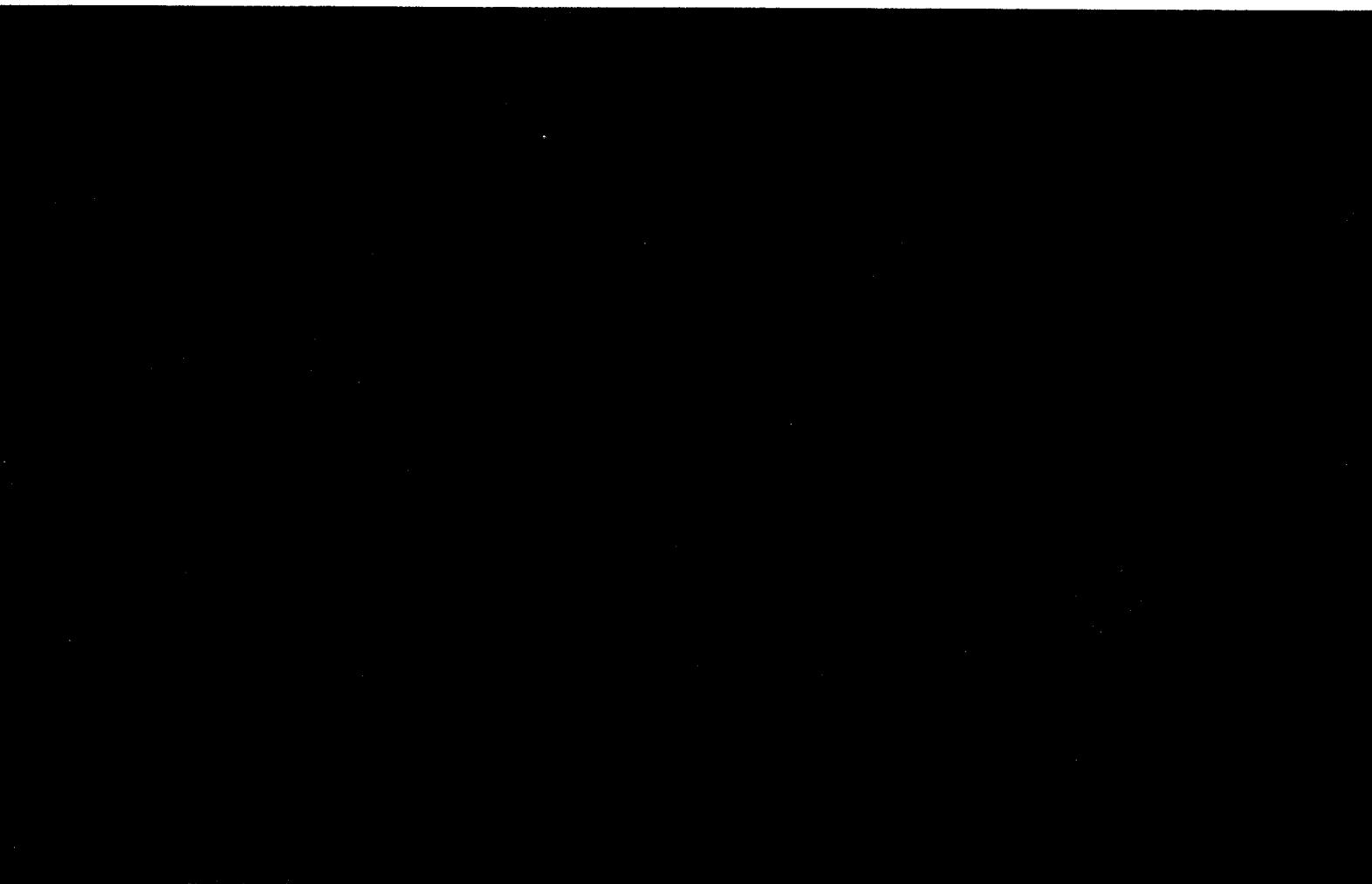




PAN AMERICAN HEALTH ORGANIZATION
WORLD HEALTH ORGANIZATION
- ENVIRONMENTAL HEALTH PROGRAM -



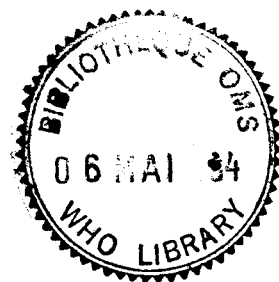
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WASHINGTON D.C. 1991

**ACTION OF THE PAN AMERICAN HEALTH ORGANIZATION
IN THE INTERNATIONAL DRINKING WATER SUPPLY
AND SANITATION DECADE 1981-1990**

ENVIRONMENTAL HEALTH PROGRAM REPORT (HPE)



FOREWORD

The International Drinking Water Supply and Sanitation Decade (IDWSSD) was proclaimed on 1 November 1980 by the General Assembly of the United Nations; it was developed with the active participation of the Governments and external technical and financial support agencies. This was a universal movement aimed at improving and promoting extension of the coverage of drinking water and sanitation services to the greatest possible number of people, especially to population groups that live in the marginal sections of the cities and in the rural areas.

For the Region of the Americas, the IDWSSD constituted a third great ten-year effort which followed those realized in the 1960s and 1970s when the Governments established goals for coverage by services, in 1961 in Punta del Este, Uruguay, and in 1972 at the Special Meeting of Ministers of Health of the Americas in Santiago, Chile. In the IDWSSD the Governments committed themselves to effect substantial improvements in the provision of drinking water services and disposal of waste water and excreta, and although the majority of the countries could not achieve 100% of the goals initially fixed, they did make very significant progress which merits special recognition, since in this period almost all the countries of the Region were faced with a very acute economic crisis which interfered with the fulfillment of their programs for the Decade.

The Pan American Health Organization (PAHO), continuing with the cooperation that it has traditionally provided to the countries in the promotion and support of the development of drinking water and sanitary services and for the purpose of making its actions more effective for the achievement of the objectives of this Decade, identified past obstacles and defined a new approach and strategies for action, and then strove to strengthen the national capacities, generate dynamic self-sustaining programs, stimulate horizontal cooperation among the countries of the Region, and promote external financing of national activities for the Decade. The Environmental Health Program (HPE) in Washington, together with its Pan American Centers for Sanitary Engineering and Environmental Sciences (CEPIS) and for Human Ecology and Health (ECO), was responsible for the development of regional actions aimed at facilitating the cooperation of PAHO at the national level, which was delivered through its Country Representations.

This document contains a summary of the technical cooperation related to the IDWSSD supplied by PAHO to the countries of the Region between 1979 and 1990 and which consisted of a great variety of activities, from the planning and promotion of the programs of the Decade to the evaluation of the progress achieved by the countries. In presenting this report, thanks are expressed for the support supplied by the Country Representations for the development of a large part of the activities mentioned, and, within their staffs, especially by the sanitary engineers, who maintained close contact with the institutions of the sector to ensure the effectiveness of the cooperation with the national programs.

The Environmental Health Program (HPE), in distributing this document wishes to recognize the work of the staffs of the water and sanitation institutions responsible for implementing the national IDWSSD programs in the countries of Latin America and the Caribbean, as well as the work performed by the staffs of the related institutions, universities, and other agencies that also dedicated efforts for the achievement of the results obtained.

At the beginning of the decade that will end with the year 2000, PAHO reiterates and commits its support for the national actions to be completed in this period and addresses itself to all those at the national and international levels that are and/or will be involved in the development of water supply and sanitation services, to request them to redouble their efforts to improve the coverage and quality of these services as a way to contribute to the health, well-being, and development of our countries.

Finally, and in reinforcement of the call expressed in the paragraph above, it is considered important to emphasize that at this moment, when the Region of the Americas is confronting a growing epidemic of cholera, it is especially urgent that the populations have good water supply and sanitary services, since this constitutes one of the measures essential to the successful confrontation of the multiple challenge of controlling the cholera epidemic in the countries in which it has already presented itself, avoiding its explosive propagation to other countries of the Region, and successfully eradicating it from this hemisphere.

