promotion programmes to be successful, adequate financial and personnel investments must be made.

### *Box 8-18: Five fallacies about hygiene promotion<sup>8</sup>*

- Fallacy No. 1: Behaviour change is easy.
- Getting people to change the habits of a lifetime is difficult, takes time and requires resources and skill.
- Fallacy No. 2: Knowledge change=behaviour change.
- It was thought that education about hygiene would be enough for people to change their behaviour. However, many people already know about germs, but still do not wash their hands. Change might be too expensive, time-consuming or there might be discouragement from other members in society.
- Fallacy No. 3: Experts know how to change behaviour.
- Hygiene promotion programmes cannot be designed by experts in an office. They have to be designed around the real needs, wants and contexts of the actors themselves i.e. by taking a consumer-centred approach. On the other hand, hygiene promotion programmes cannot be designed by communities themselves. Outside expertise is also needed.
- Fallacy No. 4: A whole variety of hygiene practices should be encouraged.
- Only a limited number of unhygienic practices are likely to be responsible for most diarrhoeal episodes. Since behaviour change is difficult, efforts should not be diluted by targeting too many practices.
- Fallacy No. 5: Hygiene promotion is a cheap add-on to water programmes.
- Serious efforts to change behaviour require serious investment and professional skill. Hygiene promotion needs careful planning and the best solutions might, or might not dovetail well with water and sanitation activities.

This chapter will discuss two types of approaches to learning and behaviour change. One type is a didactic or directive approach to learning; it involves giving information to the learner perhaps in a classroom setting or through public messages. Such messages can be linked with preventive measures such as latrine construction and use, chlorination of water, soap distribution, etc. A drawback to this type of learning is that it does not encourage learners to develop problem-solving skills.

Participatory methods, on the other hand, encourage the development of problem-solving skills. Participatory approaches are also called learner-centred approaches because they encourage people to express their ideas freely about understanding and solving problems. Some people might resist freely expressing themselves in participatory ways. Some people, particularly women, might not be confident about their ideas particularly if they

are not used to freely expressing them. Some people might want to avoid conflict with others and others might feel that their opinion will never make a difference. Despite these obstacles, participatory methods can produce great enthusiasm and involvement the more they are used and the more facilitators allow participants to direct and shape their own learning and exploration.<sup>10</sup>

Under some circumstances, didactic approaches are best to use and in other situations, participatory methods or a combination of both might be more suitable. Whether didactic or participatory methods or a combination of the two are used depends on each particular situation. For example, during the acute emergency phase or during an outbreak, it is critical to disseminate basic health information to the entire community as quickly as possible. Such information might include how disease is spread, early signs of possible infection and danger signs for seeking immediate medical attention particularly for children. During such circumstances, participatory methods might not seem appropriate because of the time investment needed. While time constraints are an important factor, engaging participatory methods can lead to lasting changes and, therefore, efforts should be made to use these methods wherever possible.

*Box 8-19: Environmental promotion in El Salvador*

In 2002, UNICEF El Salvador with the ministries of health, education and the environment as well as national and international NGOs and private sector met in a consortium to organise an environmental campaign called ‘Re-encuentro con el Rio Lempa’ which translates as ‘Let’s Do a Reconciliation with the Lempa River’. The campaign’s aim was to give the population of El Salvador environmental and hygiene messages in an original way about understanding what a great resource the Lempa River was for El Salvador and how important it was to take care of it to ensure a healthy environment for the children of El Salvador. The campaign’s strategy was to work at different levels sending environmental messages to children, adolescents and adults to create a space where all generations could join together to think about water related issues in El Salvador. The main components of the campaign were:

- Rafting the river—a twenty day navigation and rafting trip on the river to discover the wonderful natural areas, the fauna and flora, the hydroelectric power, the dams and water treatment facilities, and water for agriculture;
- Competition of environment and sanitation songs—schools, private radios and TV programmes for children helped the consortium to advertise the competitions through songs for children. Hundreds of songs were submitted. The best ten were recorded and sent to all schools in El Salvador to raise awareness about hygiene and environmental promotion;
- Selecting an environmental mascot and publications—a ‘tengereche’ was selected to be the environmental symbol of El Salvador. Publications were also made about the flora and fauna of El Salvador and distributed to schools.

The campaign was very successful and was repeated over the following years. The songs were broadcast repeatedly, becoming very familiar throughout the country. Eco-tourist activities were also developed along the River Lempa. Finally, children learned what a precious element in

## Food safety

Food-borne diseases are spread through eating food. Diarrhoeal diseases including cholera and dysentery are among food-borne diseases. This section focuses on food safety at the household level and highlights the best practices that avoid illness when storing, preparing and consuming food.

## Standards and key indicators for food safety

The following is the minimum standard for ensuring food safety:<sup>24</sup>

- Food is stored, prepared and consumed in a safe and appropriate manner at both household and community levels.

To help measure progress toward this standard, key indicators corresponding to this standard are presented in Box 8-20.

### *Box 8-20: Key Indicators for food safety<sup>24</sup>*

- Food is stored and distributed so that it is protected at all times from contamination by vectors such as flies, insects and rodents;
- Milk products are properly distributed;
- There are no adverse health effects resulting from inappropriate food handling or preparation at any distribution site;
- Recipients of food aid are informed about and understand the importance of food hygiene;
- There are no complaints about difficulties in storing, preparing, cooking or consuming the food distributed;
- Every household has access to appropriate cooking utensils, fuel and hygiene materials;
- Individuals who either cannot prepare food or feed themselves have access to a carer to prepare appropriate food in a timely manner and administer feeding when necessary;
- Where food is distributed in cooked form, staff has received training in safe storage, the handling of commodities, the preparation of food and understand the potential health hazards caused by improper practices.

## Ensuring food safety

The five keys to safer food are:

- Keeping clean;
- Separate raw and cooked food;
- Cook thoroughly;
- Keep food at safe temperatures; and
- Use safe water and raw materials.

Table 8-8 provides more details about each of these aspects of food safety (WHO, Five Keys to Safer Food).

*Table 8-8: WHO five keys to safer food*

Indicator	Description	Purpose
Keep clean	<ul style="list-style-type: none"> <li>▪ Washing your hands before handling food and often during food preparation;</li> <li>▪ Washing your hands after using the toilet;</li> <li>▪ Wash and sanitise all surfaces and equipment used for food preparation;</li> <li>▪ Protect kitchen areas and food from insects, pests and other animals</li> </ul>	While most microorganisms do not cause disease, danger microorganisms are widely found in soil, water, animals and people. These microorganisms are carried on hands, wiping cloths and utensils, especially cutting boards. The slightest contact can transfer microorganisms to food and cause food-borne diseases.

Indicator	Description	Purpose
Separate raw and cooked	<ul style="list-style-type: none"> <li>▪ Separate raw meat, poultry and seafood from other foods;</li> <li>▪ Use separate equipment and utensils such as knives and cutting boards for handling raw foods;</li> <li>▪ Store food in containers to avoid contact between raw and prepared foods</li> </ul>	Raw food, especially meat, poultry and seafood and their juices might contain dangerous microorganisms that are transferred onto other foods during food preparation and storage.
Cook thoroughly	<ul style="list-style-type: none"> <li>▪ Cook food thoroughly, especially meat, poultry, eggs and seafood;</li> <li>▪ Bring foods like soups and stews to boiling to make sure that they have reached 70°C. For meat and poultry, make sure that juices are clear, not pink;</li> <li>▪ Reheat cooked food thoroughly.</li> </ul>	Proper cooking kills almost all dangerous microorganisms. Studies have shown that cooking food at a temperature of 70°C can help ensure that it is safe for consumption. Foods that require special attention include minced meats, rolled roasts, large joints of meat and whole poultry.
Keep food at safe temperatures	<ul style="list-style-type: none"> <li>▪ Do not leave cook food at room temperature for more than two hours</li> <li>▪ Refrigerate promptly all cooked and perishable food (preferably below 5°C);</li> <li>▪ Keep cooked food piping hot (more than 60°C) prior to serving;</li> <li>▪ Do not store food too long even in the refrigerator;</li> <li>▪ Do not thaw frozen food at room temperature;</li> </ul>	Microorganisms can multiply very quickly if food is stored at room temperature. Temperatures below 5°C or above 60°C slows down or stops the growth of microorganisms; but some dangerous microorganisms still grow below 5°C.
Use safe water and raw materials	<ul style="list-style-type: none"> <li>▪ Use safe water or treat it to make it safe;</li> <li>▪ Choose foods processed for safety, such as pasteurised milk;</li> <li>▪ Wash fruit and vegetables, especially when eaten raw;</li> <li>▪ Do not use food beyond its expiry date.</li> </ul>	Raw materials including water and ice can be contaminated with dangerous microorganisms and chemicals. Toxic chemicals can form in damaged and mouldy foods. Care in selection of raw materials and simple measures such as washing and peeling can reduce risk.

In addition, rules for the safe preparation of food to prevent cholera can be found in the water and sanitation in cholera outbreak response section of this chapter.

## Vector control

This section focuses on important public health vectors in emergencies such as mosquitoes, non-biting flies, biting flies, lice mites, fleas and rodents. This section provides a brief overview of vector control in emergencies. For additional details about the transmission and control of vector-borne diseases, see 'Malaria Control in Complex Emergencies, An Inter-Agency Field Handbook,'<sup>22</sup> 'Emergency Vector Control Using Chemicals'<sup>21</sup> and 'Vector and Pest Control in Refugee Situations'.<sup>27</sup>

## Standards and key indicators for vector control

The following minimum standards for vector control include protecting the individual, family and environmental levels and address issues related to the safe use of chemicals:<sup>24</sup>

- All disaster-affected people have the knowledge and means to protect themselves from disease and nuisance vectors that are likely to represent a significant risk to health or well-being;
- The number of disease vectors that pose a risk to people's health and nuisance vectors that pose a risk to people's well-being are kept at an acceptable level;
- Chemical vector control measures are carried out in a manner that ensures that staff, the people affected by the disaster and the local environment are adequately protected and avoid creating resistance to the substances used.

To help measure progress toward these standards, key indicators corresponding to them are presented in Box 8-21 through Box 8-23.

*Box 8-21: Key indicators for vector control for individual and family protection<sup>24</sup>*

- All populations at risk from vector-borne disease must understand the modes of transmission and the possible methods of prevention;
- All populations have access to shelters that do not harbour or encourage a vector population growth and are protected by appropriate vector control measures;
- People avoid exposure to mosquitoes during peak biting times by using all non-harmful means available to them. Special attention must be paid to protect high-risk groups such as pregnant women, feeding mothers, babies, infants, older people and the sick;
- People with treated mosquito nets must be used effectively;
- Control of human body lice must be carried out where louse-borne typhus or relapsing fever is a threat;
- Bedding and clothing are aired and washed regularly.

*Box 8-22: Key indicators for vector control for physical, environmental and chemical protection<sup>24</sup>*

- Displaced individuals are settled in locations that minimise their exposure to mosquitoes;
- Vector breeding and resting sites are modified where practicable;
- Intensive fly control is carried out in high-density settlements when there is a risk or the presence of diarrhoea epidemic;
- The population density of mosquitoes is kept low enough to avoid the risk of excessive transmission levels and infection;
- People infected with malaria are diagnosed early and receive treatment.

