# THE CHALLENGE IN DISASTER REDUCTION FOR THE WATER AND SANITATION SECTOR:

## improving quality of life by reducing vulnerabilities

Pan American Health Organization

unicef

International Federation of Red Cross and Red Crescent Societies

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Pan American Health Organization
Regional Office of the World Health Organization

INTERNATIONAL STRATEGY ISDR FOR DISASTER REDUCTION

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# Contents

**Introduction** . . . . . .V

**Water and Sanitation: Suspension of Services Worsens Impact and Suffering Caused by Disasters** . . . . . .1

Interruption of services causes more than just the lack of water and sanitation. . . . . .3

In emergencies, besides providing water, affected services must be restored. . . . . .5

**Ensuring Water and Sanitation Services Against Disasters** . . . . . .9

The aim of political benefit and social stability . . . . . .12

A concrete and basic step toward sustainability of services . . . . . .12

**Reliance on Safe Water and Sanitation Systems for Vulnerable Populations: A Feasible Challenge** . . . . . .17

Minimum standards for levels of operation . . . . . .18

Improving sustainability of existing services—an integral approach to risk reduction . . . . . .20

Conceiving new, safer services . . . . . .23

**Risk Reduction: A Sectoral Responsibility** . . . . . .27

Regulation of services . . . . . .28

Service providers . . . . . .32

**Conclusion. Relying On Water and Sanitation Services during Disasters: A Political, Social, and Economic Concern** . . . . . .35

# Introduction

Water, a life-sustaining element, can become the source of major concerns after a disaster. It is critical to have sufficient clean water in the immediate aftermath of an event in order to treat the ill, provide for human consumption and maintain basic hygiene, support in the work of search and rescue, and to resume normal productive and commercial activities.

Access to water is a basic human right, and implies a responsibility that goes beyond the protection of investments and is, above all, a responsibility of public health.

In the current global situation, characterized by conditions of inequity and extreme poverty, environmental degradation and climate change have caused an increase in the occurrence of natural hazards such as landslides, intense rains, hurricanes, drought, fires, and earthquakes. Furthermore, rapid and unplanned urban growth has increased the number of settlements on unstable, flood-prone, and high-risk land where phenomena such as landslides, rains, and earthquakes have devastating consequences. Socioeconomic factors increase the vulnerability of communities as well as existing infrastructure and services.

Each year more than 200 million people are affected by droughts, floods, tropical storms, earthquakes, forest fire, and other hazards. As demonstrated by recent events, natural hazards can affect anyone in anyplace. From the tsunami in the Indian Ocean to the earthquake in South Asia, from the devastation caused by hurricanes and cyclones in the United States, the Caribbean, and the Pacific, to the intense rains throughout Europe and Asia, hundreds of thousands of persons have lost their lives and millions their livelihoods because of

disasters triggered by natural hazards. The impact of events of catastrophic magnitude on all aspects of the economy and development has been evident, in particular for developing countries.

In Latin America and the Caribbean alone, the impact of natural disasters on water and sanitation systems caused damages amounting to some 650 million dollars between 1994 and 2003.

In an environment where natural hazards are present, local actions are decisive in all stages of risk management: in the work of prevention and mitigation, in rehabilitation and reconstruction, and above all in emergency response and the provision of basic services to the affected population. Commitment to systematic vulnerability reduction is crucial to ensure the resilience of communities and populations to the impact of natural hazards.

Current challenges for the water and sanitation sector in the framework of the world's Millennium Development Goals require an increase in sustainable access to water and sanitation services in marginal urban areas and rural areas, where natural hazards pose the greatest risk. In settlements located on unstable and flood-prone land there is growing environmental degradation coupled with extreme conditions of poverty that increase vulnerability. The development of local capacity and risk management play vital roles in obtaining sustainability of water and sanitation systems as well as for the communities themselves.

## Hurricane in Honduras, 1998

Development in Honduras was set back by 30 to 40 years following Hurricane Mitch in 1998.

Damage to the infrastructure for drinking water and sanitation systems amounted to some US$ 58 million and estimated costs of reconstruction exceeded US$ 196 million.

Source: Pan American Health Organization (PAHO), Crónicas de Desastres: Huracanes Georges y Mitch (PAHO: Washington, D.C., 1999).

When these factors are not taken into account, there is the danger of designing and constructing unsustainable services that progressively deteriorate and malfunction. Poor design and construction put both the community and infrastructure at risk in disaster situations.

The many actors in the water and sanitation sector (the administration, supervisors, providers, consumers, etc.) complicate the definition and assignment of functions and responsibilities. This results in confusion as to who does what regarding specific actions related to disaster prevention, preparedness, mitigation, and response. During each of these phases, each of the actions and actors have one common objective, that is, to ensure that the levels of water and sanitation service, established with local authorities and the community, can be sustained even during disaster situations.

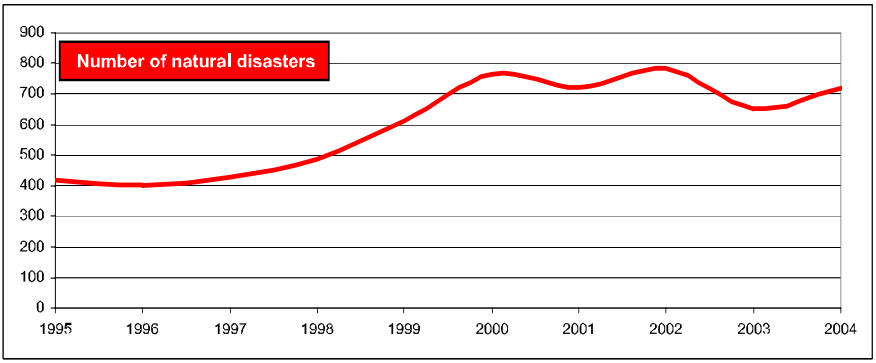
The reduction of vulnerabilities entails multi-disciplinary work in a network with other actors in risk management, such as public ministries (in particular those responsible for public works and utilities, land planning and management, health, education, and finance), disaster management agencies, NGOs, the private sector, and the academic sector (universities, professional associations, research centers) fostering the development and exchange of knowledge in matters of protecting water and sanitation systems against natural hazards.