Horst Otterstetter
Interim Coordinator
Environmental Health Program

Washington, May 1991

ACRONYMS

AIDIS	Inter-American Association of Sanitary and Environmental Engineering
AyA	Costa Rican Institute of Water Supply and Sewerage
BMZ	Ministry of Economic Cooperation of the Federal Republic of Germany
CAGECE	Water and Sewerage Company of Ceará (Brazil)
CAPRE	Regional Coordinating Committee of Drinking Water and Sanitation Institutions of Central America
CARICOM	Caribbean Community
CEDAT	Center for Development and Technological Applications
CENAGUA	National Center for Water (Colombia)
CEPIS	Pan American Center for Sanitary Engineering and Environmental Sciences
CIDIAT	Inter-American Center for Integral Development of Water and Soil
DIECA	Division of Education and Training of AIDIS
DTIAPA	Project for Technological Development of Drinking Water and Sewerage Institutions
ECLAC	Economic Commission for Latin America and the Caribbean
ECO	Pan American Center for Human Ecology and Health
ERIS	Regional School of Sanitary Engineering
FINNIDA	Finnish International Development Agency
GEMS/WATER	Global Environmental Monitoring System/Water
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
HABITAT	United Nations Conference on Human Settlements, 1976
IAWPRC	International Association on Water Pollution Research and Control
IDB	Inter-American Development Bank
IDRC	International Development Research Centre (Canada)
IDWSSD	International Drinking Water Supply and Sanitation Decade
INAPA	National Institute for Drinking Water and Sewerage
IPEA	Institute of Economic and Social Planning
IRC	International Reference Centre for Community Water Supply (Netherlands)
MOGGOD	Mixed Oxidants Generated On-Site for Disinfection
PAHEF	Pan American Health and Education Foundation
PAHO/WHO	Pan American Health Organization/World Health Organization
PRELAB	Regional Program of Laboratories for Water and Effluents Analysis
REPIDISCA	Pan American Information and Documentation Network on Sanitary Engineering and Environmental Sciences
SENAPA	National Water Supply and Sewerage Service (Peru)
SENASA	National Service of Environmental Sanitation
UNDP	United Nations Development Program
UNI	National University of Engineering
UNICEF	United Nations Children's Fund
UNIVALLE	"Universidad del Valle", Cali, Colombia
USAID	United States Agency for International Development
WB	World Bank
WTP	Water Treatment Plant

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1. INTRODUCTION

The International Drinking Water Supply and Sanitation Decade (IDWSSD) given out of the United Nations Water Conference held in Mar del Plata, Argentina, in 1977. At that meeting, a recommendation adopted by governments worldwide at the United Nations Conference on Human Settlements (HABITAT) in Vancouver, Canada, in 1976 was examined and endorsed. The recommendation urged achievement of the universal provision of potable water and adequate sanitation services by 1990.

The "Decade" Declaration was a response to the recognition that potable water and the sanitary disposal of excreta constitute two of the most fundamental needs of mankind and that their absence has a direct, profound, and constant deleterious effect on the lives of millions of people in the developing countries.

The Decade was proclaimed globally on 10 November 1980 in an Extraordinary Session of the General Assembly of the United Nations.

For the countries of Latin America and the Caribbean, fulfilling Decade goals meant providing 254 million additional persons with potable water and expanding excreta disposal services to cover 390 million more between 1981 and 1990. At 1978 prices this represented an investment of more than US\$50,000 million.

In 1980, to initiate the WHO global monitoring of the Decade, 25 Latin American and Caribbean countries set national goals to be attained by 1990 which, on the average, meant expansion of coverage of water supply to 87% of the urban population and to 62% of the rural population, and in the case of sewage or sanitation, to provide service to 79% of the urban population and 37% of the rural population, which required an approximate investment of US\$30,000 million.

At the beginning of the IDWSSD, 10 agencies of the United Nations formed a Decade Directing Committee to coordinate activities aimed at optimizing their participation and support of national programs. The World Health Organization (WHO) acted as the Secretariat of the Committee and was responsible for monitoring the implementation of the IDWSSD and reporting on its evolution.

In the Americas and the Caribbean, the Pan American Health Organization worked within this framework and in accordance with the mandates expressed in Resolution XXII of the XXVI Meeting of the PAHO Directing Council of (1979).

To support achievement of the IDWSSD goals PAHO and WHO identified the obstacles of the past and defined a new approach and action strategies which were approved by the PAHO Directing Council in 1981. Accordingly, at the Regional level, PAHO devoted special attention to:

- promote and support national programs for the Decade through technical cooperation;

- concentrate technical cooperation in strengthening of national capacity to generate dynamic, self-supporting programs;
- promote technical cooperation among the countries of the Region; and
- foster external financing of national Decade activities.

At the national level, the applied approach took into account that the activities of the Decade should contribute to the implementation of primary health care and considered:

- complementary development of environmental sanitation and water supply;
- priority attention to rural and urban unserved populations;
- development of model programs for self-sufficient and self-sustaining action;
- employment of socially adapted systems within the reach of the population;
- community participation in all the phases of the projects;
- coordination of water supply and of sanitation programs with other sectors; and
- linkage of water supply and sanitation with other health improvements.

Based on the stated approach and strategies, PAHO through its Environmental Health Program dealt especially with:

- promoting and supporting the preparation of plans and national programs, identification and implementation of projects, and strengthening of the capacity of national institutions;
- facilitating the exchange of information, especially concerning appropriate technology, and other means to facilitate the technical coordination and cooperation;
- carrying out the monitoring/evaluation progress as well as the Decade actions; and

- promoting the mobilization of external resources, especially aimed at the preparation and implementation of national plans and programs, strengthening of institutions, and training and improving of human resources.

This coordination and technical cooperation involved many diverse activities, the most important of which are referenced in the following sections.

To give order to this presentation illustrative examples of the work that has been carried out have been grouped under subtitles that are representative of aspects directly or indirectly related to the Decade. Some activities, by their nature, could appear in more than one of the items; we have elected to place them under the area in which they had the greatest impact.

2. *PROMOTION OF THE DECADE*

PAHO played a very active role in the promotion of the objectives and goals of the Decade in the Americas and the Caribbean, giving impetus to the activities needed to fulfill the goals established for the Decade.

Promotion of the Decade was implicit in all of PAHO's activities organized in this area. This was exemplified in the meetings that were held in the countries for the preparation of their national plans of action for the IDWSSD, which included in addition promoting the Decade among institutions and professionals of the countries of the Region. Also, the regional advisory meetings with international cooperation agencies, which were held to seek financing of projects identified in the country plans, were also used to advise these agencies of the IDWSSD objectives and to motivate them to support their fulfillment.

Among PAHO's most significant actions to specifically promote the Decade the following stand out:

2.1 *Regional Symposia Pre-AIDIS Congresses*

Traditionally during the week preceeding the biennial AIDIS Congress, PAHO organized symposia on relevant sanitary and environmental engineering topics. During the IDWSSD, four of the five symposia were devoted to promotion of the Decade goals.

The first symposium associated with the XVIII AIDIS Congress was held in July 1982 in Panama, with the theme "Human Resources for the IDWSSD"; it attracted 150 participants from 29 countries of the Region of the Americas and 17 observers from international organizations.

The second symposium, held in conjunction with the XIX AIDIS Congress in Santiago, Chile, in November 1984, focused on "Water Supply and Disposal of Excreta in Urban-Fringe Areas"; 105 participants from 22 countries of the Region attended the symposium.

The third symposium, held in Guatemala together with the XX Congress in November 1986, focused on the topic "Water Supply and Sanitation: An Element of Primary Health Care." It was attended by 120 participants from the countries of the Region.

The fourth symposium was the "Regional Conference on Water Supply and Sanitation," held from 4-6 September 1990 in San Juan, Puerto Rico, in association with the XXII AIDIS Congress. Its objective was to evaluate Decade achievements and projections for the year 2000. The symposium was attended by 79 participants from 24 countries, as well as 19 observers from international organizations.

2.2 *Participation in the AIDIS Congresses*

In the Congresses that AIDIS organized during the Decade, PAHO made presentations about Decade activities, and the results of the previous symposium. These presentations began in December 1980 with the XVII AIDIS Congress held in La Paz, Bolivia, and continued in all the following Congresses.

2.3 *Publications*

The publications that PAHO produced in support of the activities of the Decade had a significant impact.

Also important was the "Environmental Series," launched in 1981 (this document is the ninth publication). Other publications include the documents that resulted from the symposia mentioned above; guidelines for the preparation of national plans of the IDWSSD; guidelines for the evaluation of Decade activities, as well as the translation, publication and distribution in the Region of numerous documents prepared by WHO, in order to orient the activities of the Decade.

2.4 *Subregional and Country Meetings*

The support that PAHO gave to subregional and country activities produced important positive results in Decade promotion, for example:

- the first meeting of the advisory committees on environmental health for the "Convenio Hipólito Unanue" of the Andean Pact, held in Lima, Peru, in 1980;

- in November of the same year, in Barbados, environmental health professionals of the English-speaking Caribbean countries met with representatives of the Caribbean Development Bank and US/AID, and prepared concrete guidelines for Decade action;
- in January 1981 the Directors of Environmental Sanitation Divisions of the Ministries of Health of Central America and Panama met in San José, Costa Rica and defined strategies to attain the goals of the Decade;
- in 1980 and 1981 meetings were held to obtain political support for the Decade in several countries, among them Argentina, Bolivia, Colombia, Guatemala, Jamaica, Nicaragua, and Peru.

2.5 *Support to Other Institutions*

PAHO collaborated with ECLAC in the planning and conduct of two Seminars for Horizontal Cooperation for the Decade, which had the objective of identifying and defining criteria, mechanism and proposals for technical cooperation among developing countries in their efforts to provide water and sanitation. The seminars were held in Chile (1981) and the Dominican Republic (1982) and were attended by officials at the decision-making level from government agencies and water supply and sanitation institutions.