*Box 8-23: Key indicators for vector control for chemical control safety<sup>24</sup>*

- Personnel are protected by the provision of training, protective clothing, use of bathing facilities, supervision and a restriction on the number of hours spend handling chemicals;
- The choice, quality, transport and storage of chemicals used for vector control, the application equipment and the disposal of the substances must follow international norms, and can be accounted for at all times;
- Communities are informed about the potential risks of the substances used in chemical vector control and about the schedule for application. Communities must be protected during and after the application of poisons or pesticides according to internationally agreed procedures.

## Risk factors for vector-borne diseases

Displaced populations are often at an increased risk of vector-borne diseases. Assessments must be made to understand the risk of vector-borne diseases and pest nuisance. They help decide if settlement sites should be accepted or rejected and also guide appropriate control and preventive measures. Assessments must address the presence of the vector, the prevalence of the disease organism and the susceptibility of the population. Factors that make displaced populations more susceptible to vector-borne diseases include immunity and disease status, increased exposure to vectors increased

number of breeding sites, the temporary nature of the camp site, reduced domestic hygiene, interruption of vector control measures and access to treatment.

### Immunity and disease status

Stress, poor nutrition, multiple infections and the lack of previous exposure to the disease will lower a population's immunity to vector-borne diseases. This is especially true for malaria when a non-immune population or a population immune to a different type of malaria parasite has moved from urban or highland areas to lowland areas that are warmer or wetter. In urban or highland areas, there might be very little exposure to malaria whereas warmer climates have an increased chance for the disease to be transmitted. When the weather is wetter than where the non-immune population came from, the vector populations increase rapidly. A displaced population can also transfer certain parasites and diseases from its old to its new location where they multiply and spread. This makes the vectors and humans at the new location susceptible to diseases they would not normally be subjected to.

### Increased exposure to vectors

Displaced populations can be more exposed to vectors because of overcrowding and poor housing. Overcrowding makes it easier for lice and mites to spread from person to person. It also increases the chance that there is an infectious human; that is a person with perhaps circulating yellow fever virus and a non-immune susceptible host are both living within the fifty-metre flight range of the *Aedes* mosquito that transmits yellow fever as well as Dengue and chikungunya fevers. Poor or no housing can also result in closer contact with sand fly, leishmaniasis, flea vectors of rodent-borne diseases or tick-borne relapsing fever.

### Increased number of breeding sites

Mosquito populations need water to reproduce. There might be an increased number of breeding sites because of either more pools of water or more domestic water containers. This can significantly increase the incidence of mosquito-borne diseases. More water-storage containers increase breeding of the Dengue fever vector *Aedes*. More water-filled pit latrines increase breeding of the encephalitis vector *Culex* mosquitoes. More groundwater pits, ponds and even footprints increase breeding of the malaria vector, *Anopheles* mosquito. While evacuation sites, newly established camps and settlements can have severe problems with flies, lice, mosquitoes, rodent populations usually take some time to build up, however. Poor food storage or disposal will increase the rodent population. Rodents bring fleas and therefore the possibility of diseases. Flies are attracted to areas with food and wastewater disposal problems especially around feeding centres. Fly problems are often severe at the very beginning of the camp before sanitation systems can be established. Natural disasters (e.g. floods) may change the environment and increase the breeding sites of other vectors of less urgent concern, e.g. ticks, tsetse flies etc. resulting in rarer disease outbreaks including viral haemorrhagic fevers.

### Temporary nature of the camp site and reduced domestic hygiene

The temporary nature of a refugee camp means that it is not intended to be 'home' for long. Displaced populations might not care as much about protecting themselves or their household from vectors or pests as they normally would. They might be too worried about the stress arising from their situation, such as the lack of resources, to be concerned about a few mosquito bites or accumulation of refuse. With the disturbed community structure and huge numbers of new neighbours, it can be difficult to develop a 'community responsibility' for sanitation.

### Interruption of vector control measures

In emergencies, vector control programmes might lack the resources to support the control measures (chemicals may be too costly). As a result, epidemics of vector-borne diseases may occur once routine vector control measures (e.g. insecticide spraying) and health care services are disrupted.

## Access to basic treatment

Epidemics can occur amongst the vulnerable displaced as well as the host populations in complex emergencies due to poor access to effective treatment. In complex emergencies, a general breakdown of the health infrastructure is common and is possibly compounded its gradual deterioration over many years. In the case of displaced populations, health services often become overwhelmed and many cases simply go undetected and untreated.

## Common vectors in emergencies

Common vectors in emergencies include mosquitoes, non-biting flies, biting flies, lice mites, fleas and rodents. Bed bugs, ticks, snails are also other problematic medical vectors that will also be briefly discussed in this section.

### Mosquitoes

Many different species of mosquitoes live in specific but different habitats from each other and each is capable of transmitting a variety of diseases. Fortunately, just a few mosquito species need to be studied to determine the most essential vector control measures. This section focuses on three types of mosquitoes:

- *Anopheles* mosquito is a vector for malaria and filariasis;
- *Aedes* mosquito is a vector for yellow fever, Dengue and Chikungunya;
- *Culex* mosquito is a 'nuisance' vector that also transmits filariasis and the encephalitis virus, but is generally not a critical vector control issue in complex emergencies.

#### Box 8-24: Summary of mosquito life cycle

All mosquitoes go through the same life cycle: egg, larval stage, pupa stage, and adult.

- The duration of each stage depends on the temperature. Generally, it takes ten days for mosquitoes to develop from egg to adult. The egg stage lasts about two days, and then goes through four larval stages in six to seven days followed by the pupa stage lasting one or two days;
- The male and female adults emerge from the pupae. Female mosquitoes have antennae that are thinly scattered across their bodies, while the males have bushy antenna;
- The male mosquito will mate with two or three females, drink plant juices (males cannot bite or take blood meals), then die after just a few days;
- The female will mate only once in her life and store the sperm in a special sac to fertilise every batch of eggs that she produces;
- After mating, the female will seek for a source of blood to give as protein for her eggs, feeding on humans, animals and sometimes both until she is engorged. She will then rest for two or three days as the eggs develop;
- The female will fly to oviposit her eggs. She seek another blood meal, engorge herself, rest for two days, oviposit her eggs again. Generally, a female mosquito lives for one or two weeks. Her entire adult stage is spent undergoing this feed-engorge-oviposit cycle up to seven or more times. Each bite is an opportunity to infect a victim.

**Note:** Oviposit means 'to lay eggs through an ovipositor.' An ovipositor is a tubular structure extending outside the mosquitoes abdomen.

It is important to understand the differences among mosquito species when planning a mosquito control programme. The three species, *Anopheles*, *Aedes*, and *Culex*, can easily be distinguished from each other as shown in Table 8-9.

**Note** that *Aedes aegypti* glue their eggs just above the water surface on the sides of containers where they can remain dry for six months. The next time the container is filled with water, the eggs are flooded and two days later the larvae hatch out of the egg.

Table 8-9: Characteristics and ecology of different mosquito species

Feature	Anopheles	Aedes	Culex
Species of Public Health Importance	Anopheles gambiae, Anopheles funestus	Aedes aegypti	Culex quinquefasciatus
Egg deposit	Deposit individual eggs on water surface	Deposit individual eggs inside containers just above water surface*	Deposit eggs in rafts on water surface
Larvae	Larvae rest parallel to water surface	Larvae hang down at an angle, suspended by breathing tubes	Larvae hang down at an angle, suspended by breathing tubes
		Larvae swim in sinuous S-shaped motion	Larvae swim in jerky motion
Adults	Adults have long palps and rest against wall with a straight back	Adults have short palps and rest hunched up against the wall	Adults have short palps and rest hunched up against the wall
Flight range	Short, generally less than 1-2 km	Short, generally less than 1-2 km	Short, generally less than 1-2 km
Biting time	The later hours of the night (11pm-6am)	Rests on hanging clothes in the house and bites during the day	Earlier in the evening just after dusk

### Non-biting

The non-biting flies of public health importance in emergencies are the synanthropic flies: house fly, blow fly, and flesh fly. These flies usually hover around food, carrion, garbage, human and animal waste. When they land, they might either transfer or carry disease pathogens attached on their legs and other parts of their bodies. These pathogens can be mechanically transported or transferred to humans and animals. Even though they can also be transmitted via fly faeces, pathogens do not undergo biological transformation in the flies. In unhygienic conditions, flies have more opportunities to cause the following:

- Flies of the *Musca* and *Chrysomyia* genera are known mechanical vectors of intestinal infections such as dysentery and typhoid;
- Flies can transmit polio and certain eye infections such as trachoma;
- Large fly populations can be extremely bothersome to human comfort.

Note that flies are not usually associated with cholera. A larger dose of cholera bacteria is required for cholera transmission than the flies can carry.

There are four stages in the fly life cycle:

- Egg;
- Larvae (or maggot);
- Pupa; and
- Adult (see illustration below).

A single female house fly, *Musca domestica*, can lay up to 2,000 eggs a month. Eggs are deposited in various habitats, especially in garbage and human and animal wastes. Depending on the temperature, the life cycle may extend anywhere from six days to six weeks before the adult emerges. As enormously dense fly population can thus develop in

a short period. In warmer climates, the adult fly can live for only two to three weeks whereas they can live up to three months in cooler climates.

Fly control must identify and eliminate flies' breeding sites. The main breeding sites of the non-biting fly species are listed in Table 8-10.

Table 8-10: Breeding sites of non-biting fly species

Common name	Scientific name	Breeding sites common name
House fly	Musca domestica	Refuse, animal or human faeces House fly
Filth fly	M. sorbens	Human faeces
Bush fly	M. vestutissima	Cattle droppings
Blow fly	Chrysomya spp.	Latrines, meat, fish
Blue bottle, Green Bottle flies	Calliphora spp. Lucilia spp.	Meat, fish and garbage
Flesh fly	Sarcophaga spp.	Meat, animal faeces
Lesser house fly	Fannia spp.	Animal faeces
Stable fly	Stomoxys calcitrans	Straw stacks, piles of weeds, animal faeces

### Biting flies

In addition to causing painful bites and sucking blood, some biting flies transmit important diseases:

- Tsetse flies are known to transmit sleeping sickness (trypanosomiasis) and must be considered a serious threat to life. Sleeping sickness is 100% fatal without complete treatment, which is often very hard to access in emergencies (costs US \$500-1,000, depending on the stage of disease). There are an estimated 250,000 cases in total in just Southern Sudan, Democratic Republic of the Congo and Angola. Refugees can be infected with sleeping sickness in different ecological habitats including forest, scrub and river areas;
- Sand flies transmit two types of leishmaniasis: *cutaneous* and *visceral*. Visceral leishmaniasis is fatal and is reported in camps and settlement areas of Southern Sudan.
- Black flies are vectors of onchocerciasis or river blindness.

