

# P LANNING AND TECHNOLOGY IN SANITARY AND ENVIRONMENTAL ENGINEERING<sup>1</sup>

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We are passing through an important transitional era in the world's environment that presents new challenges, in addition to more familiar ones previously encountered. The contrasts between these "new" world issues and those of the "old" world are the major elements addressed here. Fortunately, the Division of Environmental Health of the World Health Organization has recently pointed up significant distinctions between these two worlds.

## THE "OLD" WORLD

The health field in which engineers have played and continue to play a major role is that of communicable disease prevention. Key issues in this field

have been well-described by WHO as follows:

"The cause-effect relationship, and the technology and costs of environmental intervention are largely known. It is known also that in some cases the health benefits of water supply and sanitation have been difficult to quantify for at least three reasons: (i) the absence of reliable methods of measurement, (ii) the masking effects of behavioral and other social factors in populations, and (iii) faulty design of interventions including the choice of a nonappropriate technology. On the other hand, it is accepted that safe water is of doubtful value without personal hygiene and the safe disposal of excreta; or, if a water system does not function (e.g., operation and maintenance), or if a functioning water system is not used adequately by the people it serves, the system itself is of no value.

"One question to consider is related to the allocation of funds by national

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decision-makers for water supply and sanitation. Do these decision-makers need 'proof' of the health benefits expected? Some scholars say the answer is YES. Others, among them the public health profession, say it is NO because the 'proof' has been there for a long time and the conditions that must underlie a successful scheme are known; this school stresses the need to go ahead with a difficult task and remain committed to it even though it may be more pleasing to work towards the eradication of specific diseases as if the two approaches were mutually exclusive.

"A multidisciplinary spectrum of expertise is required to carry out these tasks including environmental health, social/behavioral sciences, management, and public health. The trend is toward the study of an appropriate technology and of its use as influenced by behavioral and community factors. WHO should not call for more health impact studies which might implicitly, at least, cast doubt on the benefits of water supply and sanitation, but rather should help to improve methods of measurement so that the result of studies that, nevertheless, will be undertaken by research institutions will be more useful for WHO than at this time." (1)

I must stress that these issues have not been fully resolved in Central or

South America, or anywhere else in the developing world. While the Americas have performed vastly better than any other WHO region, much remains to be accomplished. Unfortunately, implementation of the International Decade for Water Supply and Sanitation has lagged greatly. With the Decade now four years gone, the record is less than satisfying. The prospect is dark, since all of us are caught in a major economic decline; and we still have much to do with the familiar issues.

## THE "NEW" WORLD

While we struggle with the past, a new era, with new and unfamiliar problems, besieges our practice. WHO again provides a succinct description of this world of the immediate future. Within it, our obligations are great, our deficiencies are equally obvious, and our methods of resolving the prevailing problems are uncertain and difficult.

"In the industrialized/industrializing countries, the surge of certain non-communicable diseases and other biomedical phenomena is associated, and likely in causal relationship, with human exposure to chemicals and other modern environmental hazards. Much is yet not known in respect to the actual exposure to such hazards, their mode of action, and the resulting risk for both the individual and populations. The concern about these diseases (e.g., cancer)

and biomedical phenomena (e.g., mutagenicity) is widespread and poses the need for intervention. Options exist: medical, environmental, regulatory, or a combination of all. The choice is difficult because of the costs, scientific uncertainty, and unknown effectiveness. The answer at this stage is generally: caution while more knowledge accrues. The problem is no longer limited to the countries of the North; all countries are potentially affected, even where the communicable diseases are still the health priority." (2)

## SOME ANSWERS

The Environmental and Sanitary Engineering Association (AIDIS) has some major tasks to perform with governments, industries, the public, and its own members. I outlined the most immediate responsibilities in recent comments to a meeting of the Water Pollution Control Federation in New Orleans (3). These, in abbreviated form, are as follows:

### Responsibility of the Waterworks Industry

The wastewater industry must accept full responsibility for removing more and more chemical residuals. It will rediscover old technologies, with modifications, and develop new ones. Full-sized plants embodying such innovations have already appeared in the United States. (Because smaller rivers prevail in

western Europe, many of these technical innovations have been widely used there for many decades.) Both capital and operating costs will mount, but not to the degree suggested by some who are reluctant to confront the reality of social and political pressure. Our industry cannot, and, I predict, will not, take refuge in the frequent pronouncement that it should wait until epidemiology perfectly discloses the complete chain of public health causation. Such disclosure is years away, if it ever happens.

### Responsibility of Industry at Large

The change in attitude of industry toward its residual wastes is profound. When I suggested, 40 years ago, that industry move rapidly toward closed-cycle operation, its reception was cold and suspicious. Today, many of the industries have moved successfully toward implementation of this principle, which asserts that unavoidable residues should be retained in situ and treated before release.

The capability of the chemical industry is astonishing in its development and conversion of synthetic materials. We have some assurance that our concerns as to toxicity may be alleviated by changing the composition of insecticides and other substances toxic to man and nature.