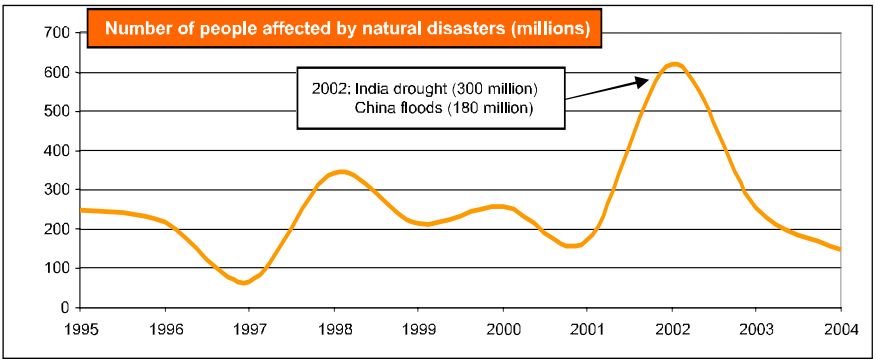
On the other hand, the resistance of systems to natural disasters is an important step toward ensuring that the achievements made in increased access to water and sanitation services are strengthened in the long term, thereby realizing the goal of reducing by half, by the year 2015, the percentage of people that lack sustainable access to safe drinking water and basic sanitation. In this sense, the local activities of risk management position themselves as a tool for realizing the global challenges of providing water and sanitation services for all and at all times.

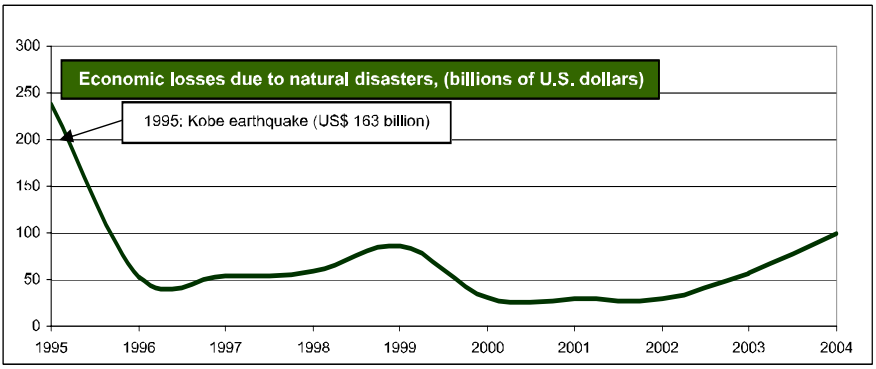
In January 2005 in Kobe, Japan, 168 governments committed to act to reduce disaster risk, and adopted a 10-year plan known as the Hyogo Framework for Action, with the objective of reducing vulnerability to natural hazards. The inclusion of criteria of vulnerability reduction to the impact of natural hazards

in the water and sanitation sector is a priority activity for advancing the objectives of the global plan. Furthermore, water and sanitation systems warrant consideration as "critical" infrastructure, and as such are a priority for the efforts of disaster risk reduction, as are schools and hospitals. The loss of human life and economic and environmental losses as a result of disasters in 2005 serve to strengthen the belief that disaster reduction should be an integral part of sustainable development, and a critical factor for reaching the Millennium Goals. The water and sanitation sector must not be overlooked when addressing this challenge.

# Increase in number and impact of natural disasters worldwide (1995 - 2005)




**Source:** Based on data from "The OFDA/CRED International Disaster Database" (Center for Research on the Epidemiology of Disasters–CRED), Catholic University of Louvain, Belgium, 2006). Accessed at www.em-dat.net

QUAKER STATE

# 1 Water and Sanitation: Suspension of Services Worsens Impact and Suffering Caused by Disasters

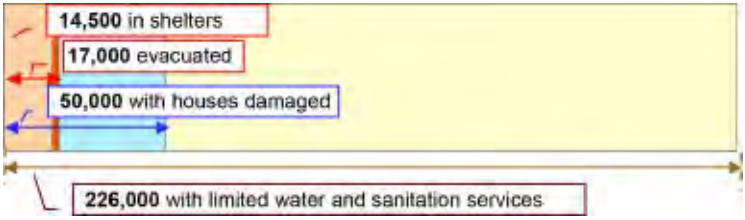
The numbers of people needing water and sanitation following a disaster are much higher than the numbers of people killed, injured, displaced, or needing medical attention.

Natural hazards such as earthquakes or hurricanes can affect large areas and populations. Particularly in urban and peri-urban areas, the failure of water and sanitation services restricts medical treatment in health facilities, degrades environmental conditions, and has a negative impact on the hygiene of a population.

## Lack of Water and Sanitation Services Increase the Number of Persons Affected

### Hurricane Emily–Mexico (2005)

In July 2005, Hurricane Emily hit the Atlantic coast of Mexico; Quitana Roo, Yucatán, Nuevo León and Tamaulipas were the most seriously affected states. In Tamaulipas, although there were no deaths, 17,000 people had to be evacuated, and of these, 14,500 were housed in 155 shelters. Another 50,000 people sustained damage to their houses. Damage to the water and sanitation systems resulted in limited service to over 260,000 people. This affected 43 localities in 11 municipalities which covered approximately 35,000 square kilometers.