### Lice

Among the species of lice that affect the body, head and pubic area, only body lice are vectors of diseases that can cause epidemics. Body and pubic lice transmit disease that can cause irritation and severe itching. Body lice can be found on clothing that is in close contact with the skin. Migrating populations easily transport body lice from their places of origin. Body lice are common among a large population living in unclean, crowded conditions which facilitate the transmission of pathogens for the following diseases:

- Epidemic typhus is a highly contagious disease transmitted by contaminated lice faeces that penetrates the skin during scratching;
- Relapsing fever can be transmitted by crushed lice penetrating the skin while scratching;
- Body lice bites can cause skin irritation leading to various skin infections.

Note that typhus or relapsing fever should be suspected if many cases of 'fever of an unknown origin' do not respond to an anti-malarial treatment.

## Mites

Mites commonly cause scabies and other skin infections in displaced populations, particularly children. Mites transmit rural typhus or scrub typhus in Asia and the Pacific. Mites' larvae feed on the skin of humans in areas of the body where clothing is close to the skin. Overcrowding and poor personal hygiene favour the spread of mites within refugee and displaced populations.

## Fleas and Rodents

The two most medical important types of fleas are rat fleas and human fleas. Fleas transmit parasitic worms in humans and spread bubonic plague and murine typhus. Rodents and rodent-borne diseases can become serious problems in displaced population camps that have existed for some time. These problems might result from the accumulation of uncontrolled solid waste, which greatly increases rat breeding. Increased rat populations discourage other efforts on environmental health improvement and lead to an increase in diseases transmitted by rats.

- Rats cause disease through their fleas, especially *Xenopsylla cheopis*, which can transmit plague (*Yersinia pestis*) and murine typhus (*Rickettsia mooseri*). Studies in refugee camps in Asia have shown murine typhus to be a major cause of Fever of Unknown Origin;
- Rats spread through their excreta diseases such as salmonellosis, leptospirosis, hanta virus and Lassa fever;
- Rat bites transmit pathogens that cause fever and rabies;
- People can contract leptospirosis from handling the dead bodies of infected rats, or get trichinosis from eating undercooked meat from pigs that have eaten the dead bodies of infected rats;
- The multi-mammate rat (*Mastomys natalensis*) is the natural reservoir of the Lassa fever virus. Outbreaks of Lassa fever have been reported among refugee populations in Sierra Leone and Liberia;
- Finally, rats can cause enormous economic damage by destroying or contaminating food stores and other materials around the house.

Table 8-11 lists the four most important rodent species of concern in emergency settings.

Table 8-11: Four most important rodent species

Common name	Norway rat (Brown or sewer rat)	Roof rat	House mouse	Multi-mammate rat
<b>Rodent species</b>	<i>Rattus norvegicus</i> (Norway rat)	<i>Rattus rattus</i>	<i>Mus musculus</i>	<i>Mastomys natalensis</i>
<b>Appearance</b>	Small eyes and ears, thick tail	Wide ears, pointed snout, long slender tail	Only 1-2 cm wide, smaller head and paws	No more than 25 cm from tip to tip
<b>Weight</b>	Up to 500 g	Up to 250 g	No more than 20 g	Small
<b>Common habitat</b>	Hole in ground, piles of refuse, warehouses, sewers	Under roofs along beams and tops of partitions (excellent climber)	Smaller range: search for food around homes. Attracted to flour, cereals, grain	Less domestic than others
<b>Geographic distribution</b>	Ocean coastal areas of Africa	Throughout Africa except desert and semi-desert areas	Spreading southward from northern Africa	Sub-Saharan Africa

Other vectors of concern in emergencies are given below:

- Ticks are not usually a problem in camp settings. They can, however, transmit Q-fever, hemorrhagic fever and tick-borne relapsing fever;
- Bedbugs can become a great nuisance after displaced population camps and settlements have been established for several months. Bedbug bites cause significant discomfort and loss of sleep. In heavily infested areas, young children may show signs of anaemia;
- Cockroaches contaminate unprotected food and transmit various pathogens including poliomyelitis virus, amoebae and intestinal viruses;
- Snails are intermediary hosts for the schistosoma flukes that cause urinary schistosomiasis and intestinal schistosomiasis.

## Options for controlling vectors

Vector control strategies can range from simple treatments (self-protection and home improvement) to more complex measures that require participation from vector control experts. The overall objectives are to reduce reproduction of the vector and personal exposure to the vector. There are three categories of control measures for reducing risk to vector-borne diseases:

- Environmental controls;
- Individual and family protection; and
- Chemicals.

Controlling vectors is a complex problem and often requires an integrated strategy that uses more than one control method. Environmental management is the preferred method of controlling vectors, but in emergencies, insecticides or chemicals are often used because of the risk of outbreaks.

Sound technical expertise is needed for selecting both effective and economically feasible appropriate control measures. With camps and settlements likely to be occupied for years, control measures should reflect the long-term needs for protecting the population from vector-borne diseases. Emergencies can change rapidly; therefore, it is important that needs be reviewed periodically to determine if the control methods previously used are appropriate later.

Vector control intends to lower the number of vectors (density reduction) and the life span of the vector (longevity reduction). Density reduction targets breeding sites and can be achieved through environmental management (e.g. physical elimination of breeding sites such as proper drainage of wastewater) or through insecticide use. Longevity reduction involves the use of chemicals and targets adult vectors. Many factors are involved in the proper selection and use of insecticides. Insecticides must properly target where vectors rest, vectors must be susceptible to the chemical used and the chemical chosen must not be harmful to the sprayers, population or the environment (e.g. drinking water sources). For these reasons, specialised personnel are needed for designing and implementing chemical control measures.

Environmental controls include altering breeding sites by draining or filling sites (see the drainage section), providing excreta disposal facilities (**see excreta disposal section**) and collecting and properly disposing of solid waste (see the solid waste management section). An additional environmental control might be to move camps and settlements away from vector-infested areas.

Individual and family protection includes mosquito nets and curtains, mosquito coils and repellents, regular washing of storage pots, covering water storage containers, keeping latrines clean, using lids or polystyrene beads in latrines, backfilling of full or unused pit latrines, clearing vegetation near dwelling areas which is useful for fly control, but there is no evidence of effectiveness for malaria control. Screens, bed nets, and impregnated plastic sheeting (such as Zero Fly), traps and food covers should also be used.

Chemical use is recommended only after environmental controls have been put into place. Chemical controls include repellents, residual spraying (inside dwellings), larviciding (killing eggs and larvae before reaching adult stage), dusting (mainly for lice and fleas) and space spraying. Space spraying is only recommended on a limited basis. Space spraying should be used when a high density of vectors needed to be eliminated quickly. It is important to note that there is little evidence to show that outdoor space spraying from a vehicle or using a motorised sprayer has any impact on malaria. Space spraying for malaria, therefore, is not recommended. Understanding a vector's resistance to insecticides is critical for ensuring that the most appropriate chemical is used.

Each emergency is different and requires different vector-control options. A vector control measure that is appropriate for one disease might not be appropriate for another. Vector control experts (national and international) should be consulted for advice about the most appropriate vector control measures and chemicals to use. All measures should be based on the national and international protocols. Box 8-25 lists criteria for selecting the most suitable vector control measure.

*Box 8-25: Criteria for selecting vector control measures*

#### Criteria for selecting vector control measures

- Type of diseases present;
- Burden of vector-borne diseases on the community;
- Disease risk factors;
- Appropriate for controlling the specific vector species, given the vector's breeding, flight and resting behaviour;
- Simple to understand and apply;
- Affordable and based on locally available resources (equipment, consumable supplies and technical skills);
- Acceptable and compatible with local customs and practices;
- Safe for the user, the population and the environment.

*Box 8-26: Advantages of environmental management over chemical use<sup>28</sup>*

The advantages of environmental management over chemical use are:

- No problems of chemical resistance;
- No risk of intoxication or environmental contamination from the inappropriate management of chemicals;
- Often longer lasting and contribute to vulnerability reduction and improvements in public health.

Environmental management is not necessarily cheaper than control with chemicals and seldom provides 'quick fixes'. To be successful, environmental management needs good cooperation with other sectors (public works, agriculture, water supply and sanitation).

## Mosquito control

Control of mosquito populations depends on the mosquito species. This guide focuses on three mosquito species: *Anopheles*, *Aedes* and *Culex*. Table 8-12 summarises breeding site and disease information for these mosquitoes.

Table 8-12: Behaviour of mosquitoes and diseases they transmit<sup>21</sup>

Genus	Breeding site	Place found	Disease and distribution
<b>Anopheline mosquitoes</b> ophelines breed in on polluted water Biting period: NIGHT	Edges of rivers, swamps, impoundments, ditches, tanks, saltwater habitats protected from wave action, rice fields, temporary rain pools, hoof prints.	Worldwide	<ul style="list-style-type: none"> <li>▪ Malaria: Tropical and subtropical areas</li> <li>▪ Bancroftian filariasis: Asia and Africa</li> <li>▪ Brugian filariasis: Asia</li> <li>▪ O'nyong nyong virus: Africa</li> </ul>
<b>Aedes mosquitoes</b> One species lives in close association with man, in any kind of human settlement. The <i>A. aegypti</i> breeds in any small water collection. Aedes spp. are primarily forest mosquitoes. Biting period: DAY	Tin cans, plastics, car tires, gutters, ornamental ponds, tanks, jars, any type of container, waste disposal areas, tree holes.	Worldwide	<ul style="list-style-type: none"> <li>▪ Yellow fever: Africa and Americas</li> <li>▪ Dengue: Africa, Americas, Asia</li> <li>▪ Dengue Haemorrhagic fever, Americas, Asia</li> <li>▪ Bancroftian filariasis: Pacific</li> <li>▪ Chikungunya</li> <li>▪ Other arbovirus: Africa, Americas, Asia</li> </ul>
<b>Culex mosquitoes</b> <i>C. quinquefasciatus</i> breeds in dirty water in urban and rural areas. Other species are also very common in rice fields in Asia. Biting period: NIGHT	<i>C. quinquefasciatus</i> Waste water ditches, latrines, septic pits, cesspools, drains, waste disposal.	Worldwide	<ul style="list-style-type: none"> <li>▪ Bancroftian filariasis: Most tropical areas</li> <li>▪ Encephalitis virus: Africa, Americas, Asia, Europe</li> </ul>
<b>Mansonia mosquitoes</b> Mainly associated with aquatic plants in rural areas with irrigation canals. Biting period: NIGHT It is a vicious biter	Ditches, ponds, irrigation canals, swamps.	Essentially tropical  Worldwide	<ul style="list-style-type: none"> <li>▪ Brugian filariasis: Asia</li> <li>▪ Other arbovirus: Rare in Africa and Americas</li> </ul>

The strategies for controlling the *Anopheles* mosquito at its source include site selection, environmental controls and chemical controls.

