

SANITARY ENGINEERING IN LATIN AMERICA

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Statements have been made by various observers during the past many years that tropical climates were not healthful or satisfactory climates for man to inhabit; and that the tropics would not maintain human endeavor at a high standard of efficiency and progress. This may be true in the absence of adequate sanitation and hygiene. However, it is now recognized that the progress of sanitation is changing this picture. Many observers now conclude that man can be as healthy, maybe not as comfortable, in tropical environments as in other areas. Preventable disease and parasitism are major contributing factors to poor health and lack of progress in most tropical regions.

The tyranny of diseases which spread because of the absence of sanitary barriers still rules many areas. This is a challenge to the sanitary engineering profession which has the opportunity to help free the people from the burden of these diseases and make possible the economic development of many areas which have ample natural resources, but, partly because of health conditions, have remained industrially and economically backward.

Sanitation is the basic foundation stone necessary for better public health. Until sanitary measures are taken to isolate human excrement from the environment of the people little progress will be made toward reducing enteric disease. The sanitary engineer can be the liberator who removes the ball and chain of intestinal and insect borne diseases which maintain large numbers of people in a condition of slavery. In some places hospital facilities are extremely inadequate partly because most of the beds are used for preventable diseases, and non-preventable ailments cannot obtain hospitalization. Medical treatment alone for people with parasitic diseases will not solve the situation because they are immediately reinfected in an insanitary environment. Sanitation necessary to remove the contamination from the environment is the most satisfactory and economical method for reducing parasitism in these areas.

In sanitation and public health lies one of the greatest opportunities to promote international coöperation and national progress. Communicable disease does not recognize political boundaries, or differences in language, creed, race and economic philosophy. Hence, the efforts of sanitation are concerned with one major objective and this is to make the world a better place in which to live.

HEMISPHERE COÖPERATION IN SANITATION

The western hemisphere has been undergoing a "sanitary awakening" which has closely paralleled its economic development. With this

awakening has come ever increasing inter-American coöperation in solving neighborhood sanitation and health problems of the hemisphere.

Recognition of the international aspects of sanitation by the republics of the western hemisphere led to the establishment by treaty in 1902 of the Pan American Sanitary Bureau as an organization supported by all the republics. Its leadership and activities have been far-reaching and have done much to develop the ground work which pointed the way to further hemisphere coöperation. The U. S.-Mexico Border Health Association and similar joint activities between neighboring countries have further developed hemisphere coöperation on the common problem of sanitation.

Another landmark in coöperation was the establishment in 1942 of the Inter-American Coöperative Health Program of the Institute of Inter-American Affairs. The republics of the hemisphere recognized the importance of health and sanitation activities in the development of human and natural resources for the defense of the hemisphere and jointly recommended a program of health and sanitation. Its basic plan for the prevention of disease in the hemisphere is the shoulder to shoulder working together by health workers of other American republics and the United States in the Inter-American Coöperative Health Service, a legal entity of each government.

The latest milestone of hemisphere coöperation in sanitation is the Inter-American Association of Sanitary Engineering. Its objectives are (1) the development of sanitary engineering; (2) an interchange of ideas and scientific information; (3) the establishment of standards of sanitation for the Americas; (4) the promotion of a more rapid advancement in sanitation of the several countries of America as a necessary basis for economic and social development; (5) the establishment of better understanding among the persons engaged in sanitation work in the Americas. Its program and activities will give further impetus to the development of much needed sanitation.

STATUS OF SANITARY ENGINEERING IN HEMISPHERE

While some aspects of sanitation have been known and practiced since ancient times, sanitary engineering as a profession is in an early or childhood stage of development. In Latin America sanitary engineering has developed very slowly. There are excellent sanitary engineers in all of the Latin American countries, but their number is much too small to handle the large task in need of accomplishment. The establishment of divisions of sanitary engineering in most of the Ministries of Health has been effected, but the rate of progress of their work will depend to a large degree on developing and securing sufficient personnel.

There are three main reasons for the shortage of sanitary engineers: first, public health has only recently received emphasis in social thinking; second, there is a great scarcity of personnel in all fields of engineering

and engineers find higher salaries in private work and in other fields of engineering than sanitary; third, engineering colleges have only recently started to provide any education in sanitary engineering.

The increase in economic development, including building, transportation, public works and industrial expansion, in which the engineer has taken a leading part, has greatly retarded professional interest in sanitary work by engineers. It is therefore only natural that the educational institutions and the authorities responsible for public health have not been familiar with the rôle and functions of the sanitary engineer. When more sanitary engineers are trained, the results of their work and their very presence will encourage and further develop the profession.

On a per million population basis there are about one tenth as many engineers educated per year in Latin America as in the United States. Latin America is entering upon an era of industrial expansion and development which requires the services of engineers in far larger numbers than are being trained. In some countries most of the engineering students are signed up for employment a year or more before they graduate. Obviously, therefore, increased impetus must be given to the education of engineers before the quality and quantity of sanitary engineers necessary to deal with the large problem of sanitation will be available. The quality of sanitation will be only as high as the quality of the personnel responsible for it.

SANITATION AND ECONOMIC DEVELOPMENT

It has been prophesied by several economic authorities that the last half of the 20th century will be an era of development and industrialization of countries which have the natural resources but are deficient industrially. This is the condition in Latin America and there is little doubt but that the next 50 years will show great advancement in economic development and industrialization there.

Where does sanitation fit into this picture? Most of Latin America needs a greater population for her development. The resources are available to support a much larger population. She may increase her population by two methods. These are (1) by reducing the mortality rate of her people, and (2) by increasing immigration. The infant mortality rate in many areas is extremely high. It is reported by most health workers that a large part of the infant mortality is due to enteric diseases. The infant mortality rate can be greatly reduced by simple basic sanitation and hygiene.

People suffering from intestinal diseases and malaria do not contribute to economic standards because they do not produce goods or services, and in turn do not consume. In other words they are part of the economic chain which raises the standard of living. The lack of sanitation has been a most important contributing factor to the failure of poten-

tially good rural areas to produce sufficient food. It has also been a factor in retarding the development of some rural areas because the people were afraid of the health conditions. As a result, malnutrition due to inadequate food supplies is common.

Public health and sanitation is a basic element in economic development and raising the standard of living. In the tropics it often must precede or parallel the pioneering of new areas.

SANITARY WORKS

Water Supply and Purification.—There are several excellent water supplies in Latin America and many others in the planning stage. For a large portion of the population the development of safe, clean water supplies is one of the most critical sanitary problems confronting them. Several relatively large cities do not have a satisfactory supply and many smaller cities have not yet been able to develop a water supply. Boiling of water is an accepted precaution used by people who are familiar with the hazards of contaminated water.

Standards of water quality have not been set up or used extensively in Latin America. However, at present the engineers of several countries are developing standards of water quality which will contribute greatly to water supply practice and improving water supplies.

Typhoid fever is common and many methods of transmission exist. All of the typhoid fever is not water borne, but a considerable portion of it is. Improved supplies and good sanitation will greatly affect the typhoid fever rates.

Table I shows the reported death rates from typhoid fever. Since reporting of vital statistics has not been well established, it is probable that some of these values are low, particularly for rural areas.

In many areas water supply is a major economic as well as health problem. People must spend hours carrying sufficient water from a stream some distance away to care for the day's requirements. The stream, as well as being a source for drinking water, is often the laundry.

Latin American engineers commonly use slow sand filters instead of rapid sand filters because of the high cost of chemicals and the need for simplicity of operation. Chlorination is practiced in the larger cities, but the shortage of both chlorine and equipment has been a serious handicap.

Low pressures and poorly maintained distribution systems are often responsible for contamination of water which may have left the treatment plant clean and safe. The rapid growth of many cities has created a demand for water which often exceeds the capacity of the system and in an effort to reduce consumption the water is turned off at night. Consumer pumping from the mains creates low or negative pressures and serious contamination of the mains.

It is believed that extensive use of ground water will be developed in

TABLE I.—*Typhoid Mortality Rates in Latin American Countries*
(From "Biostatistical and Epidemiological Report on the Americas"—Feb. 1948)

Country City	Deaths per 100,000 pop.	Year	Country City	Deaths per 100,000 pop.	Year
Argentina:			Honduras:		
Buenos Aires.....	1.7	1941	Tegucigalpa.....	27.5	1940
Bolivia:			Mexico.....	42.5	1941
La Paz.....	193	1933	Mexico City.....	21.4	1941
Colombia.....	27.6	1940	Nicaragua.....	9.3	1941
Bogota.....	22.0	1940	Managua.....	68.0	1939
Costa Rica.....	9.5	1940	Panama.....	6.0	1931
San Jose.....	11.0	1939	Panama City.....	0.0	1938
Chile.....	14.3	1941	Paraguay.....	15.0	1941
Santiago.....	17.5	1939	Asuncion.....	30.8	1941
Ecuador.....	13.7	1940	Peru:		
Quito.....	35.0	1938	Lima.....	12.8	1941
El Salvador.....	3.5	1941	Dominican Republic...	11.0	1941
San Salvador.....	16.8	1942	Ciudad Trujillo.....	10.5	1941
U. S. A.....	0.8	1941	Uruguay.....	9.5	1939
Washington.....	0.4	1942	Montevideo.....	6.1	1941
Guatemala.....	6.7	1940	Venezuela.....	21.3	1940
Guatemala City.....	37.6	1940	Caracas.....	21.0	1941

the smaller communities and rural areas of Latin America. Several countries now have extensive ground water investigations in progress. The most difficult aspect of water supply development for the smaller communities is that of financing their costs. Many countries are undertaking various methods whereby the national government will aid the community to develop a water supply.

A sincere keen interest in safe, clean water supplies exists with the engineers and the people of the Americas. The next several years will see an unprecedented water supply development. Many countries have had extensive projects planned and ready for construction, but materials were not available.

Sewerage and Excrement Disposal.—Sewerage except in the larger cities of Latin America is not common. Latrines and privies are uncommon in the rural areas and small communities. Sanitary disposal of excrement is one of the most important health problems in most of the countries and must be accomplished before hookworm and other intestinal diseases can be controlled. The sanitary privy or other low cost methods for sanitary disposal of excrement is the great need among the mass of rural people. The sanitary engineer can make a great contribution to the public health of his country in this field.

There are several excellent sewage treatment plants in Latin America but in most areas, except where sewage is used for irrigation, extensive sewage treatment is years in the future. Most cities are located on the

coast or on large rivers where sewage treatment will not be necessary for some years. For a considerable period in the future investments in water supplies, sewerage and general sanitation will pay far greater health returns than sewage treatment. Some of the arid west coast of South America sections use sewage for irrigation, and treatment of this sewage is being planned.

Refuse and Garbage Disposal.—Sanitary land-fill is the most satisfactory method of garbage and refuse disposal in most of Latin America. It is being used more and more widely. The garbage and refuse is usually fairly dry and the quantity per capita is not large. Incineration is used satisfactorily in several places but it is not as economical as land fill. In addition to being a method of disposing of refuse, sanitary fills can be used to reclaim low-lying lands and filling swamp areas which are foci for mosquito breeding. Because of a more or less uniformly warm climate sanitary fill can be operated more satisfactorily and more economically in Latin America than in some of the colder areas of North America.

Mosquito control.—With intestinal disease control, mosquito-borne disease control, particularly malaria, is at the top of the list of sanitary problems in the tropical areas of the Western Hemisphere. Malaria control is of great economic importance in the development of natural resources in Latin America.

Sanitary engineers in Latin America for the most part have taken little interest in malaria and mosquito control. When observing mosquito control, the deficiencies due to the lack of the engineering approach are extremely apparent. This is a field in which the sanitary engineer can contribute greatly to the health of his country. He will find many interesting and difficult engineering problems in this field.

Drainage and filling have been the most effective means for controlling malaria around large cities, but these methods are much too expensive for use in most areas of Latin America. The high cost of malaria control in small cities and rural areas has been largely responsible for the limited progress on this disease. The use of D. D. T. in house spraying has been showing good results and is proving to be within the cost limitations of the people in interior areas. It appears that through spraying of dwellings with D. D. T., we have a method which can be economically used in areas where most of the houses are of a type which cannot be mosquito-proofed and the cost of drainage would be greater than the value of all of the buildings in the community.

Industrial Sanitation.—Industrial sanitation and occupational disease control are being given emphasis in certain of the areas which are now developing industrially. Legislation to improve health conditions of the worker exists in several countries. Active programs in mine sanitation and safety have been and are in progress in several mining areas. There is great need for sanitary engineering in the mining industry but there

has been little interest in this field by sanitary engineers. Because of the shortage of labor and the increasing industrial development, industrial hygiene and sanitation will be emphasized as an economic means of obtaining greater production from manpower and raising the standard of living.

GENERAL SANITATION, HYGIENE AND EDUCATION

In addition to safe water and the sanitary disposal of excrement, a great deal can be accomplished by simple fundamental sanitation and hygiene. Because of the lack of reliable data it is impossible to even estimate accurately the amount of enteric disease which is spread by food, but there is little doubt that insanitary food handling is a very important factor.

The engineer in Latin America has for the most part been interested in large sanitary works and has not been very interested in promoting hygiene and sanitary education. In this field of basic sanitation such as food sanitation, privy programs, and hygiene education he can find opportunities for great accomplishment which will not involve large individual projects and a great deal of money, but which will yield far reaching and spectacular results. Education of the people concerning hygiene and sanitation must parallel sanitary developments if the maximum health returns can be obtained from sanitary works.

Areas in which average figures for intestinal parasites are as follows offer great opportunities for highly effective sanitary engineering: Positive for parasites 85.4%; *Ascaris lumbricoides*, 65.8%; *Necator americanus*, 44.3%; *Trichuris trichiura*, 28.8%; *Endamoeba coli*, 18.9%.

SUMMARY

Sanitation and sanitary engineering are basic developments necessary for healthful living in many sections of Latin America. Without greater emphasis being given to environmental control of several of the most important diseases, the development of their economic resources will continue to be slow. In economically retarded areas sanitation is usually the basic foundation which must be built in developing a progressive public health program.

INGENIERÍA SANITARIA EN LA AMÉRICA LATINA (*Sumario*)

La aplicación de la ciencia sanitaria y médica en Latino América, está disipando la antigua creencia de que un clima cálido no es propicio a una vida saludable ni a una buena producción. Sin embargo, se avanza lentamente: se necesitan hospitales urgentemente; los ingenieros civiles y sanitarios son competentes, pero escasos; las escuelas de ingeniería están apenas organizadas. Los próximos 50 años presenciarán, sin duda, grandes adelantos industriales, lo que disminuirá el índice de mortalidad y aumentará el de nacimientos, ya que ambos dependen de mejores condiciones del medio ambiente. La necesidad más urgente por el momento es contar con mejor abastecimiento de aguas y después, todas las ventajas que los programas de salubridad pueden proporcionar.