**The Potable Water Industry.** Similarly, potable water treatment will be extended to remove some inevitable residuals of actual or potential toxicity. These include metals and insecticides as well as various other organic chemicals, both natural and manmade. Technology is at hand or will be innovatively developed, without undue increases in the cost to consumers. Potable water is cheap and a marvelous bargain.

## CURRENT DISABILITIES AND CONSTRAINTS

Although this Region has to its credit great progress in water supply and wastewater treatment (4, 5), much remains to be done—particularly because of the new era and its chemical threats. Since this is the case, we must confront the conditions constraining us from advancing faster in prevention of a relatively new category of diseases. Most consequences of these diseases take a long time to manifest themselves, thus adding to our normal difficulties of implementing sound water supply and sanitation.

WHO addressed these constraints in 1984 by canvassing over 150 countries. The response was strong, and a surprising unanimity of opinion was registered. At least four major areas of concern were identified, as follows:

“a. *Low government priority for the sector:* Apparent lack of influence of agencies and ministries concerned with the water and sanitation sector on governmental policy and resource allocations.

“b. *Operation and maintenance inadequacies and the need for rehabilitation:* Broken down and badly performing systems demonstrated the failure of operation and maintenance arrangements in many countries.

“c. *Human resources:* Shortage and maldistribution of skilled manpower had been identified by the countries as their single most

severe constraint. They plan huge training programs to meet the estimated demand, but are the priorities right?

“d. *Failure to attract more external financing:* Shortages of funds for accelerated Decade programs featured in reports from most Regions.” (6)

I should stress that in the Region of the Americas, as well as elsewhere, we have fallen short of creating skills at virtually all levels of practice, from managerial to operating personnel. For a long time we had great success in providing such people, via training in the regional universities and in U.S. institutions. Neither of these are now producing students who man the emerging systems. A committee jointly sponsored by PAHO and AIDIS is active in assessing this situation and before long should provide some guidelines to close the gap in education and training. Meanwhile, it seems reasonable to seriously consider why engineers do not always appear to be filling management posts within this field.

## THE CURRENT GLOBAL SITUATION

In June 1984, WHO assembled representatives of the world's 4.5 billion people in Geneva. Their assignment was to review the present status of the Decade's accomplishments, to consider the aforementioned implementation delay, and to suggest modes of action for the remainder of the Decade that might accelerate the construction of desired projects. Among these represen-

tatives were three members of AIDIS—one from Panama, Mr. Ivan Estribi Fonseca; one from Argentina, Mr. Luis Urbano Jauregui; and the author of this paper, who served as consultant to the conference.

It is fitting to amplify my exposition of current and foreseeable problems by extensive, but deeply relevant, excerpts from the Report of the WHO Conference Group. The issues and proposals therein are highly applicable to the Region of the Americas.

“Water supply and sanitation received increasing emphasis through the 1970s by their inclusion in the United Nations Second Development Decade, by assignment of a high priority at the UN Conference on Human Settlements in 1976, by a positive Resolution at the Mar del Plata UN Water Conference in 1977, and a Proclamation of the International Drinking-Water Supply and Sanitation Decade of 1981 to 1990 by the UN General Assembly in 1980. This sequence of events, contrary to the views of some, was not a sudden recognition of the necessity to meet the obvious needs of unserved or underserved billions of people. It was a desire to speed up the implementation of projects for such purposes, perceived in fact since ancient times as essential for the survival of man. The Decade registered the universal feeling that people should not be condemned

to live without these necessary amenities for much longer. The decision was to move forward more rapidly.

“With this decision universally agreed upon, a goal to be attained within the 10 years and the means by which it might be reached was set forth. Their quantitative index reflects the enthusiasm of that time. Now three-and-a-half years have gone by; progress in meeting the goals is too slow. The constraints faced by the governments have been discerned. The task at hand is to assess the achievements, and there have been some significant ones, and to suggest ways and means of alleviating the constraints and thus materially accelerating the pace of implementation.

“The pursuit of this complex task, in a world of some 4.5 billion people, is obviously an intimidating exercise. However, close examination has disclosed some important devices which might and can assist in finding answers to the task imposed. Such answers may sensitize the responsible decision-makers of the world to move more rapidly to serve the needs of the people everywhere. The goals to be reached need no redefinition and no reduction. They are not time-related. Whatever time it takes to reach them is contingent upon the forces of men.