- Site Selection: From a malaria control perspective, any camp or settlement should be located one to two kilometres upwind from potential vector breeding sites (some natural water sources) whenever an additional clean water source (pumps, tanks, or capped wells) can be provided for the camp population. In this case, they have less direct need to be sited close to natural water sources;
- Environmental control: If there is only a few *Anopheles* temporary breeding sites, larval control is possible through draining or applying larvicide. In most rural situations in Africa however, larval control for malaria prevention is not usually practical because common vectors breed in a variety of water sources. *Anopheles gambiae* breeds in temporary water bodies without vegetation and in open sunlight, where as *Anopheles funestus* breeds in permanent water bodies with vegetation including ponds and swamps.
- Chemical control: If larvicide is to be effective, all breeding sites contributing to the *Anopheles* mosquito population must be targeted. There are two main larvicides that

can be safely applied on drinking or bathing water: temephos and *Bacillus thuringiensis* H-14 (BTI). Temephos (an organophosphate insecticide better known as Abate®) is widely used to control Dengue, onchocerciasis and guinea worm. Temephos is effective and safe to drink at a concentration of 1 part per million. *Bacillus thuringiensis* H-14 (BTI) is a biological insecticide and is specifically toxic to mosquitoes and black flies. BTI is costly and has a short residual action requiring weekly re-treatment. Note that because pyrethroid insecticides are toxic to fish, they are unsuitable for use in breeding places.

The most commonly used and effective methods for blocking the transmission of malaria by *Anopheles* mosquitoes are Indoor Residual Spraying (IRS) within the inside surfaces of dwellings and Insecticide Treated Mosquito Nets (ITNs) and Materials (ITMs).

- IRS involves spraying long lasting insecticide on the walls and ceiling of dwellings to kill adult mosquitoes that land and rest on these surfaces. At least 85% of dwellings must be sprayed for this method to give mass protection across the community. When coverage reaches 85%, mosquito populations decrease and even the people in dwellings that were not sprayed benefit from the lower mosquito populations and, therefore, reduce the risk of malaria. In fact, spraying only a single shelter gives little personal protection since mosquitoes rest on walls after they feed (and after they have potentially transmitted malaria). The timing of IRS is important because to be most effective, spraying should be done just before the start of the malaria season (wherever it is seasonal) and before the peak of the epidemic. Delayed IRS has little impact on malaria control and is a waste of resources. See WHO 'Manual for Indoor Residual Spraying: Application of Residual Sprays for Vector Control' (WHO, 2002) for details about training personnel for IRS;
- *Anopheles* mosquitoes tend to bite after sunset and before sunrise, and therefore, night time protection from the mosquito is needed. When used properly, ITNs can provide such protection for not only the person sleeping under the bed net but also others in the same room because less transmission will occur. Both conventional ITNs and Long-Lasting Insecticidal Nets (LLIN) are currently available. Conventional ITNs must be retreated every six to twelve months depending on the persistence of the insecticide used, the frequency of net washing and the seasonality of malaria transmission. For ITNs to provide community-wide vector control benefits, 60% (some studies indicate 50%) coverage is needed. When conventional ITNs are issued, it is important that initial insecticide treatment be performed in the presence of the net users. Experience shows that having users present for the initial insecticide treatments is beneficial for appropriate use and re-treatment. Nets must be distributed with information on proper their use and hanging materials if needed. The long-lasting type of LLIN is preferred in emergencies to avoid the need for treating and re-treatment. These nets are treated with insecticide at the factory when they are made. The result is that they should keep their insecticide activity for up to twenty washings and for three years of field use. WHO has recommended the use of two LLINs, PermaNet® 2.0 and Olyset Net®, for malaria prevention and control.

*Aedes* mosquitoes transmit yellow fever and Dengue. Remember that *Aedes* mosquitoes are daytime biting mosquitoes that do not rest on walls. Most *Aedes* mosquitoes live close to humans. They typically breed in household water storage containers and other containers holding water. The critical method of control of *Aedes* mosquitoes is eliminating breeding places. Elimination involves the clean-up, bury or disposal of 'non-essential' water containers, old tires, tin cans, broken jars, plastic bottles etc. The prevention of breeding sites includes emptying and cleaning domestic water containers once a week. Since it takes ten days for the mosquito to develop from egg to adult, cleaning and covering the jars once a week will prevent adults from emerging. Containers should be covered to prevent mosquitoes' access. Because the *Aedes* mosquito prefers to rest on hanging clothing, *neither ITNs nor IRS are effective control measures against Dengue, yellow fever or Chikungunya*. Effective chemical control of *Aedes* mosquitoes includes larvicides and many space spraying programmes using thermal fogs or ultra-low volume insecticides. Space spraying is very expensive, but is necessary during epidemics

and should always be combined with larval control. Insect resistance has been found in *Aedes* mosquitoes; therefore, it is important that any insecticides must be tested for effectiveness. There are also some types of insecticide pellets that can be deposited in small water collections, tins or other sites to deter the *Aedes* mosquito.

*Culex* mosquitoes rest outdoors more than indoors; therefore, indoor residual spraying is not a suitable option. Bed nets provide relief from the nuisance bites of *Culex* mosquitoes. Larval control is achieved through environmental sanitation, improved latrines and applying insecticides and polystyrene beads on the surface of pit latrines and cesspools.

### Non-biting flies

The breeding sites of flies include human and animal excreta, domestic rubbish and other organic matter. Environmental sanitation is the basic measure for fly control. Insecticides should be used only during outbreaks of vector-borne diseases and as a supplement to sanitation. Because flies can develop resistance to insecticides very quickly, chemical control should be used for only a short period of time and only when necessary. Specialised manuals should be consulted before beginning any insecticide applications.

The most important control measure for flies is to ensure that latrines are fly-proof. Measures for making latrines fly proof include providing a water seal or functioning ventilated improved pit latrines or providing covers for simple (non-water seal) types of latrines. In addition, if defecation fields are used in the early stages of an emergency, they should be at least 500 metres down wind from the nearest household and thirty metres from a water source. A second important control measure is to regularly dispose of all garbage. Collect refuse from households and markets as well as from refuse sites at least twice a week to limit the number of flies that reproduce. The final disposal of all refuse should be in covered garbage pits or by burying. Studies show that food scraps from communal feeding centres are often stored in baskets on the ground. This shaded, damp environment with organic matter mixed with mud provides a perfect breeding site for house and bluebottle flies. Finally, dead animals and waste from slaughterhouses must be buried as soon as possible.

Traps and screens can also prevent the spread of disease caused by flies. Large numbers of flies can be caught with non-poisonous traps and screens. A simple trap can be made by cutting off the upper third of a plastic bottle and placing it upside-down inside the lower portion of the bottle, which is half-filled with bait. Ripe mango waste and fish flour mixed with water make excellent bait. The traps are suspended above the ground near breeding sites. Flies entering the trap will not be able to leave and die. The traps become active in two to three days and can last two to four weeks. Traps can be efficient only if well maintained otherwise they become additional breeding sites for flies. Poison baits must never be used in refugee camps.

Sticky strings and sticks suspended in latrines and around food preparation areas can help reduce fly populations, but might not be very practical in emergencies. Residual spraying of the inside of pit latrine shelters to control adult insects and using polystyrene beads in the pit latrine fluid to discourage vectors from breeding in the fluid surface are more effective approaches in emergencies. Putting screens on doors and windows might also not be practical in most refugee situations. However, food and utensils can be protected by placing netting over them or keeping them in fly-proof containers or cupboards.

### Biting flies

It is important to control biting flies such as tsetse flies and sand flies. Tsetse flies transmit trypanosomiasis or sleeping sickness. Control methods for tsetse flies are directed at adult populations with traps, insecticide treated targets and insecticide spraying. The *biconical trap*, *pyramidal trap* and *vavoua trap* are made up of blue and black cloths and mosquito netting. Flies are attracted to the brightly coloured mosquito netting over the traps and are unable to escape after entering. Traps are cheap, easy to transport, completely safe for the user and very effective means for controlling biting flies. Because these cloths do not require any specific training to use, they are ideal for

use by individuals or communities. Insecticide treated targets consist of impregnated traps and screens, which are more effective since they kill any flies that land on them. They can be impregnated by the same pyrethroids used for impregnating mosquito nets and can be effective for up to three months. Traps attract more flies than screens and require less handling. Screens are much cheaper than traps and cover a larger area. However, traps continue to be effective in catching flies once the insecticide wears out, screens are only effective as long as the insecticide is active. Aerial and ground spraying of insecticides might be the preferred method for controlling tsetse flies during acute epidemics of sleeping sickness. Daytime resting places such as tree trunks, twigs and roots should be targeted. Because of its high cost, special equipment and trained workers, spraying is not recommended as a routine control measure.

Sand flies transmit leishmaniasis, which is a disfiguring and sometimes fatal disease. Visceral leishmaniasis is the most serious form and is fatal if left untreated. Other forms of leishmaniasis cause skin lesions and skin ulcers. The sand fly larvae are located in soil; therefore, control measures for them focuses on adult populations. The infection and spread of leishmaniasis can be controlled through personal protection, residual spraying and the control of animal reservoirs. Personal protection involves avoiding bites by keeping away from areas wherever sand flies breed or rest and by using bed nets, repellents and clothing. Although spraying the interior and exterior sides of doorways and windows and inner walls is effective against sand flies indoors, malaria control is the primary reason for spraying wherever leishmaniasis is a problem. Controlling the animal reservoir population (e.g. rock hyrax in Ethiopia, dogs or other domestic animals) can reduce the incidence of leishmaniasis.

### Fleas and rodents

When controlling flea-borne diseases such as plague and murine typhus, rodents should never be tackled before getting rid of the fleas. If not, with the rodents gone, the fleas will still attack humans. Where fleas are a biting nuisance, simple hygiene measures are effective such as taking bedding outside to air in the sun weekly.

There are two effective ways to get rid of fleas: chemical control and rat control. With chemical control, dusting rodent footpaths with insecticide dust or powder is effective for large scale flea control during outbreaks of typhus or plague. When the rats groom themselves, the dust spreads on their fur, thus killing the fleas. Resistance to pyrethroid insecticides is common.

Methods for controlling rodents include mechanical protection and sanitation, traps and poisons. Mechanical protection and sanitation are the only permanent methods for reducing rodent populations in refugee camps. Efforts should be made to store all food in rat-proof containers. The final disposal of solid waste should be done in a location and manner that does not encourage rat breeding or create other environmental health risks. Burial or incineration can be used for final disposal of household waste and refuse from markets and slaughtering areas. Trapping rats is good for publicity, but generally catches only the sick and the stupid. As long as there is enough food and nesting places, the rodent population will grow and quickly reach its former population levels. Rodenticides are generally not recommended in emergency settings. The large number of children, having little to do and few things to play with makes it dangerous to place poison bait traps around the camp environment.

The following is a word of caution about rodent trapping and safe handling of rodents carrying Lassa fever. Lassa fever is common in Sierra Leone and Liberia. The virus is spread through the rat urine. If trapped, these rats have to be disposed of without direct contact between the human and the rat as they urinate wildly and their bodies become covered in the virus. Rodent trapping campaigns could cause outbreaks of Lassa fever if this inadvertently increases host virus contact through normal handling and disposal of the corpse. This might also include safe handling of rodents when dealing with the risk of rabies, especially with live animals.

