



Technical

Discussions



Washington, D.C.
September-October 1979

INDEXED

Provisional Agenda Item 20

CD26/DT/1 (Eng.)
25 July 1979
ORIGINAL: ENGLISH

STRATEGIES FOR EXTENDING AND IMPROVING POTABLE WATER SUPPLY AND EXCRETAL
DISPOSAL SERVICES DURING THE DECADE OF THE 80's

POTABLE WATER SUPPLY AND EXCRETA DISPOSAL
SERVICES DURING THE 1980s

by

Dr. Abel Wolman

Emeritus Professor of Geography
and Environmental Engineering of
The Johns Hopkins University
Baltimore, Maryland, USA

CONTENTS

	<u>Page</u>
Introduction	1
The Situation in Latin America and the Caribbean	5
Motivation and Commitment	7
Management	10
Training	11
Appropriate Technology	12
Finance	13
Appendix I : Brazil's New National Sanitation Plan (PLANASA II)	
Appendix II : Water Supply and Sanitation Programs in Colombia: Community Participation	
Appendix III : Evolution of Rural Water Supply Programs in Venezuela	
Appendix IV : Selected Bibliography on Water Supply and Sanitation	

POTABLE WATER SUPPLY AND EXCRETA DISPOSAL
SERVICES DURING THE 1980S

Abel Wolman

The United Nations Conference on Human Settlements at Vancouver, Canada, in June 1976, emphasized two significant realities of long standing in a large part of the world. It concluded among other things that:

In the less developed countries, nearly two thirds of the population do not have reasonable access to safe and ample water supply, and even a greater proportion lack the means for hygienic human waste disposal.

Safe water supply and hygienic waste disposal should receive priority with a view to achieving measurable qualitative and quantitative targets serving all the population by a certain date; targets should be established by all nations and should be considered by the forthcoming United Nations Conference on Water.¹

The Conference also urged the adoption of water programs for urban and rural areas, with realistic standards for quality and quantity, to be implemented by 1990, "if possible."

These laudable objectives were unanimously approved at the United Nations Water Conference at Mar del Plata, Argentina, in March 1977, in the following terms:

Realizing that the accelerated development and orderly administration of water resources constitute a key factor in efforts to improve the economic and social conditions of mankind, especially in the developing countries, and that it will not be possible to ensure a quality of life and promote human dignity and happiness unless specific and concerted action is taken to find solutions and to apply them at the national, regional, and international levels,

1. Urges strongly that the recommendations of this Conference be effectively implemented in good faith by all States;
- "2. Decides that these recommendations be known as the Mar del Plata Action Plan.²

If any additional official mandate were needed to move forward in providing sanitary facilities, it is vividly apparent in the deliber-

ations at the International Conference on Primary Health Care at Alma Ata, U.S.S.R., in September 1978 which was jointly sponsored by the World Health Organization and the United Nations Children's Fund. More than 500 delegates from 140 nations confronted the glaring disparities in access to health care in different parts of the world. Of great importance was the fact that 70 ministers of health were joined by 50 ministers of planning, finance, education, and agriculture at the Conference.

The Conference recognized and emphasized that sanitary facilities must be provided for hundreds of millions of people without them. It could not be otherwise because, according to WHO, 80 per cent of all sickness and disease in the Third World is attributable to contaminated water. The contributions that water supply, sanitary disposal of excreta and other wastes, food sanitation, and personal hygiene can make to primary health care are undeniable. Among the long-term goals on which it agreed, the Conference therefore gave adequate supplies of safe water and basic sanitation high priority.

In essence, these are the goals the Ministers of Health of the Americas have set themselves. Achieving them places an extraordinary responsibility on public and private leaders in the 32 countries encompassing the Region. Providing water supplies and basic sanitation has historically been more successful in urban areas than in widely disparate periurban and rural areas, where major challenges to ingenuity and innovation now lie. The apparent ease with which many people think village problems can be solved is very deceptive and has often led to unexpected program failures and permanent frustration in the use of the services. Overgeneralization about how to solve technical and administrative problems in both urban and rural areas is likely to lead to failure. The uniqueness of each local situation within the tremendous variety of each country or region places an extraordinary responsibility on every worker engaged in this task.

Definitions of "urban" and "rural" differ greatly throughout the world and hence one is sedulously tempted to generalize the approaches for reaching the objectives. In too many instances these efforts are doomed to fail. Human communities range from thousands of people in towns through discrete, scattered farm houses to nomads who stay put only for weeks or months at a time.

Similar variations in culture and religion frequently influence people's attitudes toward the introduction of sanitary devices and ideas.

An awareness of the variation in man's way of life, the availability of natural and human resources, of local wealth, and of organization, is a prerequisite to fulfilling the grand goals. It should not intimidate those seeking an overall strategy, but simply remind them that the task is large and that complete success in the next decade is improbable. Yet

increasing the actual number of people served in the next 10 years is practicable and essential. It must be understood, though, that the program goal is not just building water and sanitation systems, but building them so that they can be operated and maintained permanently. Assuring sustained operation requires close collaboration between national or regional professionals and adequately trained village workers.

The search for justification of such sanitation investment is unending. The World Bank's statement on the matter is worth repeating here, since the issues raised in the competition for limited local resources in every country cannot be ignored. It is predictable that problems in setting priorities will emerge and must be confronted in every country. The World Bank's view is a balanced one:

Ideally, decisions to invest in village water supply should be based on cost/benefit analyses in which both costs and benefits are quantified. However, despite considerable research, no satisfactory method has yet been developed for quantifying all the benefits of improved water supply. Nevertheless, experts in the field, particularly WHO, have little doubt that safe water is essential for good health, and is a prerequisite to the control of those diseases most common to the rural areas of developing countries.

In urban areas, good water supply is essential to the existence of a city and to protect public health. There is usually no alternative to a public water system. Projects in urban areas can normally be supported by consumers' willingness to pay for the service provided. In rural areas, the justification becomes far more tenuous: The threat of epidemic due to waterborne diseases lessens as population density decreases, but the number of diseases is greater. Alternative sources frequently exist but are polluted, inconvenient, or unreliable. Willingness to pay declines, due to poverty or to a lack of appreciation of the benefits of improved supply. Direct benefits which are readily quantifiable--for example, the development of agro-industries, fish freezing, and the like, which had been inhibited by the lack of safe water--may accrue in some cases but are unlikely to be sufficient, on their own, to justify the investment.

In most cases, therefore, it is impossible to present a rigorous economic justification for village water projects. Instead, the justification must rest on a qualitative assessment of the benefits anticipated from the investment. The most important direct benefits from improving the quality and quantity of water available are better public health, greater convenience, and some fire protection. The first two of these may

also increase productivity. The indirect benefits commonly cited are a slowing down of rural-urban migration; redistribution of real income in favor of the rural poor; a better standard of living; and the development of village institutions.

Numerous epidemiological studies have clearly identified contaminated water as the principal agent in transmitting typhoid, cholera, and shigellosis (bacillary dysentery). Lack of safe water for drinking and washing is also an important factor in the spread of other diarrheal diseases, the most common cause of death in infants in the developing world. A number of additional diseases, especially the debilitating parasitic diseases, are linked to inadequate and contaminated water supply and poor sanitary conditions ... It is nevertheless difficult to predict exactly to what extent an improved water supply will reduce the number of diseases or their incidence, partly because alternative vectors exist and partly because some of the diseases are epidemic in nature and may be temporarily absent in project areas.