Source: CENAPRED, CEPAL

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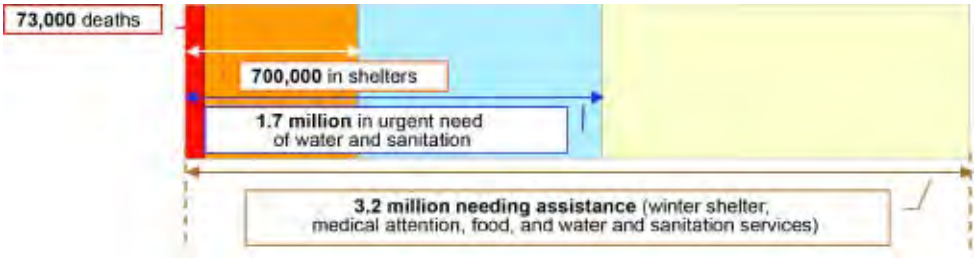
*LACK OF WATER AND SANITATION SERVICES INCREASE THE NUMBER OF PERSONS AFFECTED*

## Earthquake in Pakistan (2005)

On 8 October 2005, an earthquake measuring 7.6 on the Richter scale devastated areas in northern India and Pakistan. Two of the most seriously affected provinces were Azad Jammu Kashmir (AJK) and North West Frontier Province (NWFP), which have the lowest human development indices in these countries. The earthquake destroyed the water supply systems in five districts of NWFP and three districts of AJK.

The number of victims and persons needing shelter was approximately 700,000, but damage to the water and sanitation infrastructure required the provision of safe drinking water and adequate sanitation to 1.7 million people. Some 3.2 million people were in need of assistance, including winter shelter, medical care, food, and water and sanitation facilities.




Source: Pakistan 2005 Earthquake, Early Recovery Framework, United Nation System, 2005.

Other localized phenomena, which are generally more frequent than major disasters and do not involve the loss of life or direct impacts on the population do affect some components of the water and sanitation systems. This is the case especially with small systems that provide service to rural populations and which are vital for the improvement of local health conditions and standards of living. Even though losses cannot be quantified by numbers of dead or injured, the population is affected by the interruption of water and sanitation services.

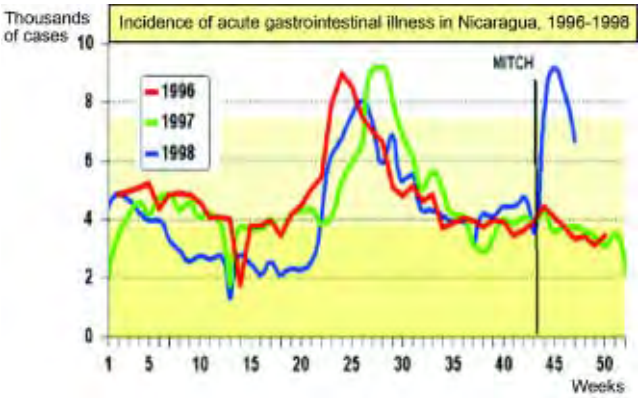
Deficiencies in water and sanitation systems can increase the vulnerability of communities. Incorrect installation or operation of units can endanger the lives and health of people living near installations, as well as the loss of goods. For example, inadequate installation of the reservoir outflow cause soils to become unstable because of humidification and erosion. Or when the installation of drainage systems is postponed, water used by the population permeates the soil, causing landslides.

## Interruption of services causes more than just the lack of water and sanitation.

Interruption of water and sanitation services during a disaster often compromises the health and social benefits derived from their installation. The damages in sewer systems and wastewater treatment cause contamination of nearby bodies of water, loss of sources of water, and environmental degradation which lead to unhealthful conditions in urban centers.

## Hurricane Mitch in Nicaragua, 1998

In Nicaragua, environmental sanitation problems during the emergency phase following Hurricane Mitch were the most difficult to control, especially in the first days of the emergency. The high number of shelters improvised in schools and churches, overcrowded, insufficient sanitation services and limited availability of water were the principal causes of the first outbreaks of gastrointestinal illness.




Source: Nicaragua, Ministry of Health, Epidemiologic Surveillance Division.

Increased incidence of water-borne illnesses is common among those living without basic access to safe water and sanitation services. The risk of this type of illness increases in unfavorable environmental conditions such as overcrowding, populations displaced by disaster, and limited health services.

The suspension of water distribution services forces people to find their own, often unsafe, sources of water. This occurs particularly in rural areas where the women and children carry water to supply their families. This time-consuming task prevents children from attending school and women from doing other productive work.

The increased costs to provide water are borne by humanitarian assistance agencies, national, regional and local governments, and the population itself. Damage to water systems has a negative economic impact on industry, com-

merce, and other activities that need a constant supply of water. This factor is not always taken into account when addressing the benefits of protecting these systems from disaster-related damage.

Losses suffered by the water companies go beyond physical damage to the infrastructure. The costs of providing water to populations in need and the loss of income can compromise the financial viability of these firms, making it difficult to restore the normal levels of service and development programs in place before the disaster.

## In emergencies, besides providing water, affected services must be restored.

In emergency situations one of the main priorities for national and local authorities as well as humanitarian assistance agencies is that of providing water (bottled water or using alternative treatment systems) or in situ sanitation facilities for the disaster victims. The transport of millions of liters of water and treatment plants to disaster affected areas is extremely expensive, and is a temporary and inadequate measure.

**In addition to responding to emergencies, the challenge for the water and sanitation sector is to restore the operation of systems affected by the disaster and to reduce their vulnerability to future events.**

During reconstruction, there are initiatives to take the opportunity provided by the disaster to carry out modernization projects for the sector, such as expanding coverage of the service. However, in many cases these projects replicate the failures in the damaged systems, and actually increase their vulnerability to similar natural hazards. After major disasters there are few efforts in the water and sanitation sector to develop technologies or technical standards that reflect prior experience with damage caused by disasters.

## Earthquake in El Salvador, 2001

The earthquakes that occurred in El Salvador in 2001 affected more than 200 water and sanitation systems, with damages amounting to US$ 11 million.

Emergency water distribution using water tankers cost some US$ 400,000. This paid for distribution of 98,700 cubic meters of water for 138 days, which amounted to US$ 4 per cubic meter.

Source: Asociación Nacional de Acueductos y Alcantarillada del El Salvador (National Association of Aqueducts and Sewerage of El Salvador), 2001.