## Controlling other vectors and pests

Vectors and pests of less urgent concern can be controlled through environmental, mechanical, biological, or chemical control, as summarised in Table 8-13.

Table 8-13: Possible vector control measures

Vector	Possible control measures
<b>Lice</b>	mass laundering in hot water; mass delousing with insecticide powder
<b>Mites</b>	mass laundering; supply adequate water for washing and distribute soap for the community
<b>Ticks</b>	clearing vegetation or insecticide spraying is difficult to apply
<b>Bedbugs</b>	household and personal hygiene; insecticide spraying
<b>Black flies</b>	larviciding breeding sites in surrounding rivers
<b>Cockroaches</b>	protect food; insecticide powder or spraying
<b>Snails</b>	sanitation measures, drain water or speed up water flow, spray molluscicides

Table 8-14 provides an overview of vectors, breeding sites and habits and disease and distribution details.

Table 8-14: Vector description and main diseases they transmit<sup>21</sup>

Vector (genus)	Particularity	Breeding sites and habits	Disease and distribution
<b>Tabanid or Horsefly</b> <i>I. Chrysops</i>	Very robust Length: 6 to 10 mm	Only the female feeds on any animal. She lays 100 to 1000 eggs, according to species. They breed in moist and wet ground.	<ul style="list-style-type: none"> <li>Loa loa filariasis: West and Central Africa</li> </ul>
<b>Tsetse fly</b> <i>Glossina Mortisans group</i> (savannah flies) <i>Palpalis group</i> (river bank flies)	Very robust Very long proboscis Wide wings 9 to 25 mm in length	Both males and females suck blood. Tsetse flies are viviparous. They deposit their larvae in damp ground and arid areas.	<ul style="list-style-type: none"> <li>Sleeping sickness: Africa</li> </ul>
<b>Sandfly</b> <i>Phlebotominae</i>	Less than 3mm long Very long legs	They are located in the tropics and subtropical areas south of Europe. They breed in moist and wet ground.	<ul style="list-style-type: none"> <li>Cutaneous and visceral (Kala Azar) Leishmaniasis occur in Sudan, Latin Americas, India, Asia, Middle East, and Southern Europe</li> </ul>
<b>Bedbug</b> <i>Cimex spp.</i> Reduviid bugs	7mm long Brownish insects Flat and oval body	They live in temperate and tropical zones. They are active only at night where they feed on humans and animals.	<ul style="list-style-type: none"> <li>Bedbugs cause nuisance such as itchiness: Worldwide</li> <li>Chagas disease is transmitted by triatomine bugs in South and Central Americas, and in some parts of Caribbean</li> </ul>

Vector (genus)	Particularity	Breeding sites and habits	Disease and distribution
<b>Blackfly</b> Simuliidae	Small insect, 1 to 6mm in length	They breed and live in all kinds of unpolluted water, vectors in Africa breed only in fast flowing oxygenated streams or rivers. They have a worldwide distribution.	<ul style="list-style-type: none"> <li>Onchocerciasis or river blindness: Africa, and some parts of Latin America</li> </ul>
<b>Cockroach</b>	5 to 73mm in length Two pairs of wings Yellow-brown to dark colour	These insect are very agile and fast and live in colonies. They prefer manufactured structures where it is warm. In the tropics, they live and breed outdoors. Latrines may be infested in a refugee camp. They are particularly active at night.	<ul style="list-style-type: none"> <li>Cockroaches act as mechanical vectors and may transmit diarrhoeal diseases, typhoid fever, dysentery, viral diseases: Worldwide</li> </ul>
<b>Tick</b> Hard tick Soft tick	7 to 20mm in length Hard back Soft back	Both males and females feed on warm-blooded animals and humans. They are attracted by the carbon dioxide from their prey. Hard ticks are located in vegetation and soft ticks live in close association with available prey. They can survive several years of starvation.	<ul style="list-style-type: none"> <li>Relapsing fever: Worldwide</li> <li>Q-fever: Africa, Americas</li> <li>Lyme disease</li> <li>Arbovirus diseases: Worldwide</li> <li>Ticks are very painful biters and can cause serious loss of blood</li> </ul>
<b>Cyclops</b> (Cyclopidae family)	Small crustacean 0.5 to 2mm in length	These are the intermediate host of the guinea worm. They live in any artificial or natural accumulation of stagnant water, which may be used as drinking water.	<ul style="list-style-type: none"> <li>Guinea worm or Dracunculiasis: Africa</li> </ul>
<b>Water snail</b> (mollusc) 1. Biomphalaria 2. Bulinus 3. Oncomelania	Aquatic snails	Snails are found in all suitable types of water except for salty and acidic waters. Snails serve as an intermediate host of schistosomiasis worms.	<ul style="list-style-type: none"> <li>Schistosomiasis (or bilharzia): In the tropics, mainly in Africa and East Asia</li> </ul>

## Summary of personal protection and hygiene methods

Table 8-15 gives a summary of selected disease vectors and the corresponding personal protection and hygiene methods for controlling the transmission of these diseases.

Table 8-15: Examples of hygiene practices and personal protection methods against selected disease vectors, diseases and nuisance pests<sup>28</sup>

Target Species	Disease(s) carried	Personal protection methods (other than vaccines)	Vector hygiene methods
<b>Anopheles mosquitoes</b>	Malaria	Chemoprophylaxis, mosquito nets (impregnated)	Residual indoor spraying, burning mosquito coils at night, space spraying before retiring (bedroom needs to be screened for effectiveness), Impregnated plastic sheeting
	Lymphatic filariasis	Mosquito nets (impregnated)	
<b>Culex mosquitoes</b>	Lymphatic filariasis	Mosquito nets (impregnated), repellents	Elimination of breeding sites on compound, Impregnated plastic sheeting
	Japanese encephalitis	Mosquito nets (impregnated), repellents	
<b>Aedes mosquitoes</b>	Viral encephalitis Dengue/Dengue haemorrhagic fever Yellow Fever Lymphatic filariasis	Repellents	Elimination of breeding sites in and around house, impregnated plastic sheeting
<b>Cockroaches</b>	Diarrhoeal infections		Kitchen hygiene, all food leftovers removed at night
<b>Houseflies</b>	Diarrhoeal infections Eye infections		Kitchen hygiene, proper (re)heating of cooked food, daily rubbish removal
<b>Tsetse flies (Glossina)</b>	Sleeping sickness	Repellents, impregnated clothing	Avoiding riverside laundering and defecation, installation of tsetse traps in human settlements
<b>Bedbugs</b>	None	Mosquito nets (impregnated)	Regular airing and washing bedding materials and beds
<b>Jigger fleas</b>	None	Wearing shoes	Pig control in residential areas, chemotherapy of dogs and cats, pesticide treatment of adjacent land
<b>Lice</b>	Epidemic typhus Relapsing fever Trench fever	Chemoprophylaxis	Body hygiene, including use of shampoos, laundering clothes
<b>Rodents</b>	Plague		Rat-proofing of houses and storage facilities, rubbish removal, kitchen hygiene
	Leptospirosis		

## Insecticides: recommended and safe use

References for the recommended and safe use of chemicals are ‘Pesticides and Their Application for the Control of Vectors and Pests of Public Health Importance’<sup>23</sup> and ‘Manual for Indoor Residual Spraying, Application of Residual Sprays for Vector Control (WHO, 2000) and ‘Emergency Vector Control Using Chemicals.’<sup>21</sup> The WHO website [www.who.int/whopes](http://www.who.int/whopes) also provides information about the safe selection and use of pesticides.

Vector control measures should address two principle concerns: efficacy and safety. They should be carried out according to internationally agreed methods and ensure that staff

and the affected population are adequately protected. The following points about pesticide safety that should be emphasised in emergency settings:

Safe use and storage of pesticides:

- Extra precaution should be taken choosing insecticides and deciding when, how, and for how long to apply them. Strict procedures must be followed when handling insecticides and their equipment. Pesticides and the spray machines should never be transported in vehicles that are also used for carrying food. They must be stored in locked and ventilated buildings. There is an increased danger of pesticide poisoning among displaced populations. Although unintentional, the danger of poisoning is because children have few toys to play with, the novelty of the situation and the traumatic experience of being displaced.

Safe storage and disposal of used insecticide containers:

- Strict guidelines have been developed for this and should be implemented to ensure that the displaced community cannot obtain used pesticide containers.

Safety of the spraying staff:

- Volunteers can be used for some types of spraying.

Also ensure that sprayers have:

- Prior training on the safe use of pesticides;
- Protective clothing (uniforms, gloves, masks etc.);
- Never smoke, drink or eat during the job;
- Access to good washing facilities after the job is done.

It is rare to find sprayers that meet all the above conditions in refugee situations. Appropriate training, protective clothing and equipment and washing facilities should, therefore, be provided.

## Solid waste management

Inappropriately disposed solid waste poses significant health problems. Poorly managed solid wastes provide good places for disease-causing insects and rodents to live and breed. Such insects and rodents include mosquitoes, flies and rats (see the vector control section of this chapter for additional details). Improper dumping of solid waste can lead to contamination of water sources, both groundwater and surface water sources, through leachate pollution.

Assessments of solid waste generation and practices should be determine the type and quantity of waste produced. Based on assessment information, options for solid waste management should be explored with the community and local officials. Options for improving solid waste management practices include on site and off site disposal methods and strategies aimed at waste reduction, reuse and recycling.

## Standards and key indicators for solid waste management

The following minimum standard has been established for solid waste management in emergencies:<sup>24</sup>

- People have an environment that is acceptably uncontaminated by solid waste, including medical waste and have the means to dispose of their domestic waste conveniently and effectively.

Key indicators related to this standard are presented in Box 8-27.

*Box 8-27: Key indicators for solid waste management<sup>24</sup>*

- People from the affected population should be involved in the design and implementation of the solid waste programme;
- Household waste must be put in containers daily for regular collection, burnt or buried in a specified refuse pit;
- All households must have access to a refuse container and be no more than 100 metres from a communal refuse pit;
- At least one 100-litre refuse container must be available per ten families, where domestic refuse is not buried on site;
- Refuse must be removed from the settlement before it becomes a nuisance or a health risk;
- Medical wastes must be correctly designed and disposed in especially constructed and operated pits or incinerators with a deep ash pit, all within the boundaries of each health facility;
- No contaminated or dangerous medical wastes (needles, glass, dressing, drugs, etc.) must be near living areas or public spaces at any time;
- There must be clearly marked and appropriately fenced refuse pits, bins or specific areas at public places such as markets and slaughtering areas, with a regular collection system in place;
- The final disposal of solid waste must be carried out in places and ways that avoid creating health and environmental problems for the local and affected populations.

Methods for disposing of solid waste<sup>12</sup>

In emergencies, disposal methods that are on site or close to dwellings are often preferred too off site disposal methods. On site methods are preferable because no waste is removed and therefore no transport is needed especially when personnel resources are limited. On site disposal is appropriate where waste volumes are low, where there is plenty of space available and waste is largely organic or recyclable.