The effect of water on health will depend on many factors, especially the prevalence of various diseases, and the extent to which villages use the water. To break the chain of transmission of certain diseases, improved excreta disposal methods must be provided together with improved water supply; the combination of these two measures will frequently be found to be the most effective means of control. Public health education will almost always be necessary to achieve full health benefits.

Provision of a safe and convenient water supply should help raise productivity as health improves and as less time and effort are spent on fetching water. In addition, the new water supply could help directly such agro-industrial activities as fruit and vegetable processing or fish freezing. But whether potential benefits to productivity are realized or not depends on individual cases. In some villages, the ill health of the labor force seriously affects agricultural development, whereas in others there is underemployment, and benefits may not be realized unless the water supply project forms part of an integrated rural development or similar project providing increased employment opportunities.

It is often argued that better rural water supply should reduce migration to urban areas, relieving their severe housing and other social problems. Even if a slowing of migration were desirable, there is little evidence that better water supply affects the rate of migration. It is possible that improved rural health and lower infant mortality could actually increase

migration, unless efforts to secure these benefits are coupled with rural development to encourage people to remain in their villages.

Rural water projects, which usually require subsidies from central government revenues or possibly from more prosperous urban consumers, often lead to income redistribution. Care must be taken that richer farmers do not benefit at the expense of the urban poor.

Although no supporting data are available, it seems likely that community involvement in the construction, operation, and funding of a water system would strengthen village institutions, and help villagers in dealing with other development decisions.³

The situation in Latin America and the Caribbean

The Governments of the Americas have recognized the importance of extending sanitary services. In 1961 they established regional goals for the 1960s in the Charter of Punta del Este signed in Uruguay in August 1961. When the Ministers of Health drew up their Ten-Year Health Plan for the Americas (1971-80) at their III Special Meeting at Santiago, Chile, in October 1972 they reviewed the situation and recommended goals for the 1970s. They further strengthened their recommendations at their IV Special Meeting at Washington, D.C., in 1977, when the concept of primary health care was elaborated and emphasized. Since sanitary facilities and their acceptance were strongly incorporated in this endeavor, the ground was prepared for undertaking the water and sanitation program of the 1980s.

Primary health care was defined as a strategy for extending health services coverage. It entails a combination of activities designed to satisfy basic community needs. To accomplish this, it is necessary to bring together, at the community's level and in accordance with its socioeconomic and cultural characteristics, those elements required to produce a significant impact on the health, well-being, and economy of its members.

This basic strategy for developing primary health care is equally applicable to the provision of sanitary services and has been used in this context in several countries. The emphasis is on community participation and intersectoral action. The Directing Council of PAHO has already recognized that satisfying a population's basic needs requires concerted action by all development sectors and that health programs must advance hand in hand with other community development programs. This agreed principle is, in fact, a charter for the water and sanitation effort of the coming decade.

What is the situation confronting us in Latin America, where more than a third of a billion people live? The average birth rate of 36 per thousand population is high; the average death rate of 9 is low. By the year 2000 the area's population may double and reach over 600 million people.

Of special interest is the infant mortality rate of 84 per thousand live births and the life expectancy at birth of 62 years. Sixty-one per cent of the population is urban, while the per capita gross national product is \$1,100.

The bare statistics are formidable in themselves, yet they conceal tremendous differences between the countries in the Region. Birth rates vary from a low of 19 to a high of 47, infant mortality ranges from 20 to 157, death rates from 5 to 18, and life expectancies from 48 to 72, for example. These differences point up the complexities of strategy formulation and the need to avoid faulty generalized solutions of limited applicability.

Similarly wide disparities exist between and within countries in proportions of urbanized population, which vary from 15 to 83 per cent. Equally wide ranges--from \$200 to \$3,310--appear in per capita gross national products. Access to safe water shows similarly great differences. The limited listing of any appropriate criteria makes abundantly clear that strategy will actually need to be site-specific

The challenge now before us is mainly to provide rural and periurban water supply and excreta removal. Although urban facilities are all too often poorly maintained and operated, their problems are highly visible and governments can correct them if they wish. In addition, money and skills are usually more available and obvious in urban than in rural areas. To rectify rural deficiencies, detailed knowledge of local conditions is a prime requisite. No escape is possible from myriads of microscale construction projects and the equally difficult task of operation and maintenance. These in turn will require a new look at stimulating local motivation and innovation, manpower availability, institutional structure, and local resources in money and equivalent labor services.

Underlying these efforts, it is generally agreed that the term "rural water supply" needs to be broken down for a better understanding of its implications, since in different countries it may apply to one or more of the following groups: (1) dispersed population best served by individual water sources; (2) small villages with distribution through public fountains; or (3) villages with concentrated populations in which water is distributed through public fountains or household connections.

This and many similar classifications emphasize the important differences in density or "geometry" of living and the factors determining the design, construction, and operation and maintenance of facilities.

The prospect for future action in the Americas seems almost intimidating, but the record of past accomplishments should guarantee future success, even though under increasingly difficult rural circumstances. Among the so-called developing regions of the world, the Americas surpass all others in their record of providing sanitary facilities.

The population served with water rose from 66 million in 1960 to 196 million in 1976. During that period, \$6 billion was invested in water and sewerage. It is significant that 70 per cent came from national and local funds and 30 per cent from outside sources. The Inter-American Development Bank invested over \$1 billion in loans, and during 1977 alone it processed 10 loans for more than \$200 million. The World Bank has similarly made loans aggregating hundreds of millions of dollars.

These amounts appear astronomical to some who are unfamiliar with these fiscal processes. They are illustrative of the saying that "where there is a will there is a way." If the past is prologue to the future, what are the principles and methods that must guide us during the next decade of sanitation progress?

Motivation and commitment

Before one undertakes to provide facilities for great numbers of people in urban, urban-fringe, and rural areas, it is axiomatic that a political will to do so must actually exist. Such motivation, at all levels of government and within the communities themselves, must be stimulated and accepted in order to materialize. A commitment presupposes understanding, evaluation of health, economic, and social benefits, and a personal and community assumption of responsibility. These essential ingredients are easy to list but most difficult to develop and use.

If and when such purposeful goals in sanitation are accepted, the necessary ingredients for carrying projects out are adequate human, technical, institutional, and financial resources. Determination of local needs is the basis for planning these resources, and it may be assumed that each country is sufficiently aware of its needs to move forward without spending years surveying them. So much must be done in such a short time that one need not search for perfect data from which to develop grand plans.

The cost-benefit features of water supply and sanitation service have been the subject of endless debate. Advocates of such facilities have subconsciously assumed that easily available safe water for drinking and washing pays dividends in disease prevention, reduction in lost labor, improved work efficiency, savings in hospitalization costs, more tourism, and general promotion of rural development. Sick people are no asset to economic or social development, and lost children are more than a cause for sorrow: their deaths age a community and destroy its future vitality.

Our pressing concern is how motivation and commitment can be upgraded and created. Too often, only national or regional officials try to do so. Important as this is, it marks only a beginning. Even at these top levels, the participation of ministries other than health is a major but neglected requirement. It is uncommon for public works, planning, and finance ministries to be partners in the program envisioned for the 1980s. Without them, national and regional commitment is unlikely to occur. Continuing and frequent dialogue between ministries jointly responsible for local development activities is essential for real progress.

The most important participants by far are local residents. The hundreds of millions of rural residents require most attention. Some have described the problem as one of "rural development," while others more accurately choose to call it "rural reconstruction." Whichever term is used, the issue remains how the peasant farmer, artisan, or mother can be made conscious of the need for sanitary facilities. What prompts him or her to want, demand, and maintain previously unavailable facilities?

