

Emergencies and Disasters in
Drinking Water Supply and Sewerage Systems:
Guidelines for Effective Response



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P r e f a c e

This book is a joint production of the Pan American Health Organization (PAHO/WHO) and the Inter-American Association of Sanitary and Environmental Engineering (AIDIS). It is based on the technical handbook *Planificación para atender situaciones de emergencia en sistemas de agua potable y alcantarillado*, written in 1993 by Jorge Escalante-Gafau for the Pan American Sanitary Engineering and Environmental Sciences Center (CEPIS).

The book is the result of common concerns on the part of AIDIS and PAHO/WHO after the disasters that have affected Latin America and the Caribbean in recent years, such as hurricanes Georges (the Caribbean, 1998) and Mitch (Central America, 1998), the Armenia earthquake in Colombia in 1999, the landslides in Venezuela (1999), and most recently the El Salvador earthquakes of 2001. These events showed that, while there were plans for disaster response in the water supply and sewerage sector, they had not been guided by the specific vulnerabilities of water supply and sewerage systems. The result was commonly a delay of several weeks in restoring these services, even months in the case of some of the affected cities.

Managers, administrators, planners, designers, and the operations and maintenance staff of the water supply and sewerage sector should find this guidebook helpful in trying to expedite their response to emergency situations and in developing emergency and disaster preparedness plans that take into account existing hazards and vulnerabilities.

As such, the current book complements *Natural Disaster Mitigation in Drinking Water and Sewerage Systems: Guidelines for Vulnerability Analysis*, published by PAHO/WHO in 1998, which provides the basic tools for helping drinking water and sewerage services to engage in disaster mitigation planning by using an integrated approach.

Finally, this publication tries to highlight the principle that the adoption of disaster preparedness procedures in water supply and sewerage systems should strive, above all, to plan an effective response in order to guarantee the quality and continuity of these services, thereby protecting and preserving the health of the affected population.



I n t r o d u c t i o n

Drinking water and sewerage systems are exposed to both natural and man-made hazards that are common in Latin America and the Caribbean. Earthquakes, hurricanes, floods, landslides, drought, volcanic eruptions, vandalism, and accidents involving hazardous materials are part of the wide variety of events that cause death, injury, and significant economic losses for the countries affected. Table 1 summarizes the impact of disasters between 1972 and 1999.¹ The impact of these disasters on the water supply and sewerage systems has been considerable.

Table 1. Damage caused by disasters in Latin America and the Caribbean, 1972-1999

Years	Affected population		Economic losses (millions of US\$, in 1998 dollars)
	Deaths	Evacuees and other affected individuals	
1972-1979	38,042	4,229,260	8,523.0
1980-1989	33,638	5,442,500	17,821.0
1990-1999	36,320	2,414,485	23,755.0
Total	108,000	12,086,245	50,099.0

In the Dominican Republic, for instance, the passing of Hurricane Georges in September 1998 affected 214 water supply systems out of a total of 352, or 61%, causing direct and indirect damages worth US\$16.4 million.² As for Hurricane Mitch (October 1998), which hit several countries in Central America, its adverse effects can be seen in Table 2.

Everyone knows how vital water supply and sewerage systems are for the health and development of any community. This makes it a priority for such services to operate optimally at all times, since a significant degradation of their quality can affect most of the population. The main objective of water supply and sewerage companies, therefore, must be to maintain systems that qualitatively and quantitatively meet the needs of the population so that interruptions in the supply of drinking water and/or the collection, treatment, and disposal of waste water are as brief as possible.

¹ Ricardo Zapata, *El impacto económico de los desastres* (conference paper), Economic Commission for Latin America and the Caribbean, Dominican Republic, September 1999.

² Pan American Health Organization, *Hurricanes Georges y Mitch, Crónicas de desastres*, No. 7 (Washington, D.C.: PAHO), 1999.

Given the negative effects that different phenomena may have on water supply and sewerage systems—such as the rupture of mains and distribution pipes, the contamination of springs or damage to treatment facilities—mitigation and prevention are very important. Moreover, it has been proven that it is always less expensive to invest in prevention than to pay for rehabilitation after a disaster. A case study of the 22 April 1991 earthquake in Limón, Costa Rica, concludes that response and rehabilitation costs were US\$9 million, whereas the timely application of mitigation measures before the disaster would only have cost US\$5 million—all this without considering the economic value of preventing the unnecessary exposure of the population to health hazards.³

Table 2. Summary of damages to drinking water and sewerage systems caused by Hurricane Mitch (October 1998) in Central America

Country	Damage to water supply and sewerage systems ⁴	Damages (millions of US\$) ⁵
Honduras	>90% of the population were without access to water services in early November; 40% were without access by late November	58
Nicaragua	32% of water service infrastructure damaged	19.8
Guatemala	396 communities with damaged systems; 20,000 latrines destroyed	16.1
El Salvador	32% of water service infrastructure damaged	2.4

While acknowledging that it is impossible to achieve 100% disaster-safe systems, it is imperative for both public and private firms in the sector to be capable of resolving, in the best fashion and the shortest time possible, the problems that may arise during and after the impact of some of the hazards mentioned above. Experiences with emergencies and disasters in the last decade of the twentieth century prove conclusively the need to prepare for such contingencies.

³ Pan American Sanitary Engineering and Environmental Sciences Center (CEPIS), *Estudio de Caso: Terremoto del 22 de abril de 1991 Limón, Costa Rica* (Lima: PAHO), OPS/CEPIS/PUB/96.23, 1996.

⁴ Pan American Health Organization, *Hurricanes Georges y Mitch, Crónicas de desastres, No. 7* (Washington, D.C.: PAHO), 1999.

⁵ Direct and indirect damages, except in the case of Nicaragua, where only direct damages were recorded.

Water supply and sewerage agencies and institutions have been undergoing a process of transformation and modernization. These changes provide opportunities to incorporate issues related to emergencies and disasters in their management plans.

Similarly, advances in information management, thanks to the availability of technological resources such as geographic information systems (GIS), must be incorporated into emergency and disaster management in order to have the best possible information available for effective decision-making.

Proper planning and appropriate organizational development that facilitate a speedy response to an emergency must be one of the priorities of any water supply and sewerage agency or company, whether private, public (national, municipal) or mixed. This calls for the total commitment, involvement and support of the key decision-makers in the sector, so that the necessary material, human and logistical resources can be made available to ensure an appropriate response.

The urgent need for disaster reduction planning by water supply and sewerage systems administrators has been stressed repeatedly in recent years. This manual for designing emergency and disaster plans strives to meet this need without disregarding key issues such as vulnerability analysis and prevention and mitigation programs, which must be in place before emergency and disaster plans can be implemented in such systems.

This manual can be used to improve the organizational structure of the agency or company and to guide its response to any emergency. However, it is important to make sure that such efforts will have a long-lasting effect and, even more importantly, that they will be reinforced with the knowledge and involvement of a significant number of the agency's or company's technicians and professionals.