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A REPORT ON THE PAHO PROGRAM OF
RESEARCH, EDUCATION, AND TRAINING
IN ENVIRONMENTAL SANITATION

Ref: RES 7/21
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PAN AMERICAN HEALTH ORGANIZATION
Pan American Sanitary Bureau, Regional Office of the
WORLD HEALTH ORGANIZATION

Washington, D.C.

A REPORT ON
THE PAHO PROGRAM OF RESEARCH, EDUCATION, AND TRAINING
DEPARTMENT OF ENVIRONMENTAL SCIENCES AND ENGINEERING

We are indeed grateful, Mr. Chairman, for this opportunity to meet with the Advisory Committee on Medical Research to report briefly on developments in Latin America in the field of environmental sciences and engineering -- to indicate the status and trends of such activities -- to outline gap areas in our intelligence -- and to relate these situations to the research potentials at universities and associated centers.

On previous occasions, Mr. Chairman, we have exchanged views with your Committee on the rapidity of environmental changes taking place in Latin America -- on the economic, social, and political factors influencing the speed of these changes -- and on the general prognosis of initiating productive research activities in the broad field of environmental sciences and engineering. We believe we are now at a point where we can be more definitive.

Earlier in the Decade, we attempted to catalogue research needs in some general orders of priority -- and, through stimulation and modest supports, to initiate a general program of university-based research -- at least in a few foci with indications for such potentials. In all candor, this approach was premature.

*Prepared for the Seventh Meeting of the PAHO/ACMR by Dr. Mark D. Hollis, Chief, Department of Environmental Sciences and Engineering and by Eng. Edmundo Elmore, Chief, Research, Education and Training, Department of Environmental Sciences and Engineering, Pan American Health Organization, Washington, D.C.

Last year, we re-focused our emphasis on stimulating an awareness of research needs -- on developing at universities and associated centers the climate and facilities requisite to research -- and on problems of research training. These steps, we concluded, were essential and basic to any productive framework of research.

In deference to time this afternoon -- and as a preface to our comments on research -- we will refer only broadly to on-going programs -- and will discuss, briefly, three developments that relate more closely to the potential research build-up.

On a continental basis, significant accomplishments are being made to improve environmental conditions -- and especially so with respect to the provision of water-supply and sewerage services. The continental water-supply and sewerage program is based on the simple rationale:

- That fresh water to satisfy human needs is nature's most precious substance;
- That community systems of water supply and sewerage are basic essentials to the health, economic, and social well-being of peoples;
- That safe water, in reasonable amounts, available in homes, together with sewerage systems, will reduce enteric infections and related illnesses; will decrease infant mortality; will promote cleanliness of the person, the home, and the community; and will engender self-respect and enhance the dignity of Man.

Throughout the Americas, these facts are well established, well understood; and are endorsed and strongly supported by the people.

More recently, this importance of water-for-people and sewer-services-for-people was reaffirmed -- and broadened to embrace related environmental needs -- by the pronouncements of the American Chiefs of State at their Summit Meeting in April 1967 at Punta del Este.

The Governments of Latin America are responding aggressively and effectively to these challenges. In terms of monetary parameters, thus far in the Alliance Decade about \$1.4 billion has been committed for water-supply and sewerage works. Of this amount, \$800 million (about 60 percent) represents national funds -- the remainder, \$550 million (about 40 percent), being loans from international agencies (75 percent from BID). In terms of the human equation, these improvements benefit 62-million people -- to us the more important statistic. The Charter Goals are in sight!

As we all know -- water-supply and sewerage services involve much more than the installation of pipes and valves -- pumps and filters. These public works must be realistically engineered to local conditions; they represent huge capital investments, requiring complex systems of maintenance, of operation, and of management. This is all well understood by the Governments of Latin America.

Again in deference to time, we will resist the temptation to discuss other continental programs in the field of environmental health.