Merely providing facilities does not mean using or maintaining them. Failures are known, even if overdramatized. Successes are less publicized, but equally pregnant with guiding lessons. A few examples are summarized in Appendices I, II, and III as well as IV, a selected bibliography. They merit detailed examination and use by the Ministers and their staffs because they provide valuable lessons and choices as to the best courses of action in different countries.

The use of mass education in the move toward our objective is not new. The examples noted herein represent historical approaches initiated in some areas as far back as the 1920s. The techniques of mass education are difficult. Rarely does it come about only through the intent, fiat, or commitment of senior governmental leaders. Its seed is there, but its development is local and earthy.

The early decision of some countries to leave the "ivory tower" and address the problems of the thousands of villages at their level was one made jointly by public, private, and academic professionals. Their mode of action is in principle appropriate to the problems of the Americas.

Sufficient experience has now been accumulated, in the world at large and in the Americas in particular, to warrant listing some general guiding principles. These are paraphrased from recent relevant remarks by Y. C. James Yen, founder of the International Institute of Rural Reconstruction:

- (a) Integration of sanitary facilities into positive rural reconstruction requires, not only the existence of an overall plan, actual living and working with the people themselves. An illiterate or a sick farmer is a poor producer. The combined correction of both deficiencies brings major dividends.

- (b) Poverty in money is not the most serious constraint. An overriding one is finding the right people to work in the villages. One of the long-term, and successful, workers in this field, speaks of the 4 C's--competence, creativity, commitment, and character.
- (c) Indigenous leadership is a first requirement. Its importance may be illustrated in the experimental undertakings in Colombia and Guatemala. Both of these may well be training grounds for representatives from other countries. Often the general local structure combines civic leaders, professionals in relevant major disciplines, and educated youths as village-level rural reconstruction workers.
- (d) Lessons from failures and successes.
 - i Go to the people. The big gap between the educated few at the top and the uneducated millions at the bottom.
 - ii Live among the people. "You can't blow in and blow out" like a tourist.
 - iii Learn from the people.
 - iv Plan with the people - not a dictatorship, but a partnership.
 - v Start with what they know, not with what we know. "Peasants may be illiterate, but they are intelligent and practical."
 - vi Build on what they have. Many projects have failed because they have lacked roots. They collapse when outside aid is withdrawn.
 - vii Not relief but release. Relief in times of disaster is necessary. As a permanent policy it is unjustifiable. Opportunity is lacking to use peoples' potential mental power, productive power, physical power, and organizing power.⁴

These seemingly simplistic principles conceal great verities as well as complexities. Acceptable as they are, they inevitably lead to several basic requirements delineated in greater detail below.

Management

Few facilities are likely to be provided in consonance with economic development unless the will to do so is strong and some kind of institutional structure is created at all levels of society. Continuity of purpose, execution, operation, and financing requires a conscious managerial entity. Without it, local installations will fail.

Most governments of developing countries and technical assistance agencies are now aware of the great importance of such structure. The argument for it is well put in a recent statement on the subject by Raymond B. Isely and Jean F. Martin, of the University of North Carolina:

The successes and failures of community development schemes over the past few decades have highlighted the fact that lasting results can only be achieved with the active participation of the community itself. In the health sector as in other sectors, working "on" or "for" people is bound to be less fruitful than working with informed, active participants in the development process. In south-central Cameroon, the participative approach was successfully used to organize village health committees. The accomplishments of the committees--latrine construction, water source protection, and similar projects--were gratifying in themselves. But equally gratifying was the catalytic effect that community organization seemed to have on other aspects of rural life. The village health committee can serve as a springboard for rural development.⁵

Similar experiences have occurred throughout the Americas.

To avoid the pitfalls of earlier community development schemes, organizers are now turning to a combination of good psychology, convincing management techniques, and political skills. Examples of success are now available in objective measurements of the numbers of latrines constructed and used, water sources built and protected, and improved personal hygiene.

The prevalence of village health and other local improvement committees makes it possible not only to increase the acceptance of sanitary facilities, but also to encourage applied health services research, promote good nutritional practices, undertake epidemiologic studies of diarrheal diseases, and provide oral rehydration salts. Institutional structure, often hitherto nonexistent, provides machinery for essential local activity while simultaneously linking services with the rest of the community's interests and life. Integration promises more rapid expansion of health and other facilities in the future.

Planning and motivation, even if available at the national level, do not guarantee that projects will be carried out in the village. The two levels are not synonymous, and in some countries might in fact contradict and be remote from each other. Local preferences need to be identified to determine if they agree with national policy or deviate from it so much that other goals must be sought in the village. It is not always true that people at the top understand the desires and actions of people who are psychologically and geographically removed from them. A national "umbrella" policy is primarily a statement of guiding principles and should be sufficiently flexible to permit sharp deviations at the local level. Local autonomy is valuable in the fields of water supply and sanitation and needs to be reviewed, strengthened, and used.

When such local participation is assured, it will undoubtedly prevent the construction of oversophisticated systems. Past deficiencies, such as lack of expensive spare parts, unavailability of trained manpower, major water losses through leakage, and generally poor overall maintenance and operation, should certainly decrease and perhaps gradually be eliminated. When people realize not only their responsibility but the financial penalties resulting from such deficiencies, the number of successes should by far exceed the number of failures.

Training

Training in sanitary engineering and sanitary inspection in the Americas was once adequately sponsored by the countries themselves and by external aid agencies, and manpower requirements were generally met. Recently such training has not kept pace with the need for it. Although much has been done, especially through continuing education and postgraduate programs, which have been mainly for professional staff, the present number of professional, intermediate, and village personnel is inadequate in most countries. Traineeships and fellowships have been seriously curtailed on the assumption that sufficient effective leaders and workers can be produced locally.

Rejuvenation and expansion of training is a prime requirement. For the most part, this task must be quickly and aggressively pursued. It should be carried out within many of the countries and on occasion at regional centers. Educational resources outside the Caribbean and Latin America may be used to train a few potential leaders.

Even if large sums of money are available from many sources, important as that is, it will not assure success of the programs. Personnel must be recruited, trained for their specific duties, and retained in the program once trained. To accomplish this, government must be able to compete for such staff through salaries, job stability, and opportunities for advancement--all unfortunately too often missing in many countries. Yet the experience of the 1940s and 1950s in the Americas

shows how these personnel objectives can be attained. The Cooperative Services of those decades, using their own wage scales and administrative procedures, produced dozens of professionals who are now heads of water and sanitation authorities and consulting firms, leaders in universities, ministers of health and public works, and in one country an assistant to the President. The methods of that era must be recaptured in some countries and newly created in others.

Training unskilled and relatively uneducated people to supervise sanitary facilities in rural communities requires special attention. Such individuals are the key to adequate local participation. They have proved to be an invaluable resource in translating purpose into intelligible understanding, acceptance, and use by rural people. The capacities of such vast groups have been insufficiently tapped. The task of the village worker is not only to release these energies for the functions here discussed, but to be responsible for operating and maintaining the system, even if it consists of only one or two hand pumps.

Such training will be difficult and time-consuming. The sooner it is undertaken, the more likely it will be to provide skills essential for present local goal accomplishment.

Educating members of the health team, particularly field workers, to better understand the relationships between health and water supply, excreta disposal, food sanitation, and personal hygiene, as part of the primary health care effort, would go a long way to improve the health of the people. Such training should clarify the role and benefits of primary health care. Methods and procedures to communicate this knowledge to local leaders and the general public need to be developed and applied.