In this regard, the recovery and reconstruction of water and sanitation systems should function as a "test laboratory" and a source of information on current, state-of-the-art measures for effective protection of the systems, providing the basis for the development of new technologies and technical standards. Contributions and involvement on the part of the academic community (universities, research centers, professional associations, and technical cooperation agencies) are essential for this work in coordination with the water and sanitation institutions. The national platforms for disaster reduction that are being promoted in all countries as a part of the implementation of the Hyogo Framework provide the opportunity and concrete mechanisms for multisectoral coordination of these efforts.

# 2 Ensuring Water and Sanitation Services Against Disasters

Providers of water and sanitation services have the direct responsibility for the public health of their users and the population in general, which should be maintained and reinforced when a disaster affects the population they serve. Ensuring access to safe water (with the quality and sufficient quantities for consumption and hygiene) and providing adequate sanitation facilities during emergency situations is part of this responsibility. The provider and the systems administered should be capable of responding in these situations and reduce the possible effects of interruption and deterioration of the services.

The availability of safe water and basic sanitation conditions are fundamental for protecting the health of the population, particularly during emergencies when people are displaced and vulnerable.

In this regard, proper operation of the water and sanitation systems and the ability to maintain this operation in the aftermath of a disaster are fundamental for the protection and recovery of health of the affected population. Control of environmental hazards that may lead to outbreaks (leptospirosis, cholera, acute gastrointestinal illness) is fundamental, as these illnesses have a greater impact on the health of a population than the event itself. In addition, ensuring the continuity of services in health facilities is essential if they are to provide adequate medical care for the affected population.

The continuity of water and sanitation services (although in suboptimal conditions) should be seen as a public health intervention and a priority for political and health authorities.

During the emergency water and sanitation services are especially important for the following activities:

- **Medical attention for victims.** In hospitals and health centers, the continuity of a safe water supply is essential to providing medical care to the victims of a disaster. Even when a health facility has taken protective measures for the impact of a disaster, the quality of care it can provide will be limited if the public services of water and sewerage are interrupted.
- **Search and rescue activities.** The search and rescue teams need water not only for their own consumption, but sufficient quantities for the consumption and hygiene of the people they rescue.
- **Human consumption (drink and hygiene).** The services must ensure that there is safe and sufficient water for human consumption and personal hygiene, particularly for persons directly affected by the disaster.
- **Attention to populations in shelters.** Especially for victims who have lost their homes and are in overcrowded shelters, the provision of enough safe water for consumption and adequate sanitation facilities are fundamental for safeguarding their health.
- **Fire fighting during earthquakes.** Fires that occur after earthquakes can not be extinguished without a reliable water source.
- **Cleaning.** Essential facilities such as hospitals and schools need to be cleaned before routine activities can resume, for which water is essential. Water is needed to clean houses and public spaces in general if they are to be fit for use.
- **Well-being.** The interruption of services has adverse effects on well-being, quality of life, and development of affected populations as well as those who are not directly affected. As mentioned earlier, lack of accessible water forces the population (especially women and children) to carry water. Many industries require continuous supplies of water to operate and produce goods and services.

Ensuring the operation of water and sanitation in the case of natural disasters requires the inclusion of safety measures at various stages of service implementation, as well as emergency preparedness and plans to deal with disasters. Postponing such activities contributes to the chaos, and prolongs and increases the impact of the disaster as well as putting the health of the population at risk.

## Fires caused by earthquakes

Earthquakes in San Francisco, U.S.A., in 1906 and Kobe, Japan, in 1995 caused numerous fires throughout the cities that could not be extinguished because the water systems were damaged. Although both cities are on the coast, the collapse of road networks prevented fire fighters from reaching the sea to fill their tankers.

These two earthquakes show that fires caused by earthquakes can cause greater damage and loss than the earthquake alone.

## The aim of political benefit and social stability

Water is an economic good and most activities need water. In the case of a natural disaster the interruption or damage to services for an extended period limit the recovery of normal development activities for the population. For example, school attendance, especially among girls, is limited due to the lack of adequate water and sanitation. Reestablishing the operation of water and sanitation services goes a long way toward restoring activities in a community impacted by a natural disaster.

The higher costs associated with using alternative means of supplying water mean greater expense for businesses, and can reduce and even halt production. This in turn can aggravate social problems such as unemployment, poverty, migration to other areas, etc.

The suspension of these services places an additional burden on the political authorities charged with managing the disaster. They are forced to divert limited resources to make up for shortages caused by damage to the systems.

The longer the time needed to restore services, the more activities are affected and resulting social problems will intensify and become more difficult to resolve. To the degree that services continue to be interrupted or are not restored to their pre-disaster conditions, the process of economic, commercial, and social recovery of the affected population will be protracted.

## A concrete and basic step toward sustainability of services

Sustainable water and sanitation systems implies that they are capable of providing services throughout their serviceable life which results in improved health conditions and quality of life. However, especially in the most vulnerable areas, the occurrence of one or more phenomena during the life of these systems threatens such sustainability. In this regard, risk management is a contribution to sustainable water supply and sanitation systems.

In populations settled in peri-urban and rural areas, the delivery of services has a social character and in many cases the services are managed by the com-

munity itself. Especially in peri-urban areas, vulnerability is high, which results in greater frequency of disasters (many of which are recurrent and to a certain extent identifiable and predictable) affecting not only the continuity of services but the lives and well-being of the population.

Experience from previous disasters indicates that damage to water and sanitation systems may exceed the technical capacity and the financial resources of the service providers. There is the risk (especially where systems are administered by the community) that these systems will be abandoned, that there will be a significant reduction in the quality of services, or that they will be repaired with temporary measures that are inadequate for permanent facilities, increasing their vulnerability to phenomena of similar or lesser magnitude.

Identifying hazards and applying measures to reduce vulnerability in water and sanitation systems are tools that protect the investment made in installing infrastructure and the financial viability of service providers following a disaster.