Off site disposal is appropriate when large volumes of waste are generated or when available space among dwellings is limited. The following measures must be considered when selecting and developing an appropriate disposal site:

- Locate sites at least 500 metres (ideally one kilometre) downwind of the nearest settlement;
- Locate sites downhill from groundwater sources;
- Locate sites at least fifty metres from surface water sources;
- Provide a drainage ditch downhill of landfill sites on sloping land;
- Fence and secure access to the site; and
- Ensure property is available for waste disposal use.

Various types of waste disposal methods including their description, advantages and constraints are presented in Table 8-16.



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Table 8-16: Disposal methods for improving solid waste<sup>12</sup>

Disposal option	Description	Advantages	Constraints
<b>Communal pit disposal</b>	Consumers dispose of waste directly into a communal pit; size of pit based on six cubic metres per fifty people; pit fenced off and not farther than 100m from dwellings; waste to be covered weekly to minimise flies and other pests	Rapid to implement; little operation and maintenance required.	Distance to communal pit can cause indiscriminate disposal; waste workers required to manage pits.
<b>Family pit disposal</b>	Better long-term option where there is enough space; fairly shallow (up to one metre deep); families must regularly cover waste with soil or ash; best suited where families have large plots and where organic food wastes are the main domestic refuse.	Families responsible for managing their own waste; no external waste workers required; community mobilisation can be incorporated into hygiene promotion programmes.	Involves considerable community mobilisation for construction, operation and maintenance of pits; considerable space needed.
<b>Communal bins</b>	Communal bins used to collect waste; bins located where they can be easily removed for transportation and disposal; bin can be constructed of an oil drum cut in half (based perforated to allow liquid to pass through); one 100-litre bin for every fifty people for domestic waste.	High hygienic and sanitary management method; final disposal of waste away from dwellings	Significant collection, transportation and human resourced required; system takes time to implement; efficient management is essential.
<b>Landfilling</b>	Waste placed in a large pit or trench; each day deposited refuse is covered with 0.5m of soil to discourage animals and flies; location of landfill decided with local authorities and affected population; site to be fenced and at least 1km downwind of nearest dwelling.	A sanitary disposal method if managed effectively.	Reasonably large land area required.
<b>Incineration</b>	Incineration only takes place off site or at a considerable distance downwind of dwellings; burning reduces the volume of waste and is appropriate where there is limited space for burial or landfill; waste should be burnt in pits and covered with 0.5m of soil once incinerated.	Burning reduces volume of combustible waste considerably; is appropriate in off site pits to reduce scavenging.	There can be smoke or fire hazards.
<b>Recycling</b>	Complex systems inappropriate, but plastic bags, containers, tins and glass will often be automatically recycled where scarce.	Recycling is environmentally friendly.	Limited potential in most emergencies; expensive to set up.

## Disposal of medical waste

Medical waste can be defined as waste generated by hospitals, health centres or any place where medical care takes place. Poorly managed medical waste poses disease and injury risks to staff, patients and visitors. It is important therefore that medical waste be managed and disposed of properly and that high standards of hygiene are achieved at medical facilities. The following discussion focuses on improving medical waste management at hospitals and health centres and is taken from ‘Starting Health Care Waste Management in Medical Institutions, A Practical Approach’.<sup>24</sup> Additional details about managing medical waste are available through this reference.

Improvements in waste-related hospital hygiene starts with separation of waste at the point of origin, safe storage and handling of waste in departments and proper disposal to minimise risk to staff, patients, hospital visitors and the larger community. Lasting improvements to waste management practices requires a strong commitment from senior directors and motivation of medical and support staff.

The key to managing medical waste better is to achieve change in the way waste is handled and stored by introducing a few simple steps. The following is a systematic approach to improving management of medical waste:

- Establish a three-bin system with three categories (see Table 8-17 for more details);
- Colour code bags and containers to differentiate between general and potentially infection wastes;
- Block transmission routes by ensuring that sharp items are not placed in plastic bags but only in rigid containers and that all waste containers are covered to prevent air-borne dispersal of pathogens;
- Specify different locations for general and potentially infectious waste (always away from patient areas);
- Fix collection schedules to ensure regular removal of waste;
- Replace bags and sharps containers when they are three-quarters full to prevent risk of bags tearing or injury from all protruding sharp items;
- Seal all bags that leave the medical area;
- Use rigid containers clearly marked as ‘GENERAL WASTE’ or ‘INFECTIOUS WASTE ONLY’ for storage bags awaiting removal from the medical site;
- Clearly label sharps containers as ‘SHARPS’ in the local language to remind medical staff what it contains;
- Ensure that waste is removed from central storage within twenty-four hours in hot, arid and tropical areas in the hot season and a maximum of forty-eight hours in the cool season. In temperate climates, waste should be disposed of within forty-eight hours;
- Ensure that medical waste at the final disposal site is disposed properly;
- Highly infectious waste such as body fluids, tissue and faecal stool samples are autoclaved before disposal;
- Assign a person in every department to be responsible for ensuring good waste management practices in the department;
- Provide refresher training to all staff and initial training to new employees on proper management and disposal of medical waste.

Table 8-17: Segregation categories for medical waste<sup>15</sup>

Category of waste	Description	Disposal methods
General Waste	Kitchen waste, paper and packaging, etc.	On-site pit disposal Burning Sanitary landfilling
Pathological and infectious waste	Lab cultures, wastes from isolation wards, tissues, body parts, blood and other body fluids, etc.	Incineration Burning and burial Placenta pit
Sharps	Needles, blades, scalpels, glassware, infusion set, etc.	Incineration at sufficient temperature (>1000°C) Sharps pit

## Drainage

In this chapter, the term *wastewater* includes storm water, floodwater, domestic wastewater and wastewater from medical facilities, but does not include water that contains excreta. Draining wastewaters properly is important to avoid a number of scenarios that can lead to increased health risks. Poor drainage can lead to the following:

- Increased number of breeding sites for water-related vectors (e.g. mosquitoes);
- Erosion of shelters;
- Wastewater filling pit latrines and solid waste pits;
- Pollution of surface or ground water; and limiting access to shelters.<sup>15</sup>

## Standards and key indicators for drainage

The minimum standard where people have an environment in which the health and other risks posed by water erosion and standing water (including storm water, floodwater, domestic wastewater and wastewater from medical facilities) are minimised has been established for drainage in emergencies.<sup>24</sup>

Key indicators related to this standard are presented in Box 8-28.

### Box 8-28: Key indicators for drainage<sup>24</sup>

- Areas around dwellings and water points are kept free of standing wastewater;
- Storm water drains must also be kept clear;
- Shelters, paths, water and sanitation facilities are not flooded or eroded by water;
- Water point drainage must be well planned, built and maintained including drainage from washing and bathing areas as well as water collection points;
- Drainage waters do not erode or pollute surface or ground water sources;
- Sufficient numbers of appropriate tools are provided for small drainage works and maintenance where necessary.

## Options for proper drainage of wastewater<sup>12</sup>

Several types of technology options exist for properly draining wastewater in emergencies. These options include:

- Soakaways or soak pits;
- Infiltration trenches;
- Diversion to natural drainage;
- Diversion to manufactured drainage;

- Bucket basins;
- Evaporation pans;
- Evapotranspiration beds;
- Irrigation use.

Table 8-18 describes these technologies with their advantages and constraints.

*Table 8-18: Disposal methods for improving solid waste<sup>12</sup>*

Disposal option	Description	Advantages	Constraints
<b>Soakpits</b>	Soakpits are holes in the ground that allow the percolation of wastewater into the surrounding soil; the success of soakaway depends on percolation of the soil; commonly between two and five metres deep and 1 to 2.5 metres in diameter; can be lined or filled with stones, blocks or bricks to support pit walls.	Soak pits are easy and relatively quick to construct; can be used on flat sites.	Soakpits are only appropriate in permeable ground conditions; can only cope with a limited volume of wastewater.
<b>Infiltration trenches</b>	Infiltration trenches are constructed from porous pipes that are buried in a series of trenches that filled with coarse gravel; pipes are laid horizontally for water to distribute evenly along the entire trench; pipes are 100mm in diameter; trenches 300 to 600mm wide and dug about 1m below the pipe.	Trenches are easy and relatively quick to construct; used on flat sites; can cope with a greater amount of wastewater than a soakpit of the same volume.	Infiltration trenches are only appropriate in permeable ground conditions.
Disposal option	Description	Advantages	Constraints
<b>Natural drainage</b>	Natural drainage involves the disposal of wastewater to flowing streams or rivers; is the preferred method of wastewater disposal; drainage into stream or river should occur downstream of water retrieval points; drainage channel must be sloped 1 in 200 for earth channels; large amounts of wastewater should not be drained into small watercourses.	A minimal amount of construction work is required; there are negligible physical effects on landscape.	Natural drainage is rarely possible; may inadvertently pollute watercourses.
<b>Man-made drainage</b>	Manufactured drainage involves the construction of drainage channels cutting through natural obstacles to reach an existing watercourse; requires a great deal of work and is expensive and time consuming.	Manufactured drainage may be the only option in impermeable sites with little slope.	Manufactured drainage is expensive and time consuming to construct; can have a large impact on the surrounding landscape.

<b>Evaporation pans</b>	Evaporation pans are shallow ponds holding and allowing water to evaporate; evaporation rates depend on many factors: temperature, humidity and wind speed; should be used only where the mean evaporation rate is at least 4mm/day, where rainfall is negligible and where there is no viable alternative.	Evaporation pans are suitable in arid conditions where other disposal methods, such as infiltration, are inappropriate.	Evaporation pans may encourage mosquitoes, flies, etc.; large land areas are required.
<b>Evaporation and evapotranspiration beds</b>	Evaporation and evapotranspiration beds consist of porous pipes buried in shallow sand beds; method relies on capillary action to draw water to the surface of sand bed; evapotranspiration beds have vegetation planted in the beds to increase water removal; size depends on soil type, vegetation, wind speed, humidity and other factors.	Beds are suitable in arid conditions where other disposal methods are inappropriate.	Careful management is required; beds can only cope with a limited volume of water.
<b>Irrigation</b>	Irrigation is appropriate where large volumes of wastewater are generated; might involve planting fast growing fruit trees such as papaya or banana in drainage channels; might involve drainage channels can be diverted to areas to promote plant growth; monitoring is needed so that drinking water is not diverted for irrigation use where there is a limited water supply.	Irrigation can make use of large volumes of water; contributions to agricultural activities in the affected area.	In general, small-scale possibilities only are viable; it may encourage inappropriate use of drinking water.

## Planning guidelines for institutions

Tables 8-19 and 8-20 provide guidelines on minimum water quantities and minimum number of toilets for institutions.