PAHO also collaborated in the programming and participated in the ECLAC Meeting to mark the culmination of the International Drinking Water Supply and Sanitation Decade held during its Twenty-third Session in Caracas, Venezuela, 3 to 11 March 1990.

3. *PLANNING*

Other early PAHO actions provided the basis for planning and programming of IDWSSD activities. Also, support was given to subregional initiatives and the generation of actions to serve the urban-fringe and rural areas.

3.1 *Specific Activities to Support Planning*

In 1978, by way of preparation for the Decade and under the guidance of PAHO, rapid evaluations were made of the water supply and sanitation situations in Argentina, The Bahamas, Belize, British Virgin Islands, Cayman Islands, Chile, Colombia, Costa Rica, Dominica, Ecuador, Guatemala, Guyana, Haiti, Jamaica, Montserrat, Nicaragua, Panama, Paraguay, Suriname, St. Kitts-Nevis, and Turks and Caicos.

The results obtained made it possible to understand: a) the readiness of the countries to carry out accelerated development of the sector; b) the difficulties that could limit development; c) the actions necessary to prepare national plans for the Decade 1981-1990; and d) the need to secure external funds and international cooperation for the preparation and development of Decade plans.

In 1978 and 1979, within the framework of the PAHO/WHO/World Bank cooperative program, 17 countries prepared sectoral studies which included an analysis of the principal limiting factors, financial ramifications and infrastructure; 26 countries prepared data bases for the Decade, and 11 countries prepared summaries of sectoral information for the use of the external financing agencies.

In 1980, 25 countries defined their national goals for the Decade and 15 countries organized national inter-agency action committees; in addition, technical support committees which included external agencies for cooperation, were established in seven countries.

In 1980 the inter-regional WHO/PAHO/GTZ project was initiated with the objective of cooperating with regional governments in the formulation of their respective national plans for the Decade, which included: the definition of national goals, the identification of programs and priority investment proposals, and the formulation of support programs such as institutional development, human resource development, community participation, operation and maintenance of services, appropriate technology, and information systems. The project initially included Haiti, Bolivia, and Paraguay, and in 1982 Honduras and Peru joined in. PAHO and each of these Governments signed a two-year collaboration agreement, a period during which the plan was prepared and the national process of sector planning was initiated. In order to coordinate the action for the Decade, each Government created an Interagency Planning Committee. In addition to the national plans for those five countries, this project produced a methodology of innovative planning that was also applied in Brazil, El Salvador, and Guatemala, countries that prepared their national plans for the Decade with their own resources.

In order to orient the countries in the formulation of their national plans for the IDWSSD, PAHO prepared a "Guideline for Decade Planning," which was distributed to all the countries of the Region.

3.2 *Subregional Initiatives*

PAHO placed special emphasis on promoting subregional cooperation in water supply and sanitation. Significant achievements were obtained in Central America and Panama, the Andean countries, and the community of countries of the English-speaking Caribbean.

- In Central America and Panama support continued for the meetings of Ministers of Health as a form of providing a framework for the planning of IDWSSD activities.
- An important achievement was the establishment of the Regional Water Committee (CAPRE) formed by the water and sanitation institutions of Central America, Panama and the Dominican Republic. PAHO and the German Agency for Technical Cooperation (GTZ) supported its consolidation and strengthening. During the Decade CAPRE developed information and training activities, and is initiating activities in control of losses in the drinking water systems and in the supply of water treatment chemical. It also made progress in the preparation of research, development, and water source protection projects. The UNDP, GTZ and the agency "FINNIDA" of the Government of Finland jointly supported these activities with PAHO.
- In the Andean countries, PAHO supported ministerial-level meetings and promoted the planning of Decade activities. In 1990 the Ministers agreed to include the topic of environmental health in their plans, confirming their interest with routine actions carried out under the Hipolito Unanue Agreement, with which PAHO had collaborated.
- In the Caribbean countries, PAHO cooperation has been carried out within the framework of the initiative of "Cooperation in Health for the Caribbean," that has as objectives: to identify priority areas and initial actions for a more productive use of resources; to develop specific projects as vehicles for improving health and simultaneously to resolve critical problems in the health sector; to mobilize national resources and direct them towards the most important problems of the groups and sectors most in need; and to improve technical cooperation in health in the Caribbean, promoting cooperation among countries, agencies and institutions.
- The governments of the English-speaking Caribbean entrusted PAHO and the Caribbean Community (CARICOM) with the coordination of the development of this initiative, and numerous activities in the field of water supply and sanitation have already been carried out, some of which will be mentioned under other headings of this document.

3.3 *Peripheral Urban Areas*

The growth in the second half of the present century experienced by the peripheral urban areas, with marginal districts deficient in public services as well as the quality of their dwellings, constitutes an unprecedented phenomenon in the Region.

The Decade, recognizing the social implications of the existing situation for the population living in these areas, assigned priority attention to these population groups. In its desire to collaborate with the governments and with engineers in the Region in attention to this important topic, the Environmental Health Program of PAHO developed multiple activities. The following were directed towards an in-depth analysis of the problem:

- From 19 to 23 October 1981 at the CEPIS facilities a regional workshop was held on water supply to marginal urban areas, with the purpose of analyzing the problem, the factors for its solution, as well as the strategies that could be applied. Twenty-two persons from Argentina, Bolivia, Brazil, Chile, Haiti, Peru, and the Dominican Republic, and two UNICEF representatives attended. Important recommendations were made and were disseminated in the Region through a Periodic Letter of the DTIAPA project.
- From 5 to 9 November 1984, in the week prior to the XIX AIDIS Congress in Santiago, Chile, was held the Regional Symposium on Drinking Water Supply, and Sanitary Disposal of Excreta in Marginal Urban Areas. Taking part were 105 participants from the Region and from nine bilateral and international agencies. Also collaborating in this effort was the International Association on Water Pollution Research and Control (IAWPRC), and support was received from IDB, WB, IRC, USAID, ECLAC, and AIDIS.

An outcome of particular importance of the Symposium was the consensus that to solve for the water supply and sanitation problems in low-income settlements would require a new sociotechnical approach, in which community participation should be understood in the broadest possible sense. It also was recommended that the water and sanitation companies existing in the cities assume the responsibility of providing these services to fringe areas.

- Beginning in 1985 CEPIS, with financing from GTZ, developed studies on the effect of these services on health in several marginal areas of Metropolitan Lima.
- In 1989, in order to assess the progress achieved in the Decade and what was being done to meet the problem, it was agreed to support the development of case studies in a representative sample of countries of the Region. "Case studies" were selected as a research and teaching method, as it was proving difficult to apply formal and traditional solutions in low-income settlements. The studies were carried out in Brazil, Colombia,

Guatemala, Honduras, and Peru; water supply and sanitation in the urban fringe areas were evaluated, special attention being given to the identification of strategies, methodologies, organization and applied technologies, with socioeconomic and cultural aspects being researched as well.

- From 12 to 15 June 1990 a Regional Workshop on Water Supply and Sanitation in Urban-Fringe Areas was held at CEPIS. Meeting on this occasion were the people who had developed the case studies mentioned in the previous item, so that they might present the studies carried out and discuss the solutions applied jointly with professionals from CEPIS and the Environmental Health Program in Washington, D.C.

The workshop was organized to obtain a basis on which to evaluate the water supply and sanitation situation in the marginal areas of Latin America at the end of the IDWSSD, as well as to discuss possible solutions that could be applied in the decade of the 1990s to face the problems that had been identified.

4. MONITORING THE PROGRESS OF THE DECADE

PAHO developed a system of evaluation and regional monitoring of the Decade, following the format adopted by WHO. This system was oriented to serve as a catalyst in strengthening the information management process in the countries, to support the acquisition, analysis and dissemination of information necessary for Governments to improve the management of the Decade programs.

To orient the countries in this process guidelines were developed, published and sent to each country. The monitoring support actions that produced the most significant results were:

- the baseline evaluation of the water supply and sanitation coverage of each of the countries of the Region at the start of the Decade, to serve as a basis for establishing their natural goals and preparing national plans;
- the evaluation of the mid-decade achievements to determine the advances, the constraints, and the general situation of the sub-sector, in order to better orient the activities over the following five years;
- the evaluation of the Decade achievements, to determine the situation of the water and sanitation sector at the end of the Decade and to provide

the elements to define strategies and to plan the necessary actions in the 1990s.

The final evaluation of the Decade followed a process initiated in 1989 with several preparatory events in the majority of the countries of the Region, continued with the giving support to the countries for the preparation of the national evaluations, which were used as basic documents by PAHO to prepare a document on the regional situation of water supply and sanitation and projections for the future, presented and discussed at the Regional Conference conducted by PAHO in September 1990 in San Juan, Puerto in conjunction with the XXII AIDIS Congress.

In addition to the actions oriented toward evaluation of the IDWSSD, both WHO and PAHO have directed efforts to the determination of strategies to be adopted in the 1990s.