“Fortunately, past human accomplishment, in

the field in which we work, gives great comfort and aid in the continuing of our Decade task. Well over one billion people in the world already are the beneficiaries of safe water supply and sanitation. These services are brilliant symbols of the practicability and the reality of fulfilling the hopes declared for the Decade. The change in the task is only in the extension of the time for bringing it to fruition. Failure or delay in meeting the timetable hoped for has obvious explanations in the less than cheerful world of today and tomorrow. The listing of these causes in the realm of the socio-economic-political arena is not our responsibility. Their implications, however, are and have found their place in our deliberations." (7)

## REFLECTIONS ON PLANNING

The delineation of old and new problems in the environment is a simpler exercise than setting forth the logistics needed to implement solutions. However, many official and unofficial groups have spent much time and energy in addressing the latter, and logical, sensible modes of action have resulted from these various deliberations. Some comments on them are worth brief reference:

### 1) Sector Relationships

Long field experience indicates that the development of water supply and sanitation projects should be fitted into a series of broader undertakings

pursued in the same region—as for example irrigation, power, and recreation. In theory, this universal approach is manifestly logical. In reality, its exercise is blocked by the multiplicity of separate agencies or institutions responsible for each function. These too often are resistant to joint sectoral planning for multiple resource use. Overlying coordination must be sought, if it exists, or it must be created.

### 2) Financial Resources

The immediate future promises little external money. Hence, a diligent search for innovative forms of financial aid must be pursued, within local rather than central governmental units. It is already clear that unit costs of water are excessively high in rural and fringe populations. In many instances such populations should be centrally supplied; and in other cases they should be provided with accessibly sited standpipes. Both categories of consumers should be charged for water, either in full or in part, where warranted. Many examples are already at hand to emphasize that such consumers may thus obtain much cheaper water than they did before. Of greater importance is the fact that they pay more promptly than many more fortunate municipal customers. Ingenuity of the purveyors is the key to widening service.

### 3) Community Participation

This is a must. Without it, many failures have resulted. It is true that peoples' assistance is not easy to develop. And since the art of accomplishing this is not usually one possessed by engineers, they must coopt educators skilled in such efforts.

#### 4) Appropriate Technology

The technical literature is filled with advisories *against* burdening projects with designs singularly inappropriate for local cultures, religions, habits, and pocketbooks. Obvious as this point is, it is still too frequently ignored. It thus needs to be reemphasized that the true index of engineering competence resides in the homily that an engineer is somebody who can do with one dollar what any fool might do with two.

#### 5) Ecology

All the activities discussed herein have important ecologic implications. These must be continually confronted as projects are contemplated and later constructed. The environment is vulnerable, but it need not be devastated. Much prevention of disease requires the full cooperation of the individual by avoiding excessive smoking, alcohol, or food consumption. The exogenous environment, however, remains our ongoing concern. Its parameters have been listed. Necessary correctives need not and should not entail permanent ecologic destruction.

## SUMMARY

An important dichotomy has emerged in the field of environmental and sanitary engineering between new problems and old ones yet to be overcome. The older problems include the host of communicable diseases encouraged by inadequate water supplies and poor sanitation. The newer ones involve human exposure to chemicals and other environmental hazards, which appears causally associated with an upsurge of certain noncommunicable diseases and other undesirable biomedical effects.

Although much has been done in the Americas in the areas of water supply and wastewater treatment, much remains to be done, especially because of the chemical threats of our present era. In the Americas, as elsewhere, preparation of skilled personnel at virtually all levels has fallen short. Progress in meeting the goals of the 1981–1990 International Drinking-Water Supply and Sanitation Decade has been slow. Various constraints faced by governments, including financial ones, have been discerned.

In developing the logistics needed to implement solutions, past deliberations by many official and unofficial groups have suggested certain logical and sensible modes of action which deserve consideration. Among other aspects, the development of water supply and sanitation projects should be fitted into a series of broader undertakings (e.g., irrigation, power, or recreation); diligent pursuit of innovative forms of financing and financial aid is needed; community participation is essential; projects must not be burdened with designs unsuited to local circumstances; and ecologic implications must be considered on a continuing basis as projects are contemplated and carried out.

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## The Netherlands Joins Sponsors of Central American Health Plan

The Government of the Netherlands has agreed to donate some US\$20 million to the Pan American Health Organization to improve health conditions in Central America. The agreement, signed on 1 April 1986 by Richard H. Fein, Ambassador of the Netherlands in the United States, and by Dr. Carlyle Guerra de Macedo, Director of PAHO, calls for cooperation in organizing a revolving fund to buy essential drugs; helping countries maintain health clinics, other health facilities, and equipment; and establishing a Costa Rica-based program to support health services for refugees and displaced persons in Central America.

At the time of its receipt, this donation was the largest received from a European government to support the Central American plan "Health—A Bridge for Peace" developed by the region's ministers of health in collaboration with PAHO.

All of the projects supported by the donation will pertain to the plan, whose purpose is to improve health conditions among the 25 million people of Central America and, through collective activities against disease by all of the countries, to promote peace.

This initiative was unanimously approved by the World Health Assembly in 1984. Later, in the Declaration of Madrid of November 1985, 32 countries and organizations pledged their support. The plan's project, aimed at vulnerable groups in Central America, are directed at seven of the most critical health priorities in the region—childhood survival, health services, human resources, malaria control, food and nutrition, provision of essential drugs, and water and sanitation.

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*Source:* Pan American Health Organization, PAHO Press Release, Washington, D.C., 3 April 1986.