Industrial-hygiene activities, for example, are expanding to meet the growing needs resulting from broad industrialization. Air-pollution control -- with its continental network of air-sampling stations -- is developing in good order. PAHO assistance with urbanization and housing problems is attracting attention and response in Latin America. More recently, the Organization has joined with the Organization of the American States and the Inter-American Development Bank to assist the five Countries involved in a developmental program for the Rio-La Plata River-Basin system. Special emphasis is being given the Santa Lucia watershed as a pilot program for the larger system.

On a continental basis, progress on health-related programs dealing with environmental determinants is most encouraging and satisfying. However, the real story is not revealed in the statistics of expenditures and services; -- rather, the real strength is the evolving solid foundation of infra-structures, of national institutions, of broadening management capabilities, and of realistic financing procedures.

The Organization is using, extensively, teams of experts in administrative-management procedures for assignment, on request, to Member Governments to work directly with appropriate Ministries responsible for water-and-sewerage services. These teams, specially trained, employ PAHO-developed techniques for strengthening organizational and management structures; for development of operation and maintenance services; and for establishing realistic rates for water-supply and sewerage services.

Initiated three years ago with PAHO resources, this activity is now financed almost entirely by the Government agencies being served. At present, there is a backlog of requests in the aggregate of about \$1 million. On this as well as on other activities, we remind ourselves continually that PAHO is not a continental health department. Rather, it is an international health organization, with the mission of assisting each Member Government in developing structures, institutions, and services -- within the framework of its particular political, economic, and social pattern -- in order better to serve the people.

And now a word about three special developments relating to education and training.

Four years ago, it was quite apparent that the massive continental programs in water-supply, in sewerage, and in related environmental controls would require trained technical manpower in numbers and types far in excess of what normally might be mobilized -- and would require service laboratories and related facilities not then in existence.

Responding to this need, aggressive actions have been taken on two broad fronts: -- First, strengthening schools of engineering (especially with respect to sanitary-engineering curricula); and, second, the establishment of a continental system of continuing professional education and a system for the training of sub-professional technical manpower. Both actions involve close collaboration with universities -- and both have been extraordinarily successful.

The program for undergraduate education integrates sanitary-engineering curricula into schools of civil engineering. This practice is now followed at 20 universities in Latin America. The programs for professionals and the training of technicians are receiving exceptional response from universities and Government agencies. In the first year (1963), four such courses were conducted, financed largely by PAHO. At present, there are 36 universities in 21 Countries in the network -- conducting 70-to-80 short courses per year and benefiting about 2,000 professional and sub-professional personnel. The total expenditure for this program is \$1.2 million per year, of which less than 20 percent is provided from PAHO resources.

Concurrently with the development of the education and training programs, the Organization is using its influence to stimulate graduate-level education for sanitary engineers at selected universities. At present, seven universities offer graduate programs in sanitary engineering. An interesting by-product of these efforts has been the upward trend in full-time faculty at schools of engineering -- from less than 10 in 1962 to about 50 at present. Material appended to the report (RES 7/21) lists the universities in the collaborating network.

These brief references to program developments and to education and training are cited, Mr. Chairman, to illustrate the range of tasks in Latin America and the efforts being made to maintain an orderly balance between related segments of the over-all mission.

The gaps in intelligence -- hence the research needs -- relate to both the technical and economic factors in massive programs of water and sewerage -- and in other environmental measures with new magnitudes and new dimensions. The response of Governments and institutions to the education-and-training programs creates an atmosphere of optimism as to what might now be stimulated and accomplished in the field of research -- especially in the field of applied research. For the predictable future, we believe our research efforts should concentrate on the application of known basic principles to the problems and conditions in Latin America. Although problems and conditions vary widely among Countries, the common denominator, we believe, is a continental need for realistic applied research.

In introducing this thought, Mr. Chairman, we are mindful that the "research engineer" is a naive creature, as compared to the "pure scientist." Engineers aren't expected to be completely at ease in the rarified atmosphere of basic research. But, to paraphrase Dr. Harold Work, we are not in sympathy with the cliché that the "wells of basic research are running dry..." -- nor with its implication that fundamental inquiry needs special stimulation.