A world "Collaborating Council," composed of external support entities, was established to promote a series of events designed to lay the groundwork for a meeting held in September 1990 in New Delhi, India, for determining such strategies. For this purpose, the PAHO Environmental Health Program has promoted two meetings of managers of water and sanitation services. The first of these meetings was held from 20 to 24 May 1989 in Washington, D.C., in which the advances of the Decade and the existing constraints were reviewed and outlines for future action were agreed upon. Participants from Argentina, Brazil, Bolivia, Costa Rica, Colombia, Chile, Guatemala, Mexico, and Peru, and staff members of IDB, WB, ECLAC, GTZ, PAHO, UNICEF, and US/AID took part. A second meeting was held from 1 to 3 November 1989 in St. Kitts-Nevis for the countries of the English-speaking Caribbean.

Also in 1989, in collaboration with the Caribbean Development Bank, PAHO participated in a meeting of directors of institutions of the sector in the Caribbean and in the XVIII Conference of Water Engineers of the Caribbean, which were held out in Trinidad and had as a theme: "Water in the Caribbean Beyond 1990."

5. MOBILIZATION OF RESOURCES

One of PAHO's more important strategies to support the countries in achieving the goals of the IDWSSD was the mobilization of resources. This was promoted through the development of activities directed toward both international cooperation agencies as well as the countries. Among the activities carried out, those noted below stand out.

5.1 *Catalog of International Cooperation*

This catalog was prepared in 1983 and updated in 1985 by the Water Supply and Sanitation Unit of the Environmental Health Division of WHO. It contains information on all the donor agencies, banks, international agencies, volunteer services, and governmental organizations that give assistance to the water supply and sanitation sector.

In 1986, for the purpose of collaborating with the governments of the Region of the Americas in the management of financing for their IDWSSD projects, as well as to improve the process of communication between the international cooperation agencies and the governments, PAHO translated into Spanish, published, and distributed the catalog to the governments of the Region, a task that was carried out by CEPIS.

5.2 *Meetings of Consultation of the IDWSSD*

During the Decade PAHO and WHO sponsored several meetings of consultation and coordination, with the participation of the international and bilateral agencies of technical and financial support interested and involved in the countries of the Region. These meetings stimulated the countries in the updating of their drinking water and sanitation plans and projects and permitted their presentation and/or discussion with the international cooperation agencies, facilitating financing.

Among the meetings held were the following:

- Regional Advisory Meeting of External Support for the Mobilization of Resources for Drinking Water and Sanitation in the Americas, held in Washington, D.C., USA, from 21 to 24 April 1986 and sponsored by IDB, WHO/PAHO and the Ministry of Economic Cooperation of the Federal Republic of Germany (BMZ).
- Advisory Meeting of Peru, held in Lima, Peru, from 30 June to 2 July 1986 under the auspices of the German Agency of Technical Cooperation (GTZ) and PAHO/WHO, with the Peruvian Government being responsible for its realization and follow-up through the National Drinking Water and Sewerage Service (SENAPA).
- Subregional Meeting of Consultation for Central America, Panama, and the Dominican Republic, held in Guatemala City from 28 to 31 October 1986. It had the support of GTZ, PAHO/WHO, the Committee of Water for the Region (CAPRE), and the Governments of the Member Countries of the CAPRE.

- Advisory Meeting of Bolivia, held in La Paz, Bolivia from 29 August to 1 September 1988. GTZ and PAHO/WHO were the principal sponsoring agencies, with the Ministry of Housing and Urban Affairs as organizer.

5.3 *Cooperation with External Support Agencies*

During the IDWSSD, PAHO and WHO played an important role in establishing relationships between the countries and international cooperation agencies.

PAHO and IDB collaborated in the preparation of investment proposals in the basic sanitation sector, that were included in the official programming of IDB. The four stages of the project during the IDWSSD amounted to \$6.3 million, of which IDB contributed \$4.2 million and PAHO, \$2.1 million.

PAHO collaborated in the development of various projects subsequently financed by the World Bank (WB). The following had a significant impact:

- Plan of Studies, Technical Assistance, and Institutional Reorganization of the Subsector of Rural Sanitation of Brazil, funded in the amount of \$47.5 million, was administered by PAHO through an agreement in March 1986 with the Government of Brazil to provide technical cooperation to the Institute of Economic and Social Planning (IPEA) and to the Ministry of Health. PAHO cooperated in the development of national policies and standards of basic rural sanitation; in the development of studies of basic rural sanitation at the national and state levels, which encompassed institutional, economic-financial, and technological aspects, human resources and community participation; in the diagnosis of conditions and formulation of the appropriate programs for basic rural sanitation; and in the preparation of basic rural sanitation projects for approximately 600 communities of the Brazilian northeast.
- Under the PAHO/WB agreement on Information and Training in Low-Cost Technologies for Water Supply and Sanitation, CEPIS adapted, translated into Spanish, published and disseminated a set of 46 audiovisual training modules developed by the World Bank (WB). PAHO also assisted the Brazilian Association of Sanitary Engineering in the production of a Portuguese version of the modules; the use of low-cost technologies was promoted among the decision-making and professional levels of the Region by means of six activities in which the modules were used; and 55 instructors in these technologies were trained through two courses, one at CEPIS for educators of the Region and another at the Regional School of Sanitary Engineering of Guatemala, for its educators. The trained

instructors could be used for the census that the World Bank may organize in the future as part of the International Training Network in Water Supply and Sanitation.

- **Rural Water in Paraguay.** At the beginning of the 1980s the Government of Paraguay, through the National Service of Environmental Sanitation (SENASA) and with the collaboration of PAHO, formulated a program for construction of rural water supply systems, which was financed by the World Bank (WB). The project made important contributions in the extension of coverage, the establishment of local administrative boards, and the institutional development of the SENASA. It was carried out with PAHO collaboration and was completed in 1986.

The technical cooperation between GTZ and PAHO that commenced at the beginning of the Decade and continues to the present deserves mention. Action by both institutions has permitted them to optimize their capacities in the task of collaborating with the countries. The joint action permitted the development of numerous activities, related to the planning of the IDWSSD in the countries; the institutional strengthening and the development of human resources; the improvement of the operation and maintenance of water supply and sanitation systems; the development of research and demonstration pilot projects, and others. As a result of this relationship GTZ is extending its support to the strengthening of CEPIS and ECO themselves in order to increase technical cooperation to the countries. The collaboration of GTZ is detailed in several chapters of this document.

5.4 Support of Water and Sanitation Projects

During the IDWSSD, PAHO carried out projects financed by IDB, WB, GTZ, UNDP, IDRC and other international cooperation entities, with a positive impact in the beneficiary countries.

The following projects are examples of this effort:

- Water Supply and Sewerage in Cochabamba (Bolivia). With a contribution of \$820,000 from IDB, technical assistance was provided in water treatment (simplified plants), sewerage (reduced cost), and wastewater treatment by means of stabilization ponds.
- Master Plan on Water and Sanitation in Bolivia. This was developed for 10 urban areas of Bolivia, with an IDB contribution of \$500,000.

- Water Supply and Sewerage in Tarija (Bolivia). An IDB contribution of \$480,000 financed technical cooperation in sewerage and wastewater treatment by means of stabilization ponds.
- Water Supply for Tijuana (Baja California, Mexico). IDB agreed to finance a program for the improvement of the water supply service of the city of Tijuana.

The technical cooperation component aimed at institutional development of the local company, including a program for control of losses, was given to PAHO. The program was launched in 1987 and is still under development.

- Project for Trujillo, Ica, and Pisco (Peru). This project had as its objective the proposal of economic solutions for the disposal of wastewater in the listed cities. It was financed by GTZ, and PAHO managed the conducting of the respective studies.

In addition, in relation to the interests of the farmers of the nearby areas, the type of most adequate treatment and the program for planting of high-profit agricultural products were determined.

5.5 *Support for the Institutional Development of the Inter-American Association of Sanitary and Environmental Engineering (AIDIS)*

PAHO has collaborated with AIDIS from its foundation. In 1986 an agreement for PAHO/AIDIS technical cooperation was signed in order to reorient PAHO cooperation, from the paternalistic position maintained in the past to one of support directed toward the institutional development of the association and the strengthening of its activities.

The first action taken within this Agreement was the contracting of a specialized consultant to conduct a study of AIDIS and to formulate a plan for its institutional development.

The report was adopted by AIDIS and gave rise to the "AIDIS Plan of Action 2000," which is being implemented. Initial results include the adoption of policies for the financing of the Association and the establishment of a Permanent Secretariat, which was installed in 1989 in Sao Paulo thanks to the support of the Government of that state.

A second cooperative action with AIDIS was the launching of a program for the joint preparation of technical papers. Two papers were produced: "Financing of

the National Water Supply and Sanitation Programs in Latin America and the Caribbean," and "Sanitary Engineering and National Development." These were distributed by AIDIS to the highest executive and legislative spheres of the countries, to provide them with updated elements to review their own policies in the water and sanitation sector. Other volumes are in preparation.