It is critical for risk management to be adapted to the environment where projects are carried out. The work should be done with a multi-disciplinary approach and coordinated with other sectors to identify hazards in the services. In cities where the systems cover large areas and are the responsibility

## El Niño (1997–1998) and its Impact on the Water and Sanitation Infrastructure in Peru

Recurrent phenomena such as El Niño in certain areas of Peru give rise to discouraging figures, as in the case of the impact on the water and sanitation systems during 1997–1998. According to information gathered by the Peruvian Ministry of Health and PAHO/WHO, rural areas reported the collapse of 199 water supply systems that served a population of 156,000.

EPS - GRAU - Perú

The deterioration of health conditions, aggravated by shortages or worsening of the water and sanitation services were made evident by a 3.2% increase in cases of acute gastrointestinal illnesses in the first months of El Niño.

As a result of damage to sewage systems and latrines in the area affected by El Niño, the Ministry of Health reported the installation of 3,532 latrines to serve a population of 17,600.

of provider companies, specific studies that identify the most vulnerable areas and the major hazards should be carried out. In the rural and peri-urban environments where systems are smaller and resources limited, the involvement of the community is essential, especially in identifying hazards in a particular area.

In rural areas where information is limited, the community's knowledge about its own environment is an important source of information about hazards. It is both feasible and desirable to make use of this knowledge in phases of the project, thereby fostering the active participation of the community by involving it in the conception and decision-making about a project, and promoting the community's control of the project and or/system.

Water and sanitation projects become a platform for the identification of hazards and risks in a community's environment and allow risk management to develop in an integral way. Community participation is central to this process.

The use of appropriate materials and technology for the existing risk and a dynamic process for updating design standards are indispensable for effective vulnerability reduction in the systems. To this end, it is necessary to have participation of actors who can contribute to the ongoing development of technologies and adaptation of design criteria, taking into account that vulnerability reduction is an important factor in achieving sustainable water and sanitation systems.

# 3 Reliance on Safe Water and Sanitation Systems for Vulnerable Populations: A Feasible Challenge

Each year the impact of natural disasters increases and associated losses mount. The water and sanitation infrastructure is exposed to increasing levels of risk and with each new disaster more systems are damaged and the losses are more serious. Despite these setbacks, the sector must continue to expand and to provide access to populations that do not yet have water and sanitation service.

The underserved populations are located in marginal urban and rural areas. Often, these locations have the greatest exposure to natural hazards and the systems constructed in these areas are the most vulnerable.

Given that it is difficult to relocate populations from high-risk areas, the systems providing services should incorporate standards that are adequate for existing conditions and hazards. This is of major importance to ensure that investments lead to expected improvements in the health conditions and quality of life of populations that experience the greatest inequities in access to basic services and health. Greater efforts in this area must be made if Millennium Development Goals are to be fulfilled.

Risk management should be oriented not only to protect the water and sanitation infrastructure; it is also necessary to minimize the possible risks to the populations that are meant to benefit that result from poor planning and operation of the systems.

## Minimum standards for levels of operation

It may be impossible or too costly to ensure that water and sanitation systems remain totally unharmed following a natural disaster. The objective of risk management is not to have systems that are infallible in any disaster situation, but continue to provide a minimum level of service.

For populations in emergency situations that do not customarily have water and sanitation systems, humanitarian assistance agencies have defined minimum standards for the provision of water and sanitation. These standards address the quality and quantity of services needed to maintain basic conditions for health and hygiene.

## Basic Indicators for Water during Emergencies and Disasters

### Access to water and available amounts

- Average amount of water for drinking, cooking, and personal and domestic hygiene: 15 liters per person daily.
- Supply of water in health centers: 40-60 liters per patient per day.
- Maximum allowable distance between houses and water collection point: 500 meters.
- Water collection points should be maintained so that adequate amounts of water are consistently available.

UNICEF - El Salvador

### Water quality

- New sources of water that must be used because of an emergency situation should contain no more than 10 fecal coliforms per 100 ml.
- Concentrations of residual chloride in piped water should be 0.2-0.4 milligrams per liter, and turbidity should be less than 5 NTU.
- Total solids dissolved in water should not exceed 1,000 milligrams per liter.

Source: The Sphere Humanitarian Charter and Minimum Standards in Disaster Response. Standard 1 on water supply: access to water and available quantities.

Companies that provide services have everything necessary to ensure more than the most basic services, which should be manifest at the time of the emergency. However, providers still do not have operational commitments to the users and local authorities.

The establishment of minimal levels in the provision of services should be done in collaboration with providing companies and the community represented by local authorities. To this end, sectoral authorities and agencies must establish a regulatory framework that allows the space, the need, and the conditions for the work to be carried out.

Once the levels are defined, works for vulnerability reduction should be oriented toward reducing the impact so that these levels can be reached in any scenario of identified risk.

The levels of operation of the services—defined by the service providers and the local authorities—should ensure that during emergencies health facilities and shelters have guaranteed provision of services, which are indispensable for primary health care. In addition, priority should be given to those institutions that form the basis of community development, such as schools.

## Improving sustainability of existing services—an integral approach to risk reduction

Vulnerability and risk reduction in existing water and sanitation systems is feasible. In some cases this comes from identification of the risks and knowledge based on lessons learned by the operators in prior events, but it is preferable not to wait for a disaster to take corrective measures. Studies should be promoted that allow identification of hazards without waiting for them to occur, and then service providers can carry out the necessary measures to minimize damage and assure continuity of the services.

Water companies should work in collaboration with local authorities, universities, technical cooperation centers, professional associations, and others to identify and characterize the hazards existing in the area, as well as to identify the weaknesses in infrastructure (physical vulnerability of the compo-

nents), financial capacity (taking into account suspension of payments because of interrupted service, expenses for repair of the systems, increases in production and distribution costs), and operational capacity (technical resources and trained personnel) of the systems and services.

## The Feasibility of Protecting Water Systems in Developing Countries: Retrofitting the Orosi Aqueduct, Costa Rica

The Institute of Aqueducts and Sewage in Costa Rica reduced the vulnerability of one of the country's major water supply systems, the Orosi Aqueduct, which serves nearly 40% of the population of San José, the country's capital.