It is difficult for the engineer to understand how the water table in that particular kind of well could ever even drop. After all, the laws of gravitation will be in the well to help us in our applied science in the future, as they have done so in the past. You don't wear out a natural law simply by using it. In the realm of physical science and mathematics, we lean to the view that the wells of fundamental knowledge are, in fact, closer to overflowing than to drying up.

In terms of environmental problems and needs, it seems a bit impractical for us to expend much energy tinkering with "the well" of fundamental research at a time when the per-capita drain on our modest resources for the improvement of living standards and the well-being of peoples is so great -- and so demanding.

In the face of overwhelming practical need, it is more typical for the engineer to focus on what needs doing -- and to do it -- than to be preoccupied with quests for the unknown -- at this point in time, on services to people, so to speak, to quench their thirst for water -- rather than to quench our thirst for knowledge.

The point we are trying to make is a simple one. In Latin America, we have major programs underway to provide water-supply and sewerage services to people -- both urban and rural. This is a basic urgency. These programs, together with those for water- and air-pollution control; for river-basin developments; for housing, solid-waste disposal, and related environmental needs, will require complex engineering works involving huge expenditures (about \$3 billion over the next decade). From a "hard-nosed" economic point of view -- in terms of research -- we believe that the influence and modest resources of PAHO might better serve the people if used to influence improvements in the approaches and practices, and in the application of known principles -- rather than submerged in "the well" of fundamental research.

We are optimistic about the research potential in Latin America. The training network has stimulated an extremely close liaison between the Ministries responsible for health and public works and the university systems. In many instances, these Ministries are supporting service and teaching laboratories operating under the jurisdiction of the universities. In other cases, they are supporting full-time faculty members and providing student fellowships.

Three ingredients -- full-time faculties, laboratories, and students -- operating in newly formed frameworks of graduate education -- not only make research possible, but provide the driving force for it. The training network has stimulated confidence in the capability of the university as a service mechanism. This confidence is now reinforced with respect to continuing professional education and technical-manpower training.

The logical next step is to demonstrate the capacity of the university for sound investigative work. To assist in this, PAHO is now apportioning modest resources to research training and to specific applied-research projects. These projects are listed in the material before the Committee. The 17 projects listed are the ones supported, in part, by PAHO funds. Other research not listed is under way with local funds and resources. For example, universities in Venezuela, in the current decade, have carried out productive research in 13 special problem areas.

We believe the day is not distant when many universities will serve as an applied-research arm for those Governmental agencies responsible for providing environmental facilities and services. In instances where universities respond with quality work, we believe they will also attract broader internal sources of support -- just as they have done with the training-and-education networks.

The third extremely important cog in the PAHO machinery for training, education, and research is our newly established regional Center for Environmental Sciences and Engineering in Lima, Peru. In addition to its other functions, the Center mission includes a major role in the development of the applied-research potential of the universities. It will assist Member Countries in establishing and developing quality research and teaching centers. It will strengthen PAHO's present supports to the education and training network, as well as to undergraduate education. It will provide stimulus for research training. And, hopefully, in time -- through the Center -- the Organization might increase its modest research-assistance program -- with special emphasis on the research-training aspect. Further details about the Center in Peru are among the materials appended to the report (RES 7/21).

Obviously, Latin America will face in a few years -- in a decade at most -- the more complex impacts and problems of man's environment. As technological industrialization sweeps the continent, it will leave in its wake a much more sophisticated array of human stresses. The magnitude and complexity of environmental contaminants will increase and will

broaden from micro-biological pollutants to those which have their origins in micro-chemical substances. These will result from the machines of man and from the production and use of the products from these machines.

Assessment of the health effects of these biological and chemical substances will become more important and more urgent. For the most part, these effects will be long-range, subtle, with wide separation of cause and effect. Epidemiology will have to embrace projections of what will happen, as well as what has happened -- to produce the intelligence needed to guide metropolitan and industrial developments.