*Table 8-19: Planning guidelines for minimum water quantities for institutions and other uses<sup>24</sup>*

Health centres and hospitals	5 litres/out-patient 40-60 litres/in-patient/day Additional quantities needed for laundry, flushing toilets, etc.
Cholera centres	60 litres/patient/day 15 litres/carer/day
Therapeutic feeding centres	30 litres/in-patient/day 15 litres/carer/day
Schools	3 litres/pupil/day for drinking and hand washing (use for toilets not included)
Mosques	2-5 litres/person/day for washing and drinking
Public toilets	1-2 litres/user/day for hand washing 2-8 litres/cubicle/day for toilet cleaning

All flushing toilets	20-40 litres/user/day/for conventional flushing toilets connected to a sewer 3-5 litres/user/day for pour-flush toilets
Anal washing	1-2 litres/person/day
Livestock	20-30 litres/large or medium animal/day 5 litres/small animal/day
Small-scale irrigation	3-6mm/m <sup>2</sup> /day, but can vary considerably

*Table 8-20: Planning guidelines for minimum numbers of toilets at public places and institution in disaster situations<sup>24</sup>*

Market areas	1 toilet to 20 stalls
Hospitals and medical centres	1 toilet to 10 beds or 20 out-patients
Feeding centres	1 toilet to 20 adults 1 toilet to 10 children
Schools	1 toilet to 30 girls 1 toilet to 60 boys
Offices	1 toilet to 20 staff

## Water and sanitation in cholera outbreak response

This section explores the very important role that environmental health plays in the control of cholera. Cholera is a diarrhoeal disease caused by the bacterium *Vibrio cholerae* (either type 01 or 0139) and is usually transmitted through faecally contaminated water or food. Of those infected, about 20% will develop Acute Watery Diarrhoea (AWD). About 10% to 20% percent of individuals developing acute watery diarrhoea will also develop severe watery diarrhoea and vomiting that will lead to large fluid losses. Because of these losses, death due to dehydration can occur within hours if prompt treatment is not provided. Cholera has an incubation period of two hours to five days. Due to this short incubation period, the number of cases can rise rapidly. Therefore, a quick response to the outbreak is crucial. The risk for cholera outbreaks is highest in areas where there is over-crowding and where inadequate sanitation, unsafe water supplies and poor food safety and hygiene exist.

Because the disease spreads quickly, it is very important to take early action to save lives in any AWD outbreak. There is a tendency to wait for the confirmation on Cholera; however, laboratory diagnosis and confirmation are often delayed because of poor access to laboratories, transport, media etc or governments are reluctant to declare that there is a confirmed cholera outbreak fearing an adverse impact on tourism, travelling and other businesses. Every time anyone over the age of five dies from AWD, a response should be initiated immediately.<sup>36</sup>

The action cycle has four stages

- Preparedness;
- Prevention;
- Containment/treatment;
- Evaluation, improvement of preparedness.

In all four stages, community participation is of the utmost importance. Volunteers, community health workers and extension officers should be used as an extended arm of the peripheral health care system.

The following information on the importance of environmental health in preventing and controlling cholera is taken from:

- The WHO Global Task Force on Cholera Control, ‘Cholera outbreak, Assessing the Outbreak Response and Improving Preparedness’ 2004; and
- The International Federation ‘Diarrhoeal Disease and Cholera Preparedness and Response Guidelines’ May of 2007.

*Table 8-21: Environmental health in cholera outbreak response*

<b>Outbreak detection</b>	<p><b>Rapid verification and response team:</b></p> <ul style="list-style-type: none"> <li>▪ When an outbreak is suspected after a person over five has died of AWD or a case has been confirmed, it is important to send a multidisciplinary team to the field to take the first measures for controlling the disease’s spread. The team can include a water and sanitation expert to investigate possible sources of contamination and start the appropriate treatment of the sources;</li> <li>▪ The following potential vehicles of transmission must be investigated so that appropriate control measures can be taken: <ul style="list-style-type: none"> <li>▪ Drinking water that may have been contaminated at source or during transport and storage, or ice made with contaminated water;</li> <li>▪ Food that might have been contaminated during or after preparation;</li> <li>▪ Seafood;</li> <li>▪ Fruits and vegetables.</li> </ul> </li> </ul>
<b>Organization of the response</b>	<p><b>When the first report of a suspected cholera case is received, the following activities should be performed (the order can vary according to the situation):</b></p> <ul style="list-style-type: none"> <li>▪ Convene the cholera coordination committee;</li> <li>▪ Make an inventory of available essential supplies;</li> <li>▪ Inform the public, neighbouring districts and media;</li> <li>▪ Conduct training if needed;</li> <li>▪ Set up temporary treatment centres if needed;</li> <li>▪ Collect, report and analyse data on cases, deaths and control activities. Document the epidemic; provide feedback and adapt interventions;</li> <li>▪ Implement measures to control the spread of the disease (disinfection of water sources, food safety measures);</li> <li>▪ Conduct health promotion campaigns;</li> <li>▪ Ask for additional help;</li> <li>▪ Monitor and evaluate control measures.</li> </ul>
<b>Case management treatment</b>	<p><b>Health promotion: The most important messages to prevent the family (and others) from being contaminated are:</b></p> <ul style="list-style-type: none"> <li>▪ Wash your hands after taking care of patients—whether after touching them, their stools, their vomit or their clothes;</li> <li>▪ Beware of contaminating the water source by washing patients’ clothes in the water.</li> </ul>
<b>Reduction of mortality</b>	<p><b>Oral rehydration therapy:</b></p> <ul style="list-style-type: none"> <li>▪ The community must be taught about the importance of starting Oral Rehydration Solution early and attending health centres quickly.</li> </ul>

<p><b>Hygiene measures in health care facilities</b></p>	<p><b>Functions to be ensured in the cholera treatment unit:</b></p> <p><i>Prevention and hygiene:</i></p> <ul style="list-style-type: none"> <li>▪ Kitchen for food preparation;</li> <li>▪ Water treatment;</li> <li>▪ Preparation of chlorine solution;</li> <li>▪ Clothes washing facilities, laundry.</li> </ul> <p><i>Health promotion:</i></p> <ul style="list-style-type: none"> <li>▪ Health promotion activities inside the Cholera Treatment Unit (CTU) and at patients, home by disinfection teams;</li> <li>▪ Active case finding in the refugee camp/villages.</li> </ul> <p><i>Waste and environment:</i></p> <ul style="list-style-type: none"> <li>▪ Safe waste disposal (incinerator, dustbins);</li> <li>▪ Cleaning and disinfection of the CTU;</li> <li>▪ Morgue.</li> </ul> <p><i>Disinfection of patients' bedding and clothing:</i></p> <ul style="list-style-type: none"> <li>▪ Patients' bedding and clothing can be disinfected by stirring them for five minutes in boiling water. Bedding including mattresses can also be disinfected by thorough drying in the sun.</li> </ul>
<p><b>Involvement of the community to limit the spread of disease</b></p>	<p><b>Health promotion campaign during outbreak. An epidemic of cholera can be more quickly controlled when the public understands how to help to limit its spread. Health promotion is crucial to ensure the participation of the community:</b></p> <ul style="list-style-type: none"> <li>▪ Select the best way to disseminate messages to the community;</li> <li>▪ Communication through radio, posters, talks etc;</li> <li>▪ Use the local language;</li> <li>▪ Give clear information—but not too many messages;</li> <li>▪ Adapt messages to the community's economic, cultural and social circumstances and its ability to cope with behaviour change e.g. chlorine or soap might not be affordable in poor communities;</li> <li>▪ Organise talks in places where people are usually waiting (health care facilities etc).</li> </ul> <p>Active case-finding: If possible, active case-finding in communities should be organised to allow:</p> <ul style="list-style-type: none"> <li>▪ The detection of cholera patients at an early stage of the disease;</li> <li>▪ Advise family members and the community about protecting themselves from contamination.</li> </ul> <p><b>Key messages to give to the community:</b></p> <ul style="list-style-type: none"> <li>▪ Come to the health care facility as soon as possible in case of Acute Watery Diarrhoea;</li> <li>▪ Start drinking Oral Rehydration Solution at home and when travelling to the health care facility;</li> <li>▪ Wash your hands before cooking, eating and after using the toilet;</li> <li>▪ Cook food;</li> <li>▪ Drink safe water.</li> </ul>

<p><b>Control of the environment: safe water</b></p>	<p><b>Types of access to drinking-water:</b></p> <ul style="list-style-type: none"> <li>▪ Household connection, public standpipe, borehole, protected dug well, protected spring, rainwater collection, unprotected well, vendor and tanker truck. The drinking-water might be contaminated where this is contact with: <ul style="list-style-type: none"> <li>▪ Hands and bodies of people who have cholera although show no symptoms;</li> <li>▪ Contaminated articles such as buckets, cups, clothes;</li> <li>▪ Faecal material e.g. by infiltration into wells when the latrines are placed less than thirty metres away from the wells).</li> </ul> </li> </ul> <p><b>Contaminated wells:</b></p> <ul style="list-style-type: none"> <li>▪ Unprotected water sources are very often contaminated. Arrangements should be made for the protection of water sources as an important measure for reducing the risk of contamination;</li> <li>▪ Treatment of the source might be the best way to prevent the spread of cholera in the community. In emergencies, free residual chlorine of about 0.5 mg/litre is advisable;</li> <li>▪ When the water source is too turbid, it should be filtered before disinfection. Alternatively, filtration and chlorination could be done at the household level.</li> </ul> <p><b>Provision of safe drinking-water:</b></p> <ul style="list-style-type: none"> <li>▪ The conditions and practices of water collection and storage contribute to the safety of household water;</li> <li>▪ There is evidence that storage in a narrow-mouthed vessel with a protected dispenser (spigot, spout) is much safer than storage in a wide-mouthed vessel. Drinking water should be kept in a clean covered pot or bucket. It is better to pour the water from the container than to use a potentially contaminated article (e.g. cut without handle) to retrieve the water.</li> </ul> <p><b>Household water treatment:</b></p> <ul style="list-style-type: none"> <li>▪ Various methods of household water treatment are available such as boiling, chlorination, storage in improved vessels, solar disinfection with UV + heat, UV disinfection with lamps, chemical coagulation-filtration + chlorine disinfection.</li> </ul>
<p><b>Control of the environment: safe food</b></p>	<p><b>Common sources of infection:</b></p> <ul style="list-style-type: none"> <li>▪ Drinking contaminated at its source e.g. by faecally contaminated surface water entering an incompletely sealed well, or during transport or supply or during storage e.g. by contact with hands soiled with faeces;</li> <li>▪ Ice made from contaminated water;</li> <li>▪ Cooking utensils washed in contaminated water;</li> <li>▪ Food contaminated during or after preparation. Moist foods e.g. milk, cooked rice, lentils, potatoes, beans, eggs, and chicken, contaminated during or after cooking/preparation and allowed to remain at room temperature for several hours, provide an excellent environment for the growth of <i>Vibrio cholerae</i>;</li> <li>▪ Seafood particularly crustaceans and other shellfish taken from contaminated water and eaten raw or insufficiently cooked or contaminated during preparation;</li> <li>▪ Fruit and vegetables grown at or near ground level and fertilised with night soil, irrigated with water containing human waste or 'freshened' with contaminated water and then eaten raw or contaminated during washing and preparation.</li> </ul>