6. *INSTITUTIONAL DEVELOPMENT AND OPTIMIZATION OF THE INSTALLED CAPACITY*

To reach the goals of the IDWSSD was a great challenge for the institutions of the Sector. PAHO, knowing the limited resources available, considered that improvement of the performance and productivity of these institutions would constitute a valuable tool for optimizing existing resources and, therefore, facilitate the fulfillment of the Decade goals. Thus, PAHO devoted much effort to promoting and supporting institutional development of the entities of the Sector, understanding as institutional development a planned process of change through which the institution is adapted so that it is able to achieve its objectives.

6.1 *Institutional Development*

As a way of facilitating institutional development, PAHO urged the adopting of a systemic approach which implies that in order to fulfill its objectives every institution should carry out certain basic functions arranged in groups known as systems, which interact and permit a harmonious development of the institution. In the publication "Modelo de Gerencia de Operación y Mantenimiento de Sistemas de Agua Potable y Saneamiento" (Serie Ambiental No. 4, 1986) this concept is presented. This was disseminated in the countries by normal PAHO cooperation, through project execution and in specific meetings.

During the five first years of the Decade, PAHO provided technical cooperation to eight countries for institutional development programs, at a cost of close to US\$13 million, which came for the most part from extrabudgetary sources. In 1989, twelve countries of the Region were already carrying out projects of institutional strengthening, including the development of human resources.

In the Decade, PAHO provided direct assistance in this field to institutions or companies in Bolivia, Brazil, the Caribbean, Central America, Colombia, Ecuador, Mexico, Paraguay, Peru and the Dominican Republic. In some countries technical cooperation agreements existed and in others the advisory services were specific. Among projects developed or ongoing are the following:

- Administrative and operational strengthening of the National Housing Bank (Brazil).
- Institutional development of the Ecuadorian Institute of Sanitary Works (Ecuador).
- Institutional development of the Municipal Sewerage Utility of Guayaquil (Ecuador).
- National Program of Control of Losses and Efficient Use of Water (Mexico).
- Institutional strengthening of Tijuana (Mexico).
- Development of the census of users of AyA (Costa Rica).
- Institutional development of the INAPA (Dominican Republic).
- Institutional development of CAGECE (Brazil).
- Project of studies, technical assistance and institutional reorganization of the subsector of rural sanitation (Brazil).

6.2 *Program for Control of Losses and Efficient Use of Water*

The concept of "control of losses," that encompasses physical and commercial losses, was developed in Brazil with the participation of PAHO and was implemented at the pilot level in São Paulo. In view of the results obtained, PAHO adopted "control of losses" as the best strategy for promoting the implementation of institutional development programs in the water companies of the Region.

Complementing this is the concept of "efficient use of water," that includes elements related to rational consumption, reduction and control of leaks, and reduction of waste and the conservation of distributed water and its source of origin.

Applying the strategy of mobilization of national resources for the identification of problems, their solutions, and the political decision that backs the introduction of the respective plans of action, CEPIS established a "Technical Nucleus for Control of Losses," comprised of technicians from the countries that already managed programs for control of losses or that were in the process of implementing them.

During the Decade this technical nucleus held four meetings (Brazil, 1984; Mexico, 1986; Peru, 1987; and the United States of America, 1988). In the 1988

meeting, contact was established with international financial agencies (IDB, WB, USAID, etc.) in order to provide them with the overall focus of the program.

Other means used to diffuse the concepts of control of losses and efficient use of water were seminars and conferences. CEPIS coordinated and participated in 25 events in eight countries that were attended by an average of 30 participants each: Argentina (1), Bolivia (2), Brazil (2), Colombia (6), Honduras (1), Mexico (3), Peru (8) and Venezuela (2).

Supplementing this task of diffusion, eight "Hojas de Divulgación" and seven manuals were prepared and distributed; the former dealt with the control of losses and the latter met the need for teaching materials for personnel training in this field. The topics of the manuals are: pitometry, macromasurement, control of leaks, commercial system of companies, micromasurement, and equipment maintenance.

In 1986 PAHO entered into an agreement with the Government of Mexico for the development of a "Project for Control of Losses and Efficient Use of Water," which has produced results that already are being transferred to the countries of Central America. Among the material produced, of special note are 20 technical documents that contain methodologies for the diagnosis of water systems, the program for control of losses and the projects that compose it. These are in press and then will be distributed in the Region.

Nine courses directed toward professionals were conducted by CEPIS: Colombia (4), Mexico (3), and Peru (2), on the subjects of pitometry, macromasurement, control of leaks, and operation of water distribution networks, with a total of 185 participants. Courses were given to train personnel of the units of detection and control of leaks of the participating institutions in the project, as part of the "Project for Development of Human Resources in Central America".

As research support for this Program, CEPIS is concluding the development of software for a management information system and for the project of preventive and corrective maintenance, both designed to be menu-driven for use in IBM XT, AT, or compatible microcomputers. This software will soon be available for interested institutions.

As a result of the efforts in this field, in addition to the program in Mexico for control of losses, Panama, Costa Rica, Nicaragua, Honduras, El Salvador, Guatemala and the Dominican Republic have already formulated their national loss control programs. These countries will be supported in implementation of their plans through an Agreement financed by GTZ, to be carried out by CEPIS.

7. HUMAN RESOURCE DEVELOPMENT AND TRAINING

The greatest challenge to management, posed by the IDWSSD, was the appropriate training of human resources, which were limited in many of the countries.

Aware of the importance of training for institutional development, PAHO devoted special attention to this area. It undertook three lines of action:

- 1) support for the enterprises in the sector with the aim of developing their institutional capacity and self-reliance to carry out programs for human resource development;
- 2) strengthening of the institutions for training of human resources, as well as support for the improvement of sanitary and environmental engineering education;
- 3) support for specific training activities in the subregions.

7.1 Cooperation with the Sector Institutions

In accordance with the foregoing, PAHO support in this field to the countries during the Decade was directed toward improvement of the performance of the institutions by means of the development of their human resources, placing special emphasis on generating and/or strengthening the self-reliance of the institutions in order to carry out their training programs.

7.1.1 Project for Development of Human Resources in the Countries of the Caribbean

This project had, as a basic objective, developing a local and subregional capacity in order to train human resources in the field of water supply and sanitation. In the first years of the Decade the project was carried out by PAHO through a project manager and later it was managed, administered and partially carried out and financed by the participating countries themselves, with the Caribbean Development Bank assuming the managership.

Currently the project operates in 13 countries, each of which has its training team, maintains a process of cooperation with the other countries, and carries out the required training activities. PAHO continues to cooperate technically in the planning of their activities, as well as in the development of some of them, especially those of a subregional character.

7.1.2 *Project for Technological Development of Drinking Water and Sewerage Institutions (DTIAPA)*

This project was designed to contribute to the technological development and adoption of appropriate technologies to improve the efficiency of services of the drinking water supply and sewerage institutions. It was carried out from 1979 to 1983 in accordance with an Agreement between the Government of Peru and the IDB, which assigned its execution to PAHO/CEPIS.

The DTIAPA project was primarily directed toward institutions of Peru, however several of its activities, especially training, also benefited other countries of the Region. Its cost was \$2,300,000--\$1,300,000 from IDB and \$1,000,000 from PAHO/WHO.

There were four lines of action: research, training, dissemination of technical information, and technical cooperation with the institutions of the sector. It included 10 research and 36 training projects; 918 persons participated, 658 from Peru and 260 from other countries. The topics included: institutional development, administration, operation and maintenance, potable and wastewater treatment, distribution and collection networks, pumping stations, wells and rural water supply systems.

The experience acquired and the material generated served as basis for the preparation of 16 manuals, which were distributed among the institutions of the Region responsible for water supply and sewerage services.

7.1.3 *Project for the Development of Human Resources in Central America, Panama and the Dominican Republic*

This project was directed toward strengthening the institutional capacity of mid-level technical human resource development in the drinking water and sanitation agencies. It was initiated in 1984 with financing by the German Agency of Technical Cooperation and the Inter-American Development Bank. PAHO was assigned management responsibility, and until 1989 it had a manager directing the project activities, with CAPRE acting as coordinator.

The project enabled the training of 1,738 persons up to 1988, strengthened or created training units in the participating institutions, provided audiovisual and computing equipment, and promoted the control and detection of leaks in those institutions that had acquired the necessary equipment and trained the required personnel.

In 1989 the participating institutions, now having the trained personnel and the required equipment, were charged with expanding the training of personnel in the field of detection and control of leaks, with PAHO monitoring the actions carried out.

The first phase of the project concluded in June 1990. GTZ financed a second phase which is being directed toward development of a Program for Control of Losses and Efficient Use of Water, which will have the advisory services of a CEPIS specialist.