The project was undertaken on the basis of risk studies and uses mitigation measures to reduce vulnerability and protect the system. Over a 10-year period, nearly 1.5 million dollars were invested in the project (an amount equivalent to 2.3% of the total cost of the system). It is expected that the reinforcement will prevent losses of some 7.3 million dollars (five times the cost of the project) from direct damage resulting from the effects caused by natural disasters. Added to this are the prevention of indirect damages, such as:

- Loss of human life and property in the community of Orosi;
- Serious losses in national production;
- Damage to the institutional image;
- Possible fines or judgments against the institution and its authorities.

As part of risk reduction, reinforcement of infrastructure and protection of the environment where the systems are constructed are necessary to ensure that systems will continue to operate in case of disaster. When this is not possible, service providers should have response plans that are compatible with the local and municipal emergency plans. The objective of these plans is to provide basic levels of water and sanitation to the community and to the key installations for emergency response such as hospitals, health centers, schools, and shelters.

## Risk Management in Colombia

In 1999, the Empresas Públicas de Medellín (EEPPM—Public Enterprises of Medellín) established as part of its organizational structure the Office of Risk Management within its Strategic Water Unit for aqueducts and sewers, which answers directly to the managers of the company.

Among the activities carried out by the Office of Risk Management, the following should be noted:

- Risk identification and analysis;
- Application and dissemination of risk management methods;
- Design, documentation, and implementation of risk reduction projects;
- Development and execution of emergency and contingency plans.

When it is not possible to reduce the vulnerability of the water and sanitation infrastructure it is possible to transfer the risk by insuring the installations, thereby defraying the expenses of system repair. Collaboration with other service providers for emergency response is another important contribution.

## Conceiving new, safer services

Including protective measures in the construction of new water and sanitation systems, which ensure sustainability in the presence of environmental risks, must not be limited for economic reasons. In complying with the Millennium Development Goals (MDG), increased access to water and sanitation services is fundamental—not only for the specific water and sanitation target, but to support the entire MDG. This has made increased funding available for inclusion of protective measures, which is justified because of the contribution of these measures toward sustaining the systems.

## Tsunami in India, 2004—Providing Services during Reconstruction

Three months after the tsunami that devastated coastal areas of India in December 2004, most initiatives focused on relocation of the affected populations. In some cases, people moved to new settlements, whether out of fear of another tsunami or because of government plans to reduce vulnerability. In those cases, water supply was centralized, usually through municipal treatment and distribution systems, or the people relied on private or communal sources of water. In other cases people returned to their places of origin and rebuilt their homes.

In both scenarios initial governmental plans for restoring systems included major expenditures for improvement of the water and sanitation systems, particularly in the most densely populated areas. This unprecedented investment creates the opportunity to carry out appropriate and sustainable improvements that reflect the best practices and integrate engineering and public health expertise. However, there is also the chance that these funds will be diverted to other projects based on other political or commercial priorities.

Source: World Health Organization, 2005

Advances made half-way through the term set for the MDG shows that more attention needs to be given to peri-urban and rural zones where the technical and economic capacity of the population is more limited than in urban areas.

These people have knowledge that has been forged over the years through their relationship with their own environment and which must be taken into account and put to use when improving water and sanitation services. Local risk management should involve the community and gather its knowledge about existing natural hazards, the places with highest risk, and the extent to which the hazards have affected the community in the past. This knowledge should be combined with available technological options so that components of the system can be located in areas with less risk, or can include preventive measures when necessary.

Both technical personnel and the technology should respond to the challenges that these risk scenarios pose, thereby serving populations that settle in increasingly hazardous areas and where conventional technological options are not always applicable.

The best time to reduce the vulnerability of systems is during the planning and execution of reconstruction and rehabilitation projects when they have been damaged. The damages reveal the vulnerability of each of the components. (In normal situations this must be determined through vulnerability studies carried out by experts, which can be costly.) The resources that can be mobilized for reconstruction should include those needed for preventive measures.

# 4 Risk Reduction: A Sectoral Responsibility

During the past several years, while national and local initiatives have been developing disaster prevention, preparedness, and response programs, in most countries institutions from the water and sanitation sector and service providers have been largely absent. In some cases private operators have not been included in government initiatives; in others there has been the mistaken belief by some providers that in emergencies institutions such as the Red Cross, the military, or humanitarian assistance agencies should provide basic services to the affected population.

The reform processes in the water and sanitation sector (decentralization to local municipalities, concessions, and privatization) have not incorporated mechanisms into concession contracts or in the regulations that make the service providers responsible for provision of services during emergencies. In fact, providers have been exempted from this responsibility. In light of this, the providers do not have incentives to reduce risk or to carry out preparedness measures to ensure that basic levels of service will be available during emergencies.

It is easier and more economical to incorporate protective measures against the impact of disasters during the installation of new systems than to install them in existing systems. Service is not interrupted during the execution of new works, and there are technical and logistical limitations to accessing underground components or in areas that are difficult to reach. However, this does not mean that protection of existing systems is not desirable and feasible; on the contrary, this work is important, particularly in those areas where there are latent and recurrent natural hazards.

The new settings in which water and sanitation systems are built have increased their vulnerability. Following are some of the reasons why risk management and vulnerability reduction in water and sanitation systems have become more urgent:

- There are more populations that, because of migration to cities and the limited land available in major cities, are forced to build houses in very high-risk areas on the periphery of the urban zones (urban fringe settlements). The water and sanitation systems installed to provide service to these populations are exposed to the same high level of risk.
- The systems need to be bigger, either because the safe water sources are increasingly limited and distant, or because the growth of cities makes it necessary for the systems to be built over great distances in the push to take services to the entire population.
- Increased environmental degradation has brought with it an increase in vulnerability not only for water and sanitation systems, but for the physical environment in general. Both at the local level (where deforestation of slopes increases the frequency of landslides) and at the global level (where climate change causes more frequent and more severe floods, hurricanes, and drought), environmental degradation increases the vulnerability of water and sanitation systems exposed to an ever-increasing number of hazards.