<p><b>Control of the environment: sanitation</b></p>	<p><b>Improvement of sanitation:</b></p> <ul style="list-style-type: none"> <li>▪ The population should have access to an improved sanitation facility such as connection to a public sewer, connection to a septic tank, pour-flush latrine, simple pit latrine and ventilated improved latrine;</li> <li>▪ Facilities such as bucket latrines, public or shared latrines and trench latrines should be replaced as soon as possible by improved sanitation facilities.</li> </ul> <p><b>Involving the community:</b></p> <ul style="list-style-type: none"> <li>▪ The community should be involved in all phases of implementation of on site sanitation projects. Without their participation and involvement, there is a risk of misuse or non-use of the sanitation facilities.</li> </ul> <p><b>Sanitation and health:</b></p> <ul style="list-style-type: none"> <li>▪ The link between sanitation, water supply and health are directly affected by hygiene behaviour. The benefits of access to sanitation services are never met without good hygiene behaviour;</li> <li>▪ Sanitation facilities should be hygienic so that they do not endanger the health of the users and the community as a whole.</li> </ul>
<p><b>Funeral practices</b></p>	<p><b>Recommendation for funerals:</b></p> <ul style="list-style-type: none"> <li>▪ Funerals for people who die of cholera—or of any other cause in a community affected by cholera—can contribute to the spread of an epidemic. If funeral feasts cannot be cancelled, meticulous hand washing with soap and clean water is essential before food is prepared and handled.</li> </ul> <p><b>Recommendations for handling corpses:</b></p> <ul style="list-style-type: none"> <li>▪ It is important to ensure disinfection of corpses with a 0.5% chlorine solution. For transporting cholera victims' corpses, corpse-carriers should wear gloves and corpses should be carefully wrapped;</li> <li>▪ If possible, physical contact between the family and the corpse should be prevented.</li> </ul> <p><b>If the corpse must be touched, the family must be aware of the need to:</b></p> <ul style="list-style-type: none"> <li>▪ Wash hands with soap after touching the corpse;</li> <li>▪ Avoid putting hands in the mouth after touching the corpse;</li> <li>▪ Disinfect the dead person's clothing and bedding by stirring in boiling water for five minutes or by drying them thoroughly in the sun before and after normal washing</li> </ul> <p><b>People who wash and prepare the dead body must:</b></p> <ul style="list-style-type: none"> <li>▪ Wear gloves, apron and mask;</li> <li>▪ Clean the body with chlorine solution (0.5%);</li> <li>▪ Fill the corpse's mouth and anus with cotton wool soaked in chlorine solution;</li> <li>▪ Bandage the corpse's head to hold the mouth closed;</li> <li>▪ Not to empty the intestines.</li> </ul>
<p><b>Surveillance</b></p>	<p><b>Descriptive epidemiology</b></p> <ul style="list-style-type: none"> <li>▪ The important information is the number of cases and deaths by area, time and by population sub-groups; calculations of attack and case-fatality rates allow the comparison of different areas and periods.</li> </ul> <p><b>Attack rate:</b></p> <ul style="list-style-type: none"> <li>▪ Calculated as the number of cases/population at risk in a given period.</li> </ul> <p><b>When the attack rate is high, it indicates that:</b></p> <ul style="list-style-type: none"> <li>▪ There is a common source of infection;</li> <li>▪ The area is very crowded (as in urban areas, for example).</li> </ul>

Table 8-22: Essential rules in a cholera treatment unit<sup>6</sup>

Mode of transmission	Essential rules in the cholera treatment unit	Additional recommended rules
<b>People</b>	Access limited to patient + one family member + staff One-way flow of people	Ideally one carer per patient only Three separate spaces within cholera treatment unit
<b>Water</b>	Safe water (chlorination concentration according to specific use) Large quantity needed (minimum 10 litres per person per day)	Ideally fifty litres per patient per day
<b>Hands</b>	Hand-washing stations with safe water and soap in sufficient quantities Wash hands with water and soap <ul style="list-style-type: none"> <li>▪ Before and after taking care of patients;</li> <li>▪ After using latrines;</li> <li>▪ Before cooking or eating;</li> <li>▪ After leaving the admission ward.</li> </ul>	Cut and clean nails
<b>Food</b>	Cooked food Health care workers should not handle food or water	Food provided by cholera treatment unit (rather than by families) Large stocks of food might be 'tempting' and lead to security problems
<b>Clothes and bedding</b>	Wash clothes and bedding with the appropriate chlorine solution	If chlorine is unavailable, wash clothes with soap and dry them in the sun
<b>Environmental contamination (faeces and waste)</b>	Ensure exclusive latrines for the cholera treatment unit Disinfect buckets, soiled surfaces and latrines regularly with the appropriate chlorine solution Incinerator for medical waste	Latrines should be sited at least 100 metres away from the wells or surface sources Special cholera beds (cholera cots)
<b>Corpses</b>	Separate morgue Disinfect corpses	Identify safe funeral practices Dispose of corpses as soon as possible

Table 8-23: Chlorine dilution according to use<sup>6</sup>

Chlorine product	For disinfecting: <ul style="list-style-type: none"> <li>▪ Excreta</li> <li>▪ Cadavers</li> <li>▪ Body fluids</li> </ul> Prepare a 0.5% available chlorine solution	For disinfecting: <ul style="list-style-type: none"> <li>▪ Gloved hands</li> <li>▪ Bare hands and skin</li> <li>▪ Floors</li> <li>▪ Clothing and equipment</li> <li>▪ Bedding</li> </ul> Prepare a 0.05% available chlorine solution
Household bleach (5% active chlorine)	Add 1 litre of bleach to 9 litres of water (1:10 solution)	Add 100 ml of bleach to 9.9 litres of water or Add 1 litre of 1:10 bleach solution to 9 litres of water (yields a 1:100 solution)
Household bleach (30% active chlorine)	Add 16 grams or 1 tablespoon to 1 litre of water	Add 16 grams or 1 tablespoon to 10 litres of water
Calcium hypochlorite powder or chlorine granules 70%	7 grams or half a tablespoon dissolved in 1 litre of water	7 grams or half a tablespoon dissolved in 10 litres of water

Table 8-24: Key messages for health promotion

<b>Personal hygiene</b>	<ul style="list-style-type: none"> <li>▪ Wash your hands with soap, ashes, or lime:</li> <li>▪ Before cooking;</li> <li>▪ Before eating or before feeding your children;</li> <li>▪ After using the latrine or cleaning your children after they have used the latrine.</li> <li>▪ Wash all parts of your hands—front, back, between the fingers, under nails.</li> <li>▪ Use latrine to defecate.</li> <li>▪ Keep the latrine clean.</li> </ul>
<b>Food</b>	<ul style="list-style-type: none"> <li>▪ Cook raw food thoroughly;</li> <li>▪ Eat cooked foods immediately;</li> <li>▪ Store cooked food carefully in refrigerator;</li> <li>▪ Reheat cooked food thoroughly;</li> <li>▪ Avoid contact between raw food and cooked food;</li> <li>▪ Eat fruit and vegetable you have peeled yourself;</li> <li>▪ Keep all kitchen surfaces clean;</li> <li>▪ Wash your cutting board especially well with soap and water;</li> <li>▪ Wash your utensils and dishes with soap and water;</li> </ul> <p style="text-align: center;"><b><i>Cook it — peel it — or leave it!!!</i></b></p>
<b>Safe drinking-water</b>	<ul style="list-style-type: none"> <li>▪ Even if it looks clear, water can contain cholera germs;</li> <li>▪ Boil, or add drops of chlorine to the water before drinking;</li> <li>▪ Keep drinking water in a clean, covered pot or bucket or other container with a small opening and a cover; It should be used within twenty-four hours of collection;</li> <li>▪ Pour the water from the container—do not dip a cup into the container.</li> <li>▪ If dipping into the water container cannot be avoided, use a cup or other utensil with a handle.</li> </ul>

<b>Wells</b>	<ul style="list-style-type: none"> <li>▪ Do not defecate or urinate in or near a source of drinking water;</li> <li>▪ Do not wash yourself, your clothes, or your pots and utensils in the source of drinking water (stream, river, or water hole);</li> <li>▪ Open wells must be covered when not in use to avoid contamination;</li> <li>▪ The buckets used to collect water should be hung up when not in use—they must not be left on a dirty surface;</li> <li>▪ The area surrounding a well or a hand pump must be kept as clean as possible;</li> <li>▪ Get rid of refuse and stagnant water around a water source.</li> </ul>
<b>For People with diarrhoea</b>	<ul style="list-style-type: none"> <li>▪ The biggest danger of cholera is loss of water from the body;</li> <li>▪ Do not panic, but act quickly;</li> <li>▪ Drink a solution of oral rehydration salts made with safe (boiled or chlorinated) water;</li> <li>▪ Go immediately to the health centre. Continue drinking as you go.</li> </ul>
<b>Taking care of patients</b>	<ul style="list-style-type: none"> <li>▪ Wash your hands after taking care of patients, touching them, their stools, vomit, or clothes;</li> <li>▪ Avoid contaminating a water source by washing a patient's clothes in it;</li> <li>▪ Stools and vomit from a cholera patient can be mixed with disinfectant (e.g.; cresol);</li> <li>▪ Disinfect the patient's clothing and bedding with a solution of chlorine (0.05%) or by stirring them in boiling water or by drying them thoroughly in the sun before or after normal washing.</li> </ul>

Table 8-25: Rules for safe preparation of food to prevent cholera

<b>Cook (raw) food thoroughly</b>	Fish, shellfish, and vegetables are often contaminated with cholera bacteria. Therefore, heat all the parts of the food to at least 70°C. Do not eat uncooked foods unless they can be peeled or shelled.
<b>Eat cooked foods immediately</b>	When there is a delay between cooking and eating food as when it is sold in restaurants or by street vendors, it should be kept over at heat of 60°C or more until served.
<b>Store cooked foods carefully</b>	If you must prepare foods in advance or want to keep leftovers, be sure to cool them to below 10°C as soon as possible and then store them in a refrigerator or icebox below 10°C. Cooked foods that have been stored must be thoroughly reheated before eating. Foods for infants should be eaten immediately after being prepared, and should not be stored at all.
<b>Reheat cooked foods thoroughly</b>	Proper storage at low temperature slows down the growth of bacteria but does not kill them. Once again, thorough reheating means that all parts of the food must reach at least 70°C. Eat food while it is still hot.
<b>Avoid contact between raw foods and cook foods</b>	Safely cooked food can be contaminated through even the slightest contact with raw food directly or indirectly through cutting surfaces or knife blades.
<b>Choose foods processed for safety</b>	Canned, acidic and dried foods should be without risk.
<b>Wash hands repeatedly</b>	Wash hands thoroughly before preparing food and after every interruption—especially if you have to change or clean a baby or have used the toilet or latrine. After preparing raw foods such as fish or shellfish wash your hands again before handling other foods.
<b>Keep all kitchen surfaces clean</b>	Since foods are so easily contaminated, any surface used for food preparation must be kept clean. Think of every food scrap, crumb or spot as a potential source of bacteria. Clothes used for washing or drying food, preparation surfaces, dishes, and utensils should be changed every day and boiled before reuse. Separate cloths that are used for cleaning the floors also require daily washing.
<b>Use safe water</b>	Safe water is just as important for food preparation as for drinking.