This particular problem is in the realm of medical research -- and we would presume it will attract the proper attention of investigators in the medical-research field. Unfortunately, thus far these new and complex factors are not receiving the priority they would seem to merit.

For the next few years, we would propose to gear our actions in support of practical applied research -- to clarify design criteria -- to devise approaches and practices within the administrative capacities and the economic realities the Governments must face -- to strengthen central intelligence on emerging problems in this technological age -- to provide clear perspectives as to the cause-and-effect of impacts created by the rapidity of change. If these we can do effectively and constructively, we believe we shall have rendered a much needed service in the interest of the well-being of the peoples.

To be realistic, foci of basic research will emerge in Latin America. This is inevitable -- and it is proper. The extent to which such foci will emerge will depend upon the dedication, competence, and capacity of individual investigators. We do not suggest that such individuals be discouraged -- rather the contrary. In fact, we fully expect that the association of biologists, chemists, physicists, and other scientists with engineers in solving the practical problem of our environment will stimulate their imaginations to conceive the basic questions for which they and their colleagues will seek the answers. Certainly we would expect to support such efforts and, wherever profitable, to provide engineer-scientist members for the research team.

To conclude, Mr. Chairman, it would be most helpful to our Department to have the general reaction of your Committee to the broad approach proposed -- and to have such specific guidance and advice as the Committee might see fit to express.

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- Attachments:
- (1) Summary Data on Community Water Supply Program in Latin America for the Alliance Decade (Data as of 1 May 1968) - 1 p.
 - (2) List of Universities in Operational Network (1968) - 10 pp.
 - (3) Discussion of Center in Peru for Environmental Sciences and Engineering (Sanitary Engineering) - 10 pp.
 - (4) Program of Short Courses in Sanitary Engineering (Tentative List for 1968) - 10 pp.

SUMMARY DATA ON THE
COMMUNITY WATER SUPPLY PROGRAM
IN LATIN AMERICA
FOR THE ALLIANCE DECADE
(1961-1971)

(Data as of 1 May 1968)

International loans from:

Inter-American Development Bank (BID).....	\$ 417,015,100 ^(a)
Agency for International Development (AID).....	81,319,600
International Development Association (IBRD).....	24,300,000
Export-Import Bank (EXIMBANK).....	<u>30,508,355</u>
 TOTAL International Loans.....	 \$ 553,143,055

National Funds (including Counterpart Funds)

to support international loans and grants..... \$ 805,355,000

GRAND TOTAL..... \$ 1,358,498,055

Number of people benefited (urban and rural): 62,450,000

(a) Includes loans which have been approved, as well as those which have been signed.

N.B. - Of total funds (\$1,358,498,055), \$1,132.2 million is for urban centers and \$225.3 million is for rural areas

RESEARCH, EDUCATION AND TRAINING IN SANITARY ENGINEERING

UNIVERSITIES OPERATIONAL NET-WORK

COUNTRIES	UNIVERSITIES	GRADUATE COURSES	RESEARCH PROJECTS
ARGENTINA	Universidad Nacional de Buenos Aires Escuela de Ingeniería Sanitaria	X	X
BARBADOS	University of West Indies College of Arts and Sciences		
BOLIVIA	Universidad Técnica de Oruro Facultad de Ingeniería		
	Universidad Mayor de San Andrés Facultad de Ingeniería, (La Paz)		
BRITISH HONDURAS	University of West Indies Extra Mural Department, (Belize)		
BRAZIL	Universidade do Estado da Guanabara Instituto de Engenharia Sanitaria (Rio de Janeiro)		
	Universidade de São Paulo Facultad de Higiene e Saúde Pública	X	X
	Universidade Católica de Pernambuco Escola Politécnica (Recife)	X	
	Universidade de Paraíba Escola Politécnica de Campina Grande		
	Univ.Federal de Minas Gerais Escola de Engenharia (Belo Horizonte)	X	
	Universidade da Bahia,(Salvador) Escola Politécnica		
	Universidade do Paraná,(Curitiba) Escola de Engenharia		
	Universidade do Pará,(Belem) Escola de Engenharia		
	Universidade do Ceará,(Fortaleza) Faculdade de Engenharia		
	Univ. do Rio Grande do Sul Faculdade de Engenharia,(Pto.Alegre)		