## Regulation of services

In most countries, the regulatory and normative frameworks that govern the water and sanitation sector consider the occurrence of natural disasters as "Acts of God" or force majeure, which exempt the public, private, or public/private providers from the responsibility of providing services during an emergency.

Regulatory agencies and sectoral authorities have a direct and urgent responsibility to change these practices. They should be explicit about the responsibilities at the moment of the emergency, the actions that should be taken so

that a population is not left without services after a disaster, and the minimal conditions that should be provided in emergencies, that is, quantity, quality, and continuity of service. All of these actions should be established in a coordinated manner with local authorities.

Currently, technical and scientific tools can identify hazards and to what degree they can affect a specific system over its serviceable life or during the concession for its operation. Using this information, decentralization and concession contracts should include guidelines on the protection of the systems so that populations are not left without services during an emergency.

The importance of these services in emergency situations demands that mechanisms go beyond fines and penalties for noncompliance by service providers. On the contrary, mechanisms should create incentives for the service providers and operators and include the necessary measures to ensure provision of services, thereby reducing and transferring the risks and ensuring the sustainability of the systems and repair of the services after a disaster.

The transfer of risk by subscribing to insurance, although it does not reduce the physical vulnerability of the systems nor ensure the continuity of service, is a tool that can be relied on for the resources needed to repair damage and

ensure the financial viability of the service provider. It is necessary for insurance companies to have systems for prompt damage assessment and policy payment. The use of insurance should promote and create incentives to incorporate prevention and mitigation measures in the systems covered. Insurance premiums might be reduced in the case of systems that prove to be less vulnerable.

Each disaster shows new vulnerabilities in a system, and the design standards used by the sector in the construction of the water and sanitation systems must be updated on the basis of the lessons learned by operators in these situations. Cooperation among different operators should be facilitated and encouraged; operators can support each other during emergencies and exchange experiences.

## The Nicaraguan Institute for Aqueducts and Sewerage Develops Instruments for Risk Reduction

The Nicaraguan Institute for Aqueducts and Sewerage (Instituto Nicaragüense de Acueductos y Alcantarillados—INAA) is the regulatory agency for water and sanitation services in Nicaragua. Following the impact of Hurricane Mitch and the evidence of the fragility of these services, and following 28 vulnerability assessments of the country's water systems, INAA has worked to develop tools to allow operators to reduce the vulnerability of the infrastructure and to be better prepared to respond to emergency situations.

In the past few years, INAA has developed tools for risk management and specifically for vulnerability reduction to be considered in the development of water and sanitation systems in Nicaragua. These include the following:

- Guides for the development of studies on environmental impact of projects for drinking water supply and sewerage.
- Guidelines on general terms for the development of vulnerability analysis and emergency plans for drinking water supply and sewerage.
- Technical guidelines for vulnerability reduction in drinking water supply systems and sewerage.

## Service providers

The delivery of water and sanitation services in a given community or population center has an eminently local character. The providers of the services are actors in the normal development of a community's activities. The administration and operation of these services on the part of local government entities (municipalities), private companies, and community organizations (administrative boards in rural areas) means that local response by these same actors, in coordination with municipal government, is fundamental in the first stages of an emergency.

After a disaster, the operators should compile their experiences from the emergency response and rehabilitation and reconstruction phases so that they form part of the institutional knowledge and can be shared and replicated by other operators in a process of information exchange. Within this process, the sector authorities and the scientific and academic institutions are essential in providing the technical and scientific support that give validity to and extend the successful practices that have been compiled, as well as broader distribution of the knowledge that is generated with every disaster.

In view of the responsibility of providing the best possible services to critical facilities during the emergency phase, it is essential for the service providers to know the location and specific needs of facilities such as hospitals and shelters (or facilities that function as shelters). In this way service providers can give priority to serving these facilities and adapt the systems to the extent possible for this purpose.

The work carried out by operators should contribute to local governments in terms of land management (restricting habitation of high-risk areas), environmental protection, and risk reduction. There should be coordination of plans that exist in each of these areas to avoid overlapping and duplicating efforts, or even worse, hindering other projects or causing some type of vulnerability.

## Risk Analysis: A New Contribution to Master Plans for Water Supply in Urban Areas

For years, master plans for water supply in major cities have been executed on the basis of studies on service demand, the master plans for urban development, urban planning, or zoning regulations.

In 2003, the Urban Community of Marseilles (France) decided to carry out a study on the safety of their water supply system, which addresses the safety of goods, persons, and the environment, as well as quality of and continuity of water supply.

This study entails the inventory of hazards and identification and classification of risk according to a predetermined classification. Within the scope of the study different steps of the water supply process were examined, from the source to the installations for users, which included the following:

- Source of supply: Marseilles Canal and wells
- Production: treatment plants for drinking water
- Storage units
- Distribution networks

The cost to carry out this first master plan for drinking water supply is 350 million euros. The project is being conducted by the Urban Community of Marseilles in association with the Water Supply Company of Marseilles, and will take 20 years to complete.

# Conclusion

# Relying On Water and Sanitation Services during Disasters: A Political, Social, and Economic Concern

## Water and Sanitation for Everyone and At All Times

Risk reduction is an indicator of the sustainability of services. The work that is carried out to reduce vulnerability and to strengthen the system will be expressed in its capacity to remain and to *survive* in the event of disaster, as well as to be repaired with vulnerability indices that are the same or lower than those before the disaster.

In the water and sanitation sector, the focus of service provision has changed from construction of systems to installation of *sustainable services*. The work to secure the systems in the event of natural disasters is a direct contribution to technical, economic, and environmental aspects of this sustainability.

*Technical sustainability* benefits to the extent that the works carried out on physical infrastructure limit future problems in the operation of the system as a consequence of a natural disaster through appropriate technologies and correct location of the components, among others. In addition, risk management projects are a means of entry for work with the community and for strengthening local capacities.