7.1.4 National Training Plans

Within the country Decade plans, training aspects were considered. To promote and foster the development of these activities, PAHO supported Bolivia, Brazil, and Peru in the formulation of specific training plans for the drinking water supply and sanitation sector, and provided Colombia with advisory services in the initial phase of the CENAGUA.

7.1.5 CEPIS Program for Young Professionals

This program was launched in 1985, receiving each year an average of nine professionals from different institutions from the countries of the Region who spent 10 months in CEPIS (Lima, Peru). The objective was to expand their knowledge on matters useful to their institutions through their participation in the activities of CEPIS under the orientation of its consultants.

To date, officials from Argentina, Bolivia, Brazil, Colombia, Cuba, Dominican Republic, Mexico, Peru, Trinidad and Tobago, and Venezuela have taken part in the program.

7.2 Strengthening of Local Human Resources Training Institutions and Support of the Improvement of the Sanitary, Environmental and Public Health Engineering Education

In view of the need to strengthen the capacity in the environmental health field in the Region PAHO directed its actions toward the universities that were conducting courses in sanitary, environmental and public health engineering with the aim of contributing to improvement of the quality of the professionals being prepared. To start with, PAHO in cooperation with the countries, prepared a directory of the programs being conducted, to later compatibilize them with the needs of the institutions utilizing such professionals. PAHO then proceeded to foster horizontal cooperation among the identified institutions in the various countries.

7.2.1 Directory of Educational Programs in Sanitary and Environmental Engineering in Latin America and the Caribbean

The Directory contains detailed information on the sanitary, environmental and public health engineering programs, at both the graduate and postgraduate levels. The information collected allows the diagnosis of the situation and provides elements to

orient actions for improving education, as well as to identify possible areas of cooperation.

7.2.2 Cooperation among Sanitary, Environmental and Public Health Engineering Schools

To foster horizontal cooperation among these institutions, PAHO organized regional meetings of professors of sanitary, environmental and public health engineering. During the Decade, PAHO conducted three such meetings. The first, organized around the aforementioned Directory, was held in July 1987 in the School of Public Health of the University of Sao Paulo. Nineteen schools participated, analyzing the problems facing sanitary engineering education and the possibilities of contributing to its improvement. It was agreed to initiate activities to define a basic curriculum of sanitary, environmental and public health engineering. The desirability of creating a Latin American Association of Schools of Sanitary and Environmental Engineering that would facilitate communication and cooperation among the areas of teaching, research, and bibliography was recognized.

The second meeting in September 1988, in tandem with the XXI AIDIS Congress in Rio de Janeiro, attracted 47 professors from 10 countries. The commitments of the previous meeting were evaluated, and agreements of cooperation between several universities were generated. The form of implementing a permanent mechanism for future meetings was discussed, and contact with AIDIS was established so that its Division of Education and Training (DIECA) could contribute to future meetings.

Following recommendations of the previous meeting, PAHO convoked, in August 1989, the first Pan American meeting of professors of sanitary, environmental, and public health engineering, held in Washington, D.C. with the participation of 42 representatives from Latin America, the United States, and Canada. The strengthening of the mechanisms of academic training in the countries of Latin America, including the planning and evaluation of the teaching programs was discussed, and bases were prepared for the establishment of technical cooperation agreements among universities at the regional level. At the end of the meeting a workshop was held to explore the possibility of incorporating the subject "Disaster Preparedness" into environmental engineering and environmental sciences curricula.

Programs and agreements of cooperation were subsequently drawn up between universities of the following countries: Mexico-Guatemala, Peru-Brazil, Argentina-United States of America, Brazil-Colombia, Ecuador-United States of America, Guatemala-Spain.

7.2.3 *Other Activities*

In almost every country, collaborative efforts for training and human resource development were carried out; the following were among the more significant:

- Support was provided to the Sanitary Engineering Institute of the University of Buenos Aires to carry out a postgraduate course in sanitary engineering as part of a joint technical cooperation program with the University of New York, Buffalo.
- In Paraguay, collaboration was provided to the National University of Engineering to initiate a sanitary engineering course (postgraduate level). Also collaboration was given to carry out several courses of a short duration.
- In Bolivia, cooperation was given to the "Universidad Mayor de San Andrés" in the formulation of a proposal for the creation of a sanitary engineering course at the postgraduate level, to be implemented shortly. Also, support was given to carry out several training and continuing education activities in the different fields of sanitary engineering.
- Collaboration was provided to the Public Health Schools of Sao Paulo and Rio de Janeiro (Brazil) in the preparation of human resources programs in sanitary and environmental engineering, emphasizing water supply and sanitation. The Catholic University of Curitiba (Brazil) received collaboration in the execution of several research programs applied to sanitation in marginal urban areas.
- In Colombia collaboration was given to the sanitary and environmental engineering programs of the universities--Nacional, Javeriana, Boyaca, La Salle, UNIVALLE, Bolivariana and Antioquia--for the strengthening of teaching and research, as well as in carrying out national meetings with the responsible parties of these programs. Also support was given in the areas of training and continuing education.
- Support was given to the "Escuela Politécnica Nacional" of Ecuador in the strengthening and conduct of its sanitary engineering program at the graduate level and in the conduct of several training and continuing education programs in the different institutions of the country. Support also was given to the strengthening of the sanitary engineering programs of the civil engineering schools of the country.

- Support was provided to the Regional School of Sanitary Engineering (ERIS) of the San Carlos University, Guatemala, for an average of seven short courses per year and, in addition, cooperative agreements with international agencies and other countries were successfully advanced.
- In Mexico the "Universidad Nacional Autónoma de México," the "Instituto Tecnológico de Monterrey" and the "Universidad Autónoma de Nuevo León" were supported in their efforts to strengthen their sanitary and environmental engineering programs, and collaboration was provided in the creation of the National Association of Sanitary and Environmental Schools. Collaboration also was given to carry out several national meetings.
- The National Engineering University of Nicaragua, was assisted through CEPIS in the structuring of its master's program in sanitary engineering, and provided with bibliographical support.
- In Panama, collaboration was given to the "Universidad Tecnológica de Panama" in conducting a technicians' course in sanitation, and in its program of research applied to treatment processes.
- The National Engineering University of Peru received support from CEPIS for the development of its first master's program in "water treatment and reuse of wastes," in the presentation of five full courses, in the orientation of graduate students in research work conducted in CEPIS, and in a 3-month course conducted by a rotating team of consultants sponsored by PAHO.
- Collaboration was given to the "Instituto Nacional de Tecnología de la República Dominicana" in the development of a formation program of sanitary engineering to be established with the technical support of the Central University of Venezuela.
- Support was provided to the Central University of Venezuela, "Escuela de Malariología" and "CIDIAT" for the creation and strengthening of their research programs in sanitary engineering. Also support was given in carrying out national meetings of those involved in sanitary and environmental programs, with the participation of the major sanitation agencies of the country.

CEPIS launched a program of technical updating of university professors, in which the participants serve a two-to-three month residence in CEPIS, reviewing and

updating their course content, with advisory services of CEPIS consultants and the resources of the REPIDISCA database and the CEPIS library. Six professors from the School of Environmental Engineering of the UNI, Peru, have taken part. Anticipating extension to universities of other countries, financial support has been requested from GTZ.

CEPIS prepared manuals and training modules in water treatment, pitometry, and macro and micro-measurement of potable water consumption and translated, adapted, and published audiovisual training modules on low-cost technologies for water supply and sanitation produced by the UNDP/World Bank. CEPIS also trained 45 educators from universities of the Region as instructors in these technologies.

In addition, PAHO has prepared and distributed various technical documents to help strengthen and develop human resources, including a manual on costs of sewerage systems, a study of review and reformulation of design criteria, a manual on selection of appropriate technologies, models of operations and maintenance management, and a manual on human resource development. Also important are the technical documents produced in the projects conducted by PAHO, as well as those whose preparation was supported by the countries.

7.3 *Support to Specific Training Activities in the Countries*

As part of PAHO's technical cooperation agreement, and in response to existing and future needs, specific training activities were developed in almost every country in the Region. These activities were carried out in coordination with the national institutions, and PAHO was involved, by either giving a conference or being responsible for the whole activity. In general, support was given by PAHO Country Offices, and sometimes support was given at a regional level from the Washington Office (HPE), CEPIS, and ECO.

The following data, which take into account only the activities carried out in the water supply and sanitation area, give an idea of the magnitude of the effort in those years:

Year	Number of Events	Number of Participants
1985	123	2,036
1987	185	5,806
1988	168	5,271
1989	163	5,748

8. TECHNOLOGY

During the IDWSSD, PAHO oriented its efforts toward increasing the ability of the Member Countries to absorb technology, to carry out the local adaptation of technologies and develop capacity for technical innovation. The strategy involved encouraging self-reliance in the countries to develop or test, analyze and adapt existing technology and to meet local needs in this field. It also encouraged technically advanced institutions to direct high level technology towards simple, sustainable solutions for developing countries.