Appropriate technology

Careful thought must be given to low-cost sanitation technology options. The much used phrase "appropriate technology" should not imply that the sophisticated technology of developed countries is never to be used. It does emphasize that the technology of systems used in developing countries should suit the size, nature, culture, history, and capacity of local people, whether they are rural, fringe, or urban. The choices cover a wide spectrum of methods, materials, systems, and operations. As has so frequently been stressed, generalized formulas or package systems are ill-adapted to disparate conditions.

Barbara Ward recently distilled the essence of these dilemmas in her foreword to a volume prepared for the Canadian International Development Research Centre and the World Bank. She said:

So, do we face a painful dilemma--the desperate need for "clean water," the impossibility of getting a needed base for it

in sanitation? Happily, there exists a wide range of effective alternatives between the unhygienic pit privy and the Western waterborne sewerage system. These systems are generally far cheaper. Most of them do not demand a heavy use of water. And many make creative use of the nutrients in human waste to fertilize fields and fish ponds or to contribute to biogas production--and can do this without serious risk of returning pathogens to human food or drinking water.⁶

Accepting the oversimplifications in this statement, its point is that one should seek out and apply that technology most applicable to that segment of society for which it is provided. The alternatives now being pressed are often those already in use in many developing countries and once widely used in every industrially developed country at the turn of the 20th century. In the latter, such rudimentary facilities were naturally superseded by more complex methods and equipment as growth occurred, money became more available, and facilities grew more hazardous and obsolete. It is important to leave options open for such evolution in the future so that people may gradually move from primitive to advanced systems as their standard of living rises.

The institutional machinery for meeting the obligations of the 1980s should be responsible for distributing pertinent technical information, training activities, and arranging the exchange of experienced individuals among countries. These practices are already common and need not be relearned. What is required is that all of the devices and measures available for the program be most widely distributed as early as possible.

There are ample precedents for the actions outlined here in the Region itself and, strangely enough, they existed a century ago in developed countries. Their revival provides a degree of novelty for the present generation. It lends assurance for its validity by a long history of village autonomy, responsibility, and accomplishment. Its rediscovery is important in order to correct the neglect of the past.

Broad extension services will have to be created as the base of the management structure, and even in small countries these will run into the hundreds. The personnel providing such advisory services represent the rich resources necessary to help local citizens develop their own methods and procedures that elsewhere were demonstrably successful many years ago.

Finance

Those countries that have made the most progress in supplying their people with sanitary facilities have had several characteristics in common. Each had budgeted increasing amounts of money and had firm policies of generating funds from many sources. Each also had cadres of

trained and experienced personnel. And perhaps most important of all, water and sanitation activities occurred within a framework of a clearly defined national policy. Financial policies and strategies were an essential part of their accomplishments.

The targets proposed for the decade ahead in Latin America and the Caribbean will require large amounts of capital investment. Per capita construction costs vary widely from country to country and even within countries and from one solution to another. WHO estimated in 1977 that in urban areas a house water connection cost about \$121, a public stand-post \$48, sewerage service \$112, and a household system \$35. In rural areas, water cost \$26 and latrines \$5 per capita. Regardless of whose estimate is accepted, in the aggregate more than \$10 billion will be needed for urban and \$2.5 billion for rural water facilities in the 1980s.

Excreta disposal will require similarly large expenditures, ranging from \$6 billion in urban projects to simpler installations in rural areas costing as much as \$700 million. The total will approach \$6.7 billion.

The probability of meeting the goals set differs greatly from country to country. In some, a continuation of existing progress will probably be sufficient. Elsewhere, expenditures will have to be greatly multiplied and more time may be needed to fulfill the goals. Efforts under these circumstances should not be reduced. Instead, one should seek ways to ease the financial burden on poorer people. Those more economically fortunate have many sources of money.

The major problems in rural water supply programs are those of financing, securing suitable personnel, and developing adequate institutions. Of these obstacles, financing--intimidating as the figures are--is not an impossible constraint. Money, of course, will be required, but many sources can provide it. Failures to seek them out and levy reasonable and adequate charges on water users account for past difficulties and slow installation. It will be essential to develop suitable financial policies and develop effective ways of collecting charges. Resistance to such procedures is to be expected since the concept of free water is old and defended, but acceptable local repayment policies can be adopted once they are understood.

Realistic programs must be defined now for the decade 1981-90. Many projects contemplated in that period will take as long as five years to consummate. Shortening that interval is both desirable and essential, but it will take strenuous activity to accomplish.

An examination of possible sources of money is necessary. Among these are funds from local, provincial or state, and national governments, foreign governments and international lending agencies, and private organizations. Historically, policies have been developed by lending banks which limit their loans to no more than 50 per cent of total

project costs. Their emphasis is on insuring that local fiscal participation is significant. Arranging financial support is ordinarily preceded by an engineering and feasibility analysis of a project and the development of a carefully documented financing plan. In seeking necessary funds, subsidies will be inevitable in some instances, particularly in rural areas. They may range from zero to as much as 50 per cent where local poverty is great. Care should be taken not to make subsidies a universal policy because repayment capital, operation, and maintenance costs guarantees permanent local interest and responsibility.

It is obvious that "softer" loans must be sought for rural and less privileged areas. Fortunately, both the Inter-American Development and World Banks have recognized this and for some years have lent money at low interest rates, repayment periods spanning several decades, and delayed repayment during the first five years.

Some countries have also developed procedures for identifying and preparing desirable projects. These have been carried out through national financing of a revolving fund nature and matched by local and international sources of money. With large amounts of money potentially available, it has been possible to require properly defined tariff structures to guarantee sufficient revenue to repay loans, operate and maintain systems, and even to provide for depreciation and replacement of obsolete facilities.

Such orderly machinery for meeting goals is not universally available, but elements of it are adaptable to less economically favored countries. They too may begin activities that have been eminently successful in neighboring countries.

References

1. Report of Habitat: United Nations Conference on Human Settlements, 31 May-11 June 1976. New York, United Nations, 1976. P. 50.
2. Report of the United Nations Water Conference, Mar del Plata, 14-25 March 1977. New York, United Nations, 1977. P. 3.
3. Village Water Supply. Washington, D.C., World Bank, March 1976. Pp. 14-16.
4. "A Conversation with Y. C. James Yen." Report of the International Institute of Rural Reconstruction 11(2):2-3, Fall 1978.
5. Raymond B. Isely and Jean F. Martin, "The Village Health Committee: Starting Point for Rural Development." WHO Chronicle 31 :307, August 1977.
6. In: Witold Rybczynski, Chongrak Polprasert, and Michael McGarry, Low-Cost Technology Options for Sanitation. Ottawa, International Development Research Centre, 1978. P. 3.

Appendix I

BRAZIL'S NEW NATIONAL SANITATION PLAN (PLANASA II)*

By the mid-1960s, Brazil's leaders, cognizant of the ever-quickenning growth of their urban population, began reorienting and strengthening the country's water supply and sanitation sector. In the rural areas, components of the Ministry of Health--especially the Fundação Serviço Especializado de Saúde Pública (FSESP)--had been responsible for rural water supply and sanitation program development and implementation, a responsibility it retained. FSESP's contribution in this field since the early 1940s has been significant, especially in the less developed states.

To come to grips with the urban problem, the National Sanitary Works Department and the U.S. Agency for International Development signed an agreement on 26 April 1965 creating the National Revolving Fund for Water Supply Financing. To administer the fund, the Brazilian Government established the Executive Financing Group (GEF), which developed operating policies and mechanisms and invested Cr\$220 million (\$50 million) from 1965 to 1967 in water supply systems for 16 cities. Even with this increased spending, however, only 22.8 million people (roughly half the urban population) benefited from water supply services and fewer than three-tenths from sewerage.