*Economic and financial sustainability* should not be affected by a natural disaster. Risk management should anticipate that in case vulnerability is not eliminated, the system must rely on a mechanism (such as payment for services in an urban area, the supply of replacement parts, and enough technical and economic capacity in the peri-urban and rural area) that will make it possible to have enough resources for recovery of the system.

*Environmental sustainability of the system,* or the harmony of the installed systems with existing environmental conditions, including natural hazards, requires that the systems operate without generating greater hazards or altering environmental conditions. This is of particular concern with systems for sanitation, sewerage, or treatment of wastewater.

Even when projects for vulnerability reduction and secure systems are carried out, an event of exceptional magnitude can damage components and affect the service. Agreements should be made with local authorities regarding the minimal levels of service delivered in emergencies, and include legal obligations in the contracts for providing services. Critical facilities such as hospitals, schools, and shelters should be identified as having priority for service even under the most unfavorable conditions.

In any case, the minimum conditions established should provide a service that satisfies local needs for consumption, hygiene, and well-being.

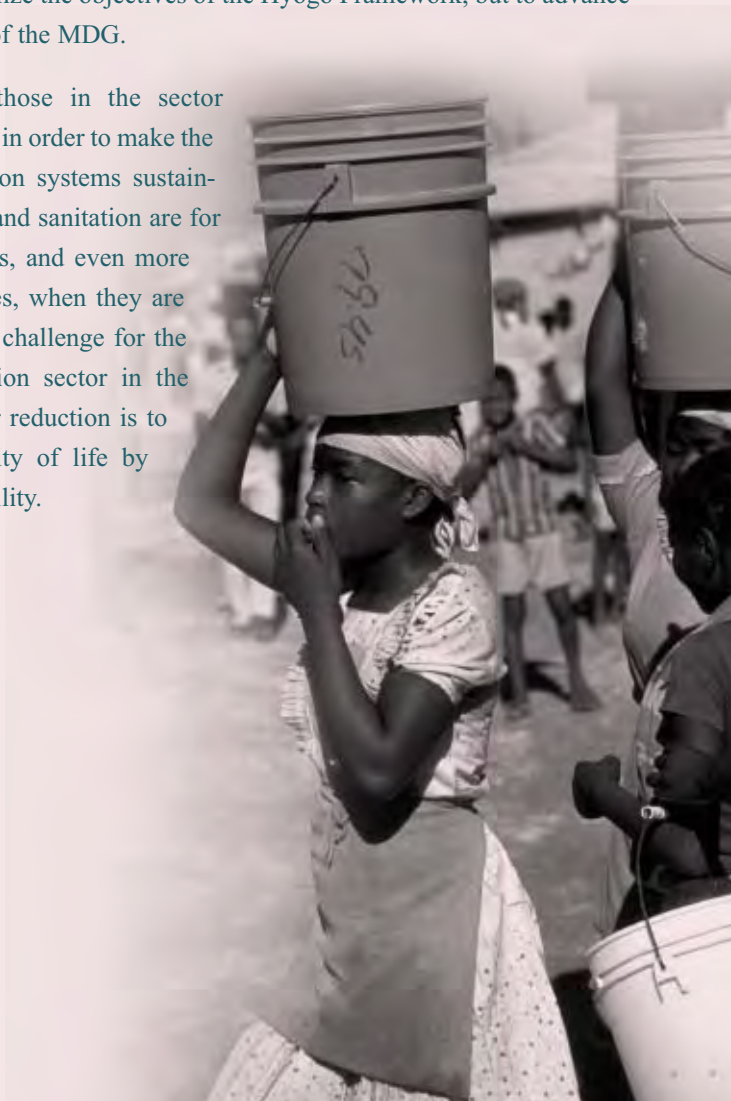
The sector's authorities must realize that it is necessary to r*enew and to update the standards and design criteria* based on the experiences gathered from each new disaster. In association with academic and scientific actors the sector authorities should systematize these experiences and establish new codes, or update the current ones for the installation of water and sanitation services. The revised standards should be circulated among professional networks and associations and to businesses at the local, national, and regional levels. By sharing the lessons learned it makes it possible to publicize the need to secure the systems and the responsibilities of the various actors in the sector, and to demonstrate that it is possible to have sustainable water and sanitation services in the event of natural disasters.

The work of risk management by the water and sanitation sector should involve all of the actors, from the authorities and regulators to the local governments and the community at large. It should also form part of the multisectoral work of risk reduction in communities. The contribution expected from the sector at the time of the emergency and in reducing vulnerability for the population in general, requires that the sector participate in stages of risk reduction that should be considered as part of the lifelines for development

and the resilience of the communities. It must recognize that its contribution is vital to the health and well-being of the community and the need to achieve sustainable services.

In this regard, the active promotion of multi-sectoral national platforms for risk reduction, one of the priority commitments by countries for implementation of the Hyogo Framework for Action 2005-2015, provides an important opportunity for involvement of the water and sanitation sector in risk reduction policies. Similarly, relying on the commitment of the water and sanitation sector in the area of risk management and vulnerability reduction provide the opportunity for the risk reduction community to focus its efforts on a key sector, not only to realize the objectives of the Hyogo Framework, but to advance in the challenges of the MDG.

A concern that those in the sector should learn about in order to make the water and sanitation systems sustainable is that water and sanitation are for all and at all times, and even more during emergencies, when they are most needed. The challenge for the water and sanitation sector in the context of disaster reduction is to improve the quality of life by reducing vulnerability.



The resilience of water and sanitation systems in the aftermath of natural disasters is an important step to ensure the long-term consolidation of the achievements in providing access to these services. Additionally, it will allow countries to meet, by the year 2015, the goal of reducing by half the proportion of people without sustainable access to drinking water and basic sanitation.

Risk management is an important tool for the fulfillment of global challenges to provide water and sanitation services to all at all times.

This publication can be consulted on the Internet at:

www.paho.org/disasters

Pan American Health Organization

ISDR

unicef

International Federation of Red Cross and Red Crescent Societies