8.1 *Development of Technology and Research*

Many of the technologies used in developed countries fail to be sustained when they are indiscriminately applied in the developing countries, due to cultural obstacles, lack of technical capability, and mainly to inadequate supporting infrastructure and the high cost of their operation and maintenance. It is for this reason that PAHO became concerned with supporting research, as a tool that would permit not only an appropriate adaptation and transfer of these technologies but also the development of appropriate technologies for the environment where they would be applied, as well as to train local personnel and develop a sense of confidence in their own ability to solve problems. An overview of what has been carried out is presented below.

During the first years of the Decade, CEPIS collaborated in research for designing simple and economical water treatment systems in Brazil, Costa Rica, Honduras and Peru; the development of disinfection devices in Argentina, Colombia, Costa Rica, Chile and Peru; and sewage stabilization ponds in Peru. A large number of specialty courses in various technologies were conducted by CEPIS providing training to hundreds of participants from 20 countries of the Region. PAHO provided direct technical assistance to 11 countries in relation with windmills, hand pumps, photovoltaics, hydraulic rams, water treatment, ocean outfalls, low cost sewers and disinfection, and cooperated with six countries in forming a special unit for appropriate technology.

In 1982, CEPIS published a two-volume technical document titled "Modular Water Treatment Plants," and organized workshops on this topic with the participation of 14 Latin American countries.

With GTZ financing, the following activities were completed. In Bolivia, a research proposal was prepared for stabilization lagoons to serve El Alto, for La Paz to derive design parameters, and recommendations were made to reduce contamination in the Lake Titicaca basin. In Peru, CEPIS carried out research on gravel pre-filters, combined with slow sand filters, the results of which were employed in designing

three water treatment installations to demonstrate three classes of pre-filters, and the construction and evaluation of such a treatment facility for the community of Azpitia. A demonstration to improve drinking water quality in a marginal urban area of Limón, Peru, was initiated; a sociocultural study on the use of wastewater in agriculture was conducted; a conceptual study of different methods of water supply and sanitation for marginal urban areas, hygienic habits and the relation with health status was conducted; and a project in collaboration with SENAPA of Peru is under way concerning the use of stabilization lagoon effluent for agricultural purposes.

In Mexico research was begun on low cost options to reduce the excessive concentrations of fluorides and arsenic in the drinking water in the city of Durango. Efforts were continued to promote the adoption of a simple technology for water fluoridation in Argentina, Uruguay, and Venezuela, and to extend this measure to another four countries.

The Organization cooperated in the development of 10 research projects on the utilization, accessibility, efficiency, and effectiveness of the health sanitation services, and in 1985 six of these proposals had their financing approved through the PAHO Program of research grants.

CEPIS carried out three research projects on the evaluation of stabilization ponds in San Juan de Miraflores (Peru) and on the recycling of treated liquid wastes for agriculture and hydroponics, financed by the International Development Research Center (IDRC-Canada) and GTZ. In 1985 a project on situation, trends, and promotion of research on water supply and sanitation, financed jointly by the IDRC and PAHO, in nine Latin American countries. Undertaken as part of this project were surveys in the participating countries, eight workshops on research policies and priorities, and publication of a document with the compiled information.

With the financial support of the IDRC of Canada, CEPIS developed a project in Peru on toxicological and microbiological aspects related to the use of waste water in agriculture. It also supported Mexico in research in this field.

A research proposal was completed on disinfection of rural water supply, which was financed by the Pan American Health and Education Foundation (PAHEF) in collaboration with Argentina, Colombia, Costa Rica, Chile, and Peru, and the results were discussed in an international symposium held at CEPIS at July 1983.

There was cooperation with Colombia, Mexico, and Peru in the development of appropriate technologies for waste water treatment, including criteria for design of stabilization ponds and anaerobic reactors of rising flow, a study being initiated on recovery of the biogas generated in these reactors. In the Caribbean, Colombia, and Peru workshops were held on development and transfer of appropriate technologies.

8.2 *Disinfection of Drinking Water with a Mixture of Gas Oxidants Produced In Situ (MOGGOD)*

PAHO promoted the development and use of technology for on-site generation of mixed oxidants for disinfecting drinking water supplies in small or remote communities of Latin America and the Caribbean.

In December 1986, with the financial support of the UNDP, the first phase of a demonstration project was undertaken, to introduce to agencies and institutions of the Member Countries the MOGGOD technology, and to obtain their cooperation in developing and adapting this technology to the Latin American situation.

This phase included the acquisition of more than 40 prototype devices that were sent to various countries, where they were submitted to laboratory and field tests. A particularly noteworthy program to develop this technology was implemented by the Center for Development and Technological Applications (CEDAT) of the Ministry of Health of Mexico.

Although additional experience is needed, results obtained indicate that MOGGOD disinfection has several positive characteristics.

The equipment uses only salt and water as prime materials; its energy requirements are small and can optionally be provided by photovoltaics and miniturbines; its operation and maintenance are simple. Both laboratory and field tests indicate that this method of disinfection equals or exceeds the efficiency and effectiveness of chlorine against several pathogens.

8.3 *Pan American Network for Information and Documentation in Sanitary Engineering and Environmental Sciences (REPIDISCA)*

REPIDISCA is a regional computerized technical information system developed by PAHO in response to the sector's identified need for technical information. It received technical and financial assistance from the International Development Research Center (IDRC) of Canada until July 1986.

The main objective of REPIDISCA is to identify, collect and offer specialized information on sanitary engineering and environmental sciences. The Regional Coordinating Center of REPIDISCA (in CEPIS) and a network of participating institutions (National Coordinating Centers) are responsible for the development of the network in each country and the Cooperating Centers in cities of Latin America and the Caribbean. These institutions enter the information and distribute the products and services of the Network.

Currently REPIDISCA has 513 Cooperating Centers in 23 countries; 249 are active centers that contribute documentation, and the remainder receive the services of the network. Its data base has 40,000 bibliographical references, with an average annual increase of 5,000 units.

During the Decade a series of manuals was developed with the methodology utilized by the network. These were distributed to the Cooperating Centers. Courses on documentary techniques of REPIDISCA and automatization of information units were given in 20 countries, with some 850 staff members of the Centers attending.

Among the products and services provided by REPIDISCA are:

- REPINDEX: Published quarterly since March 1982, it is a computerized index of the data base that has 700 references in each issue.
- TABCONT: Published every two months, it presents the table of contents of journals in the field and identifies the Cooperating Centers that have them.
- SPECIALIZED REPINDEX: Stabilization ponds, control of losses, reuse of waters, and solid waste.
- Collective catalog of serial publications: Published annually beginning in 1984, it identifies the titles of journals and the Cooperating Centers that have them.
- Bibliographical research services, copy of data bases in CD-ROM, photocopy, and on microfiche of documents in the data base.

9. WATER QUALITY

With a view to providing the countries of the Region with the necessary technical assistance so that they may succeed in achieving the goals of the IDWSSD concerning safe water supply, PAHO carried out the following activities:

9.1 Improvement of the Quality of Water for Human Consumption

In 1980 a Regional Program devoted to this topic was launched. It was directed by CEPIS and had as its goals the training of professional personnel of the Region in identifying problems inherent to drinking water quality, and in the preparation of plans and programs to solve problems of design, operation, maintenance and management of water treatment plants with the resources available.

The strategy employed to fulfill this objective can be synthesized as follows:

9.1.1 Training of Human Resources through Short Courses in the Countries

In the period 1980-1984 seven courses were given on evaluation of water treatment plants (Colombia, Costa Rica, Dominican Republic, Guatemala, Mexico, Panama, and Peru), six courses on the design of preliminary plans for water treatment plants (Colombia, Dominican Republic, Mexico, Nicaragua, Paraguay, and Peru); five courses on operation and maintenance of water treatment plants, two at the professional level (Costa Rica, Colombia) and three for supervisors (Peru).

In the period 1985-1989 the program continued with instructors trained in the previous period: two courses in evaluation of water treatment plants (WTP), five courses in design of provisional drafts of WTP, and four courses in operation and maintenance of WTP, which were given in Bolivia, Mexico, Peru, the Dominican Republic, and Uruguay.

9.1.2 Direct Advisory Services and Residencies at CEPIS

From 1980-1984, 15 direct advisory services were given to institutions in Colombia, Costa Rica, Cuba, Chile, Ecuador, Guatemala, Honduras, Mexico, Nicaragua, and Peru for the preparation and development of evaluation programs, design of WTP, and the solution of specific problems.

Under the residency program, the participants went to CEPIS (generally for not less than two weeks) to learn how to develop a specific project or extend a project using "module projects" for different water caudals and characteristics. During the Decade 10 residencies were carried out with more than 20 professionals participating in Colombia, Dominican Republic, Mexico, Nicaragua, and Peru.

9.1.3 Preparation of Manuals and Specific Information

In the first two years of the Decade 58 teaching modules were prepared and were used in the aforementioned courses. Among the published documents were modular water treatment plants in the rural environment, guidelines for the design of slow filtration plants, manual on evaluation of WTP, and a manual for supervisors of WTP.

9.2 Water Quality Standards

The three volumes of the WHO/1985 Guidelines for Drinking Water Quality were translated into Spanish and were distributed to all the countries of the Region in the appropriate language. To encourage and facilitate the application of these

standards in national programs for improvement of water quality, two regional workshops were held, one for the countries of the English-speaking Caribbean in Saint Lucia and another, in Spanish, at CEPIS (August 1985).

In the following years, for the purpose of promoting the revision of national standards and actions to improve drinking water quality, a series of national workshops (Bolivia, Brazil, Colombia, Ecuador, Honduras, Mexico, Paraguay, Peru) and two regional workshops in the Caribbean, were held.

There also was collaboration with Argentina, Brazil, and Peru in studies aimed at the definition of standards on permissible concentrations of toxic substances in bodies of water.

9.3 *Surveillance and Control of Water Quality*

PAHO, with the support of the US Environmental Protection Agency (USEPA), cooperated with the countries in a study of the analytical quality of the water in the laboratories of the Region. Samples of several control parameters were sent to 50 national laboratories that are collaborating with GEMS/WATER, as well as to the participants in the Regional Program of Laboratories for Water and Effluents Analysis (PRELAB) coordinated by CEPIS. There are 23 laboratories in different countries involved in this study.

Among the activities carried out for this purpose, CEPIS has collaborated with the Ministry of Health of Peru in the National Program of Surveillance of the Water Services for Human Consumption.

In 1989 technical information was sent to all the countries of the Region on a new method known as COLILERT, which makes it possible to determine rapidly the presence of coliform bacteria indicators of fecal contamination; Honduras and Montserrat have already begun an evaluation of this method.

ECO cooperated in the development and conduct of national workshop-seminars for the control of drinking water quality with emphasis on the contribution of toxicology, in Argentina, Brazil, Mexico, Peru and Venezuela.

In 1989 in Brazil, programs for the control and surveillance of drinking water quality were implemented in five states through the agency of the Division of Ecology and Human Health of the Ministry of Health.

9.4 *Chemical Contamination of Surface Water and Groundwater Aquifers*

CEPIS established two technical nuclei in 1985, one for the evaluation and control of surface water contamination by toxic substances and another for groundwater.

The technical nucleus that studies the contamination of surface water is made up of professionals from Argentina, Brazil, Colombia, Cuba, Mexico, Peru, and Puerto Rico. It held meetings for coordination and evaluation of the progress of the studies it is developing in 1985, 1986, 1987, and 1989, in which specialists from other countries have also participated. The nucleus has already developed a methodology for evaluation and management of these pollutants which has been published in six volumes, and it is carrying out studies on pollution of the principal rivers of Argentina, Brazil, Colombia, Cuba, and Mexico.

In the technical nucleus for the evaluation and control of chemical substances in groundwater, Argentina, Brazil, Canada, Colombia, Cuba, Ecuador, the United States, Japan, Peru, Puerto Rico, and Venezuela are taking part. The nucleus met in 1985, 1986, and 1988 and produced two "Action Guidelines" and an "Alert" pamphlet directed at the political level, in order to raise the level of awareness on the importance and the danger represented by the pollution of groundwater.

These documents have already been distributed to the countries of the Region. CEPIS is also devoting attention to the problem of eutrophication through its Regional Project to Develop Simplified Methodologies for Evaluation of Eutrophicates of Tropical Lakes.

10. TREATMENT, DISPOSAL AND REUSE OF WASTEWATER

10.1 Diverse Activities

In this area, PAHO cooperated in training and research, especially on appropriate technologies; the development and application of standards for the use of wastewater in agriculture and aquaculture; the organization of advisory meetings to evaluate the situation of the sector and/or to mobilize financial resources; and direct consultantships to collaborate in the solution of specific problems in the countries. Below, mentioned in chronological order, are some of the activities carried out.

- In December 1983, in Washington, D.C., a meeting was held on transportation and disposal of sewage sludge, in which the potential environmental health risk of sludge and the benefits it offers for agriculture were evaluated.
- In April 1985, in Antigua, a subregional workshop was held on wastewater management and reuse in which problems of wastewater in 14 countries of the Caribbean were analyzed and recommendations made, to improve management.

- In 1985, a regional study was carried out of the existing situation in wastewater disposal, using Bolivia, Brazil, Colombia, Chile, Guatemala, and Peru. The results were presented at a consultative meeting with specialists, held in December of the same year in Sao Paulo. This meeting was organized to establish the basis on which to orient PAHO/WHO cooperation and accelerate the extension of coverage with regard to wastewater. As a result, the publication "Wastewater Disposal and Excreta in Latin America and the Caribbean" was prepared.
- A meeting for development of criteria and standards of water quality for agricultural irrigation with wastewater in Mexico, was held in Cutzamala, Mexico, in April 1988, with participation of the Environmental Health Program through consultants from Headquarters and its Centers (CEPIS, ECO).
- In September 1988, in Barbados, a workshop was conducted on collection, treatment and disposal of wastewater, in which professionals from the countries of the Eastern Caribbean took part.
- An Advisory Meeting for the Development and Financing of the Sewerage Sector in the Caribbean was held in June 1989 in Port of Spain, Trinidad and Tobago. This activity was sponsored by the Caribbean Development Bank, CARICOM, ECLAC, PAHO, and the Government of Trinidad and Tobago.
- Technical review and translation into Spanish of the "1989 WHO guidelines on the use of wastewater in agriculture and aquaculture," were carried out. These guidelines were presented and discussed in a Central American meeting on appropriate technologies in the collection and disposal of wastewater, held in Guatemala in October 1989.

10.2 *Activities in Support of Training and Research*

With the purpose of mobilizing national resources toward the treatment, disposal, and reuse of wastewater, CEPIS participated in eight seminars each with an average attendance of 30 professionals. In addition, seven courses were given in five countries: Antigua (1), Colombia (2), Ecuador (1), Saint Lucia (1) and Venezuela (2), with the participation of some 250 professionals.

Research, in this area was directed toward appropriate technologies with special attention given to stabilization ponds and upflow anaerobic reactors. In addition, with the financing of international cooperation agencies, CEPIS carried out five research

projects that encompassed the sociocultural aspects related to the use of the wastewater in agriculture and hydroponics.

Finally, mention should be made of two programs that CEPIS is conducting in this field: the Research Program Developed in the Stabilization Ponds of San Juan de Miraflores (Lima, Peru), and the Program for Submarine Outfalls.

10.2.1 The Stabilization Ponds of San Juan de Miraflores

In 1961, the Peruvian Government constructed 21 stabilization ponds in 20 hectares of a desert area to the south of Lima. Currently this complex receives the wastewater of three neighborhoods of Lima, with a population of more than 200,000 inhabitants of which only 59% have sewerage services.

Since 1977, CEPIS has collaborated with the health authorities of Peru in numerous field and laboratory studies for the purpose of establishing design and efficiency parameters for the treatment of stabilization ponds and to identify and evaluate the risks to human health of the reuse of the effluents in these ponds.

The results obtained have shown the effectiveness of stabilization ponds as a method of wastewater treatment and that the resulting effluents, in principle, meet the water quality requirements for irrigation with respect to levels of fecal contamination, enterobacteria, and to the elimination of helminths and parasites.

The evaluation of the quality of the agricultural products obtained with reuse, from the microbiological and toxicological point of view, made it possible to establish sanitary criteria in order to prepare a program for quality control of the wastewater and agricultural products; from the toxicological point of view, a potential hazard was recognized in the reuse of industrial wastewater.

Currently, a demonstration aquaculture project is under development. The reuse in that area of the effluents of the San Juan ponds has served to promote silviculture through the creation of green areas, irrigation of recreation parks and the recovery of contiguous sanitary landfills, aquaculture for fish and prawns, and the production of algae for chicken feed.

10.2.2 The Underwater Outfalls Program

This program was launched in 1983 for the purpose of developing studies and material that could guide the countries of the Region on the use of underwater outfalls for wastewater disposal, as a substitute for conventional treatment or in combination with it.

Among the products generated by this program are a manual directed toward the water and sewerage institutions of the Region, which aims at providing basic knowledge of the design requirements for underwater outfalls and developing the capacity of these institutions to prepare terms of reference in order to contract such projects, as well as to review adequately the quality of the work during the proposal and execution phases.

11. DIRECT TECHNICAL COOPERATION

The technical cooperation given by PAHO during the Decade was in response to the cooperation programs agreed in each country, with special emphasis on the reinforcement of national technical capacities.

PAHO's Country Offices played an important role in the delivery of technical cooperation to the countries and the sanitary engineers assigned to the countries acted in line with the cooperation agreements. The personnel of the Environmental Health Program in Washington and those of the Pan American Centers ECO and CEPIS complement actions in support of Country Offices and also offer direct technical cooperation within national and regional programs.

In addition, PAHO, acts as executing and cooperating agency for several projects financed by external support agencies. These projects are not mentioned here because they have been referred to in other chapters of this publication.