In 1967, GEF's responsibilities were transferred to the newly created National Sanitation Fund (FISANE), responsibility for whose operation was assigned to the National Housing Bank (BNH). The financial resources of the late GEF and of the new FISANE proved inadequate to take care of the sector's needs, however, and so in 1968 the Government created the Sanitation Financing System (SFS). BNH was designated its central organ, with responsibility for regulating and stimulating its activities.

In contrast to that of GEF, SFS's policy was to establish and develop state revolving funds (Fundos de Água e Esgoto, or FAE) from state and BNH resources to finance programs carried out by state sanitation companies. Under the new policy, 238 cities in 15 states benefited from water supply systems and Cr\$2.2 billion was invested between 1968 and 1971.

*This document has been prepared by PAHO on the basis of published information. Its sole purpose is to illustrate the salient and positive features of the program; it is not an official document.

On the basis of its experience and additional studies, SFS undertook an examination in 1971 of the main variables affecting the development of the country's basic sanitation services. The resulting operational improvements paved the way for the National Sanitation Plan (PLANASA), whose broad objective was to provide basic sanitation services to the people of Brazil.

An agreement between the Ministries of the Interior and Health in 1973 established a basis for joint activities. The Ministry of the Interior became responsible for promoting and developing PLANASA's activities, while the Ministry of Health established and enforced water quality standards and provided health education, training, and technical assistance. In the same year, Brazil and the Pan American Health Organization signed an agreement under which the latter was to provide technical assistance to the state companies.

To eliminate some of the obstacles to rapid water supply development, PLANASA not only provided financing but also helped develop state companies' infrastructures and in general streamline the logistic support they required. This included technical assistance in institutional development, training, and the production of building materials.

In 1975, the Social Development Council of Brazil, composed of the Ministers of Planning, Education, Labor, Health, Social Welfare, and the Interior evaluated PLANASA's progress from 1971 through 1974. It concluded that water supply development in large and medium-sized cities was satisfactory but that both water supply and sewerage services in smaller communities needed to be improved.

The Council recognized that accelerated urban development was causing serious health and social problems and affecting the country's quality of life. It therefore recommended to Brazil's President that he approve a proposal for a revised National Sanitation Plan (PLANASA II), which he did on 16 April 1975.

PLANASA II's goals were more ambitious than those of its predecessor in that they were quantified and extended to smaller communities. They included providing potable water for more than 80 per cent of the total urban population in at least four-fifths of Brazilian communities and all metropolitan areas, adequate sewerage to metropolitan areas, state capitals and larger cities, and simple sewerage services to cities and smaller communities to the greatest extent possible. The target date for all these activities was 1980.

PLANASA has made major progress since its creation in 1971. In December 1970, 28.7 million people (53 per cent of the urban population) received water through house connections;¹ by 1977, 49.4 million urban residents (75 per cent of total) were receiving water in their homes, and

46 per cent of the rural population had house connections or easy access to water.² In 1973, fewer than 600 of the country's 3,954 municipality seats were included in PLANASA; by 1975 the number had jumped to 1,000; and by early 1978 it had reached 2,000. Only 34 per cent of the urban areas had sewerage by 1977, however.

PLANASA II's efforts are now aimed largely at smaller communities since 85.1 per cent of the country's 7,857 communities have populations below 5,000.

PLANASA II's basic concept remains the same as when it was created: each state has only one basic sanitation authority linked to the PLANASA system. State authorities are responsible for preparing overall plans for building, operating, and maintaining water supply and sewerage systems and for fixing water rates according to criteria established by the federal government.

The new goals emphasize that state governments give state water supply and sanitation authorities adequate technical, organizational, administrative, and financial resources. PLANASA's basic finance mechanism has remained essentially the same over the years, but its interest rate has been reduced from the range of 4 to 8 per cent to 2 to 7 per cent. The lower rates are applicable in the less developed states.

PLANASA's strategy for attacking Brazil's water supply and sanitation problems includes simplifying engineering designs and construction methods and processes, and standardizing equipment, accessories, and treatment units to lower capital and operating costs without adversely affecting water quality. Since it is expected that services in small communities may not pay for themselves, realistic water rates are established throughout each state to offset deficits and insure system financial self-sufficiency. In other words, overall costs are balanced by charging larger consumers higher rates and the poor lower rates. To insure the whole system's viability, provision is also made for federal or state assistance in making up such deficits through loans or other mechanisms if necessary.

Health education is to be introduced in the communities to make them conscious of the benefits of water and to get them involved in helping build and maintain water and sanitation services. The provision of water supply can proceed even with little local participation, however.

The legislation underlying PLANASA II's policy includes new water quality criteria to be drawn up by the Ministries of Health and the Interior, water and sewerage rates, financing for water supply and sewerage construction, and coordination and control mechanisms.

The Plan's success will depend to a large extent on getting the population to make maximum use of the services provided. The Minas Gerais plan includes provision of water supply services to most of the state's large and small communities to take advantage of economies of scale, especially in operation and maintenance. Groups of communities around a focal city will operate as a subsystem within the statewide system, and smaller outlying communities will be satellites. Models for administering and maintaining the overall system to derive the greatest benefits are being developed.

Efforts in the State of Sao Paulo have been directed toward the gradual incorporation of small communities in the state water authority. One hundred twenty-three were included between October 1977 and December 1978, and most now have new water supply systems. All systems not now in operation are expected to be functioning early in 1979. The state's planners hold that less costly but still workable solutions must be adopted to solve the problems of small communities. On this premise, standardized engineering designs have been developed and are being applied in most such communities. It was determined that except for identifying and developing water sources, about 95 per cent of the systems can be equipped with standard units. This has resulted in simpler systems, more rapid construction, and lower installation and operation costs.

The Sao Paulo state authority has created a specific unit to deal with small communities. It has engineering design and project preparation, construction, and administrative support groups which work in unison to accelerate system construction and operation.

References

1. Pan American Health Organization, Annual Report of the Director, 1972. Washington, D.C., 1973.
2. Pan American Health Organization, Report of the Director, 1974-1977, Washington, D.C., 1978 Washington, D.C., 1975.

Sources

Document E.M. No. 003-CDS prepared by the Social Development Council and approved by the President of Brazil on 16 April 1975.

"Implantação de Sistemas de Abastecimento de Agua em Comunidades de Pequeno Porte" ("Installation of Water Supply Systems in Towns"), a

position paper prepared for a June 1976 water supply seminar at Belo Horizonte, Brazil, sponsored by the Banco Nacional de Habitação, Associação Brasileira de Engenharia Sanitaria (ABES), and Companhia de Saneamento de Minas Gerais.

"Projeto de Saneamento Básico" ("Basic Sanitation Project"), a position paper prepared for the June 1976 water supply seminar at Belo Horizonte, Brazil, by the Companhia de Saneamento de Minas Gerais.

Eng. Paulo Gomes Machado et al., "A Experiência da SABESP no Programa de Abastecimento de Agua para Comunidades de Pequeno Porte," DAE (official journal of SABESP) 38(119):165-168, 1978. (Document presented at the ABES Congress in Manaus, Brazil, 21-26 January 1979.)

Engenharia Sanitária (journal of the Brazilian Sanitary Engineering Association (ABES)), July/September 1978.

Appendix II

WATER SUPPLY AND SANITATION PROGRAMS IN COLOMBIA: COMMUNITY PARTICIPATION*

The objectives of the Colombian Government's Social, Economic, and Regional Development Plan for 1975-78 included the provision and maintenance of adequate water supply and sewerage services throughout the country. Rural water supply and sewerage activities fall under the National Rural Sanitation Program (NRSP) and include construction of small water supply and sanitation facilities, sanitary units for schools, and latrines.

Colombia's Ministry of Health has two water supply and sanitation agencies. The National Institute for Municipal Development (INSFOPAL) operates in towns and cities of more than 2,500 population, and the National Institute of Health (INAS) operates in rural communities with populations of between 50 and 2,500. The health services of various departments and private groups also operate in rural areas, and 24 municipal agencies are responsible for water supply and sewerage in the major cities.

The NRSP began modestly in 1963 but gained considerable momentum after a study of environmental sanitation in the country's rural areas was made in 1968 with the cooperation of the Pan American Health Organization and INAS, which became its executive agency.

The survey, which included population studies, water source identification, and evaluation of existing water supply, excreta disposal, and other sanitation programs and institutions, was the basis for NRSP's current activities.

The methodology used by the NRSP comprises five consecutive stages, in each of which there is distinctive community participation. They are: (1) determination of a community's economic, social, cultural, and sanitary characteristics (problems, resources, attitudes, sources and means of water supply, capacity to pay, and the like); (2) project preparation, including engineering plans, cost estimates, and materials; (3) motivation, promotion, and organization of the community to participate actively in the construction; (4) construction, and; (5) administration and supervision.

*This document has been prepared by PAHO on the basis of published information. Its sole purpose is to illustrate the salient and positive features of the program; it is not an official document.

In the last stage, the operation and management of the service are transferred to a management board of elected community representatives. NRSP continues to give the board guidance and advice on the operation and management of its service. The board has the benefit of the continued advice of the promoter who also serves as liaison with the national Program organization in obtaining assistance for repairs, expansions, or other needs.

A key element in the Program is a well-trained promoter with knowledge and understanding of community organization and cooperation and the technical and financial aspects of rural water supply construction and operation.

Community participation represents about 20 per cent of the total construction costs in labor, local materials, and cash. Based on an assessment of its financial capacity, the community further assumes a loan for up to 40 per cent of the project's cost. Loans are for 10 to 15 years at 6 per cent annual interest. Each family pays a monthly charge which helps to pay off the loan and cover operational charges. INAS contributes the remaining 40 per cent of the construction costs.

A special characteristic of the program is the payment of house connection costs in labor or local materials.

The level of activity of the rural program is illustrated by the following figures. In December 1976 the country had 7,808 communities with populations of between 50 and 2,500, of which 3,509 (45 per cent of the total) had water supplies. Although its budget was limited in 1976, INAS completed 215 water supplies.

Community participation is not limited to rural areas. In Bogotá, for example, mechanisms have been developed to provide services to marginal populations. The first stage is the provision of public fountains for water and latrines for excreta disposal. As a community's organization improves over the next year or two, it requests house connection services. The Bogotá Water and Sewerage Authority (Empresa de Acueducto y Alcantarillado de Bogotá) draws up an annual program including construction of the water supply system and cooperates with the community in providing house connections. In most cases, the Authority provides funds and recovers them through service charges in about 30 months. Once water is provided, the community requests sewerage service through the same mechanisms. Because of its limited resources, the Authority usually cannot meet all the demands. Those most in need and better organized groups finance their water systems through communal action by providing materials, labor, or money. As neighborhoods advance economically, they usually undertake other works such as street paving and storm sewer construction.

The progress made in recent years is seen in the coverage reported in November 1977, when 64 per cent of the total population had water. In the urban areas, 78 per cent had house connections and 9 per cent had public fountains, while 65 per cent had sewerage. In the rural areas, 33 per cent were reported to have water supplies.

Sources

Jaime Mora Ramírez and Orlando López Orozco, "Participación Comunitaria y Saneamiento Básico Rural en Colombia," Carnets de l'Enfance (UNESCO), No. 34, April-June, 1976.

Pan American Health Organization, Report of the Director, 1974-1977. Washington, D.C., 1978.

República de Colombia, Ministerio de Salud, Instituto Nacional de Salud, Informe de Actividades Durante 1976. Bogotá, July 1977.

República de Colombia, Ministerio de Salud, Instituto Nacional de Fomento Municipal, Informe sobre Programas de Agua Potable, Alcantarillado y Desechos Sólidos. Bogotá, 17 November 1978.

República de Colombia, Ministerio de Salud, Estudio Sanitario de Comunidades Rurales, Anexo 5: Manual Metodológico. Bogotá, 1972.

República de Colombia, Empresa de Acueducto y Alcantarillado de Bogotá, "Un Programa Integral de Acueductos y Alcantarillados para Bogotá, Colombia." Bogotá, (1976). (Report prepared for the XIX National Congress on Water Supply and Sewerage, Valledupar, Colombia, October 1976.)

Appendix III

EVOLUTION OF RURAL WATER SUPPLY PROGRAMS IN VENEZUELA*

The Venezuelan Constitution gives municipalities responsibility for building and maintaining water supply services. Aware of the many problems local governments had encountered in providing and maintaining their own systems, the central Government has given major and ever increasing attention in the last 30 years to providing adequate services to the population.

One of its early steps was to make the the Ministry of Public Works' Directorate of Water and Sanitary Works responsible for national water supply development. This arrangement persisted until 1943 when the Government created the National Institute of Sanitary Works (INOS), which was to give primary attention to towns and cities with more than 5,000 inhabitants.

Because much of the country's population lived in smaller communities, most of which had no water services, the Inter-American Public Health Cooperative Office (OCISP) was established in 1943 with the support of the U.S. Government's Institute of Inter-American Affairs to attend to their water needs. Operating as an arm of the Ministry of Health and Social Welfare, it laid the foundation for the country's future rural sanitation programs. In 1959 its functions were transferred to a newly created Rural Water Supply Section in the Ministry's Division of Sanitary Engineering. A year later the Directorate of Malaria Control and Environmental Sanitation was established and absorbed this program, and in 1961 the Ministry raised its Rural Sanitation Section to divisional level and developed guidelines for expanding its activities.

The main objective of the program was to provide rural residents an adequate and continuous supply of water meeting minimum physical, chemical, and bacteriologic requirements at a price they could afford. The systems were designed according to new criteria such as provision of house connections, a 20-year useful life, and the use of better building materials. Mechanisms for financing and differential water tariffs were also established.

*This document has been prepared by PAHO on the basis of published information. Its sole purpose is to illustrate the salient and positive features of the program; it is not an official document.

In 1974, the Division of Sanitary Works was organized and included the Departments of Rural Water Supply, Rural Housing, and Rural Sanitation. The division's responsibilities are to direct and coordinate the various activities of the rural water supply program, which is jointly conducted with other national agencies and the state governments.

This progressive institutional development of the rural water supply program and the large investments the Government made facilitated the extension of its coverage. The Inter-American Development Bank and the United Nations Children's Fund supported the program in various phases. With these additional funds the program developed rapidly. Three thousand forty communities with less than 5,000 population were provided with service between 1959 and 1976. The total population in these communities was estimated at 1,946,956, about 85 per cent of whom had household water connections. The total investment was more than \$160 million (712 million Bolívares) during the period and 7 per cent of the rural population had sewerage by 1976.

The difficulties in administering the water supplies, for which municipalities were responsible before 1961, resulted in the creation of autonomous management boards in the municipalities where the water supply services had been organized. At the end of 1974 there were 694 boards serving 1,162 communities with 900,000 people and 150,198 house connections. Since some of the difficulties persisted, the Ministry of Health and Social Welfare, after an analysis of the program, created an Office of Rural Water Supply Administration, Coordination, and Control responsible for managing and operating the country's small water supply systems and gradually eliminated the boards. It was felt that this new approach would result in more efficient management and operation of the systems.

In the urban areas, the National Institute of Sanitary Works is responsible for water supply and sewerage disposal. In December 1976, Venezuela reported that 6 million people (63 per cent of the urban population) had house connections and 3 million (31 per cent) had easy access to water, a combined total of 94 per cent. In the same year, 5 million urban residents (52 per cent of the total) had sewerage.

Sources

"Acueductos Rurales," Informe del V Congreso Venezolano de Salud Pública, Caracas, 9-16 October 1976. Caracas, 1977.

Ing. Otto Díaz Quijano, "Abastecimiento de Agua, Administración y Organización de Acueductos Rurales." Caracas, (1977). (A paper presented at the XXXIV International Course on Malaria and Environmental Sanitation.)

Pan American Health Organization. Report of the Director, 1974-1977. Washington, D.C., 1978.

Appendix IV

SELECTED BIBLIOGRAPHY ON WATER SUPPLY AND SANITATION

Planning

ECUADOR. Ministerio de Salud Pública. Plan Nacional de Saneamiento Ambiental. Quito, Instituto Ecuatoriano de Obras Sanitarias, s.d. 1 v. (varias paginaciones).

HARRIS, Robert R. A summary of guidelines and criteria for water supplies in developing countries. Journal AWWA, 62(9):561-562, Sep. 1970.

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT. Agua potable para poblados. Documento del Banco Mundial. Washington, D.C., Banco Mundial, 1976. 117p.

LAURIA, Donald T.; KOLSKY, Peter J. & MIDDLETON, Richard N. Design of low-cost water distribution systems. Washington, D.C., World Bank, 1977.

OROZCO O., Guillermo. Consideraciones para un plan de abastecimiento de agua para la población rural dispersa. Quito, Organización Panamericana de la Salud, 1974. 1 v. (varias paginaciones).

PANAMA. Ministerio de Salud. Programa de agua potable rural y de la construcción de letrinas, 1977-1980. Panamá, Ministerio de Salud, 1977.

PINEO, Charles S. Informe de los resultados del programa nacional de abastecimiento de agua en la República Dominicana, PLANAR. Washington, D.C., Organización Panamericana de la Salud, 1973. 26 p.

ZUNIGA, J.M. Planificación y programación de un proyecto de saneamiento ambiental rural. XI Seminario AIDIS (C.A.), 1977. 73 p.

DONALDSON, D. La planificación de sistemas de agua y saneamiento para pequeñas comunidades. Curso de Planificación y Programación de Saneamiento Básico Rural en Managua, Nicaragua, Nov. 1977. 28 p.

Administration

BOTTERI, Amadeo B. Manual de control administrativo y estadística de acueductos rurales. Tegucigalpa, OPS, 1975. 99 p. y anexos.

CAIRO H., Tito; ABREU, Jafet; ROSA, Tomás de la; GONZALEZ, Francisco; GARCIA, Fernando & ROMAN, Plutarco. Acueductos rurales en República Dominicana. Santo Domingo, Instituto Nacional de Aguas Potables y Alcantarillados, INAPA, 1974. 39 p.

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT. Agua potable para poblados. Documento del Banco Mundial. Washington, D.C., Banco Mundial, 1976. 117 p.

PANAMA. Ministerio de Salud. Programa de agua potable rural y de construcción de letrinas, 1977-1980. Panamá, Ministerio de Salud, 1977.

PINEO, Charles S. Informe de los resultados del programa nacional de abastecimiento de agua en la República Dominicana, PLANAR. Washington, D.C., Organización Panamericana de la Salud, 1973 26 p.

MEXICO. Primera reunión nacional de juntas de agua potable en el medio rural. Comisión Constructora, 1979. 191 p.

Financing

GARCIA, Fernando; CAIRO, Tito & ROMAN, Plutarco. Fondo rotatorio de acueductos rurales. Santo Domingo, Instituto Nacional de Aguas Potables y Alcantarillados, INAPA, 1974. 27 p.

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT. Agua potable para poblados. Documento del Banco Mundial. Washington, D.C., Banco Mundial, 1976. 117 p.

REPUBLICA DOMINICANA. Plan Nacional de Acueductos Rurales. Constitución del fondo rotatorio. 1969. 28 p.

UZIN, Luis. Manual de tarifas de acueductos rurales. Tegucigalpa, Organización Panamericana de la Salud, 1976. 1 v. (varias paginaciones).

SANCHEZ, L. Aspectos fundamentales en el financiamiento de obras de agua potable para el medio rural. 1976. 19 p.

SANCHEZ, L. El recurso financiero. XVI Congreso AIDIS (Santo Domingo), 1978. 28 p.

Design and Construction

MARTIN M., Luis. Consideraciones sobre diseños de acueductos para barrios marginales. Congreso Interamericano de Ingeniería Sanitaria, 14/ México, ago. 4-9, 1974. Caracas, Asociación Venezolana de Ingeniería Sanitaria, 1974. 10 p.

REID, Coffey. Appropriate methods of treating water and wastewater in developing countries. University of Oklahoma, 1978. 765 p.

DONALDSON, D. El enfoque masivo. Curso de Planificación y Programación de Saneamiento Básico Rural en Managua, Nicaragua. Nov. 1977. 32 p.

Operation and Maintenance

CARILLO, José M. Programa nacional de calidad del agua (área rural). Caracas, 1975. 34 p.

CONFERENCIA PANAMERICANA SOBRE MEJORAMIENTO DE LA CALIDAD DEL AGUA PARA EL CONSUMO HUMANO (SUR AMERICA), Sao Paulo, oct. 28-31, 1975. Informe final. Sao Paulo, OPS, CETESB, 1975. 1 v. (varias paginaciones).

LEON DE LA BARRA ROWLAND, Francisco. Consideraciones sobre la calidad del agua en comunidades rurales. Puerto España, 1976. 36 p. Presentado a la Conferencia sobre Mejoramiento de la Calidad del Agua para Uso y Consumo Humano del 30 de agosto al 3 de septiembre de 1976, Puerto España, Trinidad y Tobago.

MONTEMAYOR, Héctor M. Consumo doméstico de agua en comunidades rurales. Informe final de la primera etapa. Panamá, Universidad de Panamá, Facultad de Ingeniería, 1974. 84 p. y anexos.

PRADO C., Alcides Fernando. Análisis de dotaciones en poblaciones rurales; efectos de la instalación de hidrómetros. Panamá, IX Seminario Centroamericano de Ingeniería Sanitaria, 1973, 6 p.

INSTITUTO COSTARICENSE DE ACUEDUCTOS Y ALCANTARILLADOS. Optimización de sistemas. 1979. 292 p.

WORLD HEALTH ORGANIZATION. Guide to simple sanitary measures for the control of enteric diseases. 1974. 102 p.

JACOME, A. Manual de operación y mantenimiento de instalaciones y equipos en un acueducto. Organización Panamericana de la Salud. 1970. 128 p.

FRANCIA, J. Desarrollo del area de operacion y mantenimiento del alcantarillado de la ciudad de Asunción. Organización Panamericana de la Salud. 1979. 153 p.

CASTRO, A. Manual de mantenimiento preventivo para los sistemas de agua potable por bombeo de UNEPAR (Guatemala). Organización Panamericana de la Salud. 1978. 25 p.

Legal Aspects

COLOMBIA. Instituto Nacional para Programas Especiales de Salud. Reglamento de Juntas Administradoras de Acueductos y Alcantarillados Rurales. Bogotá, 1974. 75 p.

PANAMA. Ministerio de Salud. Reglamento de administración para los acueductos rurales. Panamá, Ministerio de Salud, 1976. 11 p.

Community Participation Aspects

ARGENTINA. Plan Nacional de Agua Potable Rural. Contenidos educativo-sanitarios aplicables en la etapa de funcionamiento del sistema de abastecimiento de agua potable rural. Buenos Aires, 1971. 1 v. (varias paginaciones).

CITIZEN participation for successful village water supply. Civil Engineering, ASCE, 48(8):68-70, Aug. 1978.

COLOMBIA. Instituto Nacional para Programas Especiales de Salud. Manual de procedimientos en promoción comunitaria para el Programa Nacional de Saneamiento Básico Rural. Bogotá, 1975. 120 p.

COSTA RICA. Ministerio de Salud; Ministerio de Planificación & PAN AMERICAN HEALTH ORGANIZATION. Costa Rica; extensión de cobertura de los servicios de salud en el marco de desarrollo socio-económico. Conferencia Internacional sobre Atención Primaria/ Alma-Ata, URSS, set. 6-12, 1978. San José, Ministerio de Salud, 1978. 68 p.

PINTO L., Luis Emilio. Promoción y relaciones públicas en los programas de agua potable y alcantarillado: un enfoque sociológico. Boletín OPS, 73(4):281-293, oct. 1972.

SALDANA, J. C. Manual de promoción y divulgación comunal. Tegucigalpa, Organización Panamericana de la Salud, 1975. 93 p.

SALDANA, J. C. Manual de procedimiento en promoción comunal. Tegucigalpa, Organización Panamericana de la Salud, 1975

ECUADOR. Ministerio de Salud Pública/Instituto Ecuatoriano de Obras Sanitarias. Guía didáctica sobre aspectos de saneamiento rural. 90 p.

Sanitation

BRADLEY, David J. & FEACHEM, Richard G. Environmental epidemiology and sanitation. Appropriate Technology in Water Supply and Waste Disposal Workshop at the Annual Convention American Society of Civil Engineers, Chicago, Oct. 20, 1978. s.l., American Society of Civil Engineers, 1978. p. 134-161.

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT. Alternate approaches to sanitation technology. Washington, D.C., IBRD, 1978.

KALBERMATTEN, John M. & JULIUS, DeAnne. Intermediate service levels in sanitation systems. Appropriate Technology in Water Supply and Waste Disposal Workshop at the Annual Convention American Society of Civil Engineers, Chicago, Oct. 20, 1978. s.l., American Society of Civil Engineers, 1978. p. 110-133.

McGARRY, M. G. Developing country sanitation. A report prepared for the International Development Research Centre. 2.l., s.n., 1975. 1 v. (varias paginaciones).

McGARRY, M. G. Sanitary sewers for underdeveloped countries - necessity or luxury? Civil Engineering, ASCE, 48(8):70-75, Aug. 1978.

WRIGHT, A. M. A review of rural excreta disposal systems. Conference on Engineering Science and Medicine in the Prevention of Tropical Water-Related Disease, Pergamon Press Ltd., London, 1978, p. 211-218.

HANSEN, J. A.; THERKSELSEN, H. H.; BUCK-HANSEN, P. Appraisal of four alternative excreta disposal systems for urban areas in developing countries. Conference on Engineering Science and Medicine in the Prevention of Tropical Water-Related Disease, Pergamon Press Ltd., London, 1978, p. 235-249.

Technology

ASSOCIACAO BRASILEIRA DE NORMAS TECNICAS, Rio de Janeiro. Elaboração de projetos de sistemas de abastecimento de água. Sao Paulo, CETESB, 1977. 1 v. (varias paginaciones).

BOLIVIA. Ministerio de Urbanismo y Vivienda. Dirección General de Ingeniería Urbana. Normas de diseño para sistemas de agua potable. La Paz, Ministerio de Urbanismo y Vivienda, 1976. 84 p.

BOTTERI, Amadeo B. & INHOUDS, Enrique M. El control de consumo en los abastecimientos rurales de agua potable. Presentado al 4º Congreso Argentino de Saneamiento, Corrientes, 27-29 de setiembre de 1973. 17 p.

CHILE. Dirección Nacional de Obras Sanitarias. Reglamentos y procedimientos para el sistema de autoconstrucción de obras de agua potable y alcantarillado. 2 ed. Santiago de Chile, 1976. 39 p.

GUNNERSON, Charles G. Historical thresholds in water supply and waste disposal. Appropriate Technology in Water Supply and Waste Disposal Workshop at the Annual Convention American Society of Civil Engineers, Chicago, Oct. 20, 1978. s.l., American Society of Civil Engineers, 1978. p. 1-25.

MEXICO. Comisión Constructora e Ingeniería Sanitaria. Normas generales para la elaboración de proyectos de abastecimiento de agua potable. México, D.F., Secretaría de Salubridad y Asistencia, Dirección de Agua Potable y Drenaje, 1976. 21 p. y anexos.

PAN AMERICAN HEALTH ORGANIZATION. CEPIS. Evaluation of lower cost methods of water treatment in Latin America; final report. Lima, CEPIS, 1978. 290 p.

WORLD HEALTH ORGANIZATION. Typical designs for engineering components in rural water supply. Regional Office for South-East Asia. 1976. 49 p.

Training

BARKER, H. W. Training of waterworks personnel in developing countries. Water Supply Association Congress, 10/Brighton, Aug. 19-22, 1974. Brighton, Water Supply Association, 1974. p. M17-20.

COSTA, Walter Pinto. Training of water and sewerage utilities personnel in Brazil; a program at national level. Rio de Janeiro, BNH, s.d., 9 p.

Case Studies

ACURIO VELARDE, Guido. Evaluación de los planes de "Agua potable rural - Perú". Lima, 1969. 107 p.

CAIRO H., Tito; ABREU, Jafet; ROSA, Tomás de la; GONZALEZ, Francisco; GARCIA, Fernando & ROMAN, Plutarco. Acueductos rurales en República Dominicana. Santo Domingo, Instituto Nacional de Aguas Potables y Alcantarillados, INAPA, 1974. 39 p.

PANAMA. Ministerio de Salud. Programa de agua potable rural y de construcción de letrinas, 1977-1980. Panamá, Ministerio de Salud, 1977.

PINEO, Charles S. Informe de los resultados del programa nacional de abastecimiento de agua en la República Dominicana, PLANAR. Washington, D.C., Organización Panamericana de la Salud, 1973. 26 p.

WOLMAN, Abel; HOLLIS, Mark D. & PINEO, Charles S. Una generación de progreso de los servicios de ingeniería sanitaria en los países de América Latina y el Caribe. Boletín OPS, 71(3):194-214, set. 1971.

BOLIVIA. Estudio sobre abastecimiento de agua y saneamiento como un componente de los programas de servicios de salud primarios, 1978.

COLOMBIA. Componentes de abastecimiento de agua y disposición de excreta de la atención sanitaria primaria en Colombia, 1978.

MEMORIA del XI Seminario de Ingeniería Sanitaria de Centroamérica y Panamá (AIDIS). (Theme was Rural Water Supplies and Sanitation) November 1977. 2 v.

PINEO, Charles S. Observations of rural water supply and sanitation programs in eight developing countries. World Bank, September 1978. 79 p.