COUNTRIES	UNIVERSITIES	GRADUATE COURSES	RESEARCH PROJECTS
COLOMBIA	Univ. Nacional de Colombia, Facultad de Ingeniería (Bogotá)		X
	Univ. de Los Andes,(Bogotá) Facultad de Ingeniería		X
	Universidad del Valle,(Cali) Facultad de Ingeniería Sanitaria		
COSTA RICA	Universidad de Costa Rica, Escuela de Ingeniería (San José)		
CUBA	Escuela de Salud Pública "Carlos Finlay",(La Habana)		
CHILE	Universidad de Chile,(Santiago) Facultad de Ciencias Físicas y Matemáticas, Escuela de Ingeniería		X
ECUADOR	Universidad Central del Ecuador Facultad de Ingeniería (Quito)		
	Universidad de Guayaquil Facultad de Ingeniería		
EL SALVADOR	Universidad Autónoma de El Salvador Facultad de Ingeniería y Arquitectura (San Salvador)		
GUATEMALA	Universidad de San Carlos de Guatemala Facultad de Ingeniería	X	
HONDURAS	Univ. Nacional Autónoma de Honduras Facultad de Ingeniería - (Tegucigalpa)		
MEXICO	Universidad Nacional Autónoma de México Facultad de Ingeniería, División del Doctorado "UNAM" - (Mexico City)	X	X
	Univ. de Nuevo León, Monterrey Facultad de Ingeniería Civil		
	Universidad de Chihuahua, Chihuahua Facultad de Ingeniería		

COUNTRIES	UNIVERSITIES	GRADUATE COURSES	RESEARCH PROJECTS
NICARAGUA	Universidad Nacional de Nicaragua Facultad de Ciencias Físicas y Matemáticas (Managua)		
PANAMA	Universidad de Panamá (Panamá) Facultad de Ingeniería		
PARAGUAY	Universidad de Paraguay Facultad de Ingeniería (Asunción)		
PERU	Universidad Nacional de Ingeniería Facultad de Ingeniería Sanitaria (Lima)		X
TRINIDAD AND TOBAGO	University of West Indies Faculty of Engineering		
URUGUAY	Universidad de la República Oriental del Uruguay, Facultad de Ingeniería y Agrimensura (Montevideo)		
VENEZUELA	Universidad Central de Venezuela Facultad de Ingeniería (Caracas)	X	

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PAN AMERICAN SANITARY ENGINEERING CENTER

This document reviews briefly some of the background relating to the Center; its functions; its present stage of development; and plans for the future.

Background

The increasing difficulty of providing a healthful living environment in cities continues to attract world attention. Mass migrations of populations from rural to urban areas have proceeded at a rate greater than our technology and our institutions can cope with, even in the most highly developed countries. These migrations are still proceeding -- at rates even beyond those predicted. Coupled with population growth and rapid industrialization, these migrations are producing particularly serious problems of water supply, sewerage, water pollution, air pollution, solid waste collection and disposal, and housing. Occupational hazards, radiation, noise, and food contamination are accompanying developments which require increased attention. The general contamination of the environment with toxic substances also is creating rather widespread public concern. A number of these problems are closely related and can be attacked efficiently only on a coordinate basis.

Major programs have been developed in several of the economically more advanced areas in an effort to meet these

massive urban problems. New departments of government have been created, new research and training centers have been established, and new incentives have been provided to both public and private enterprise in an effort to halt the degradation of the urban environment.

In areas where economic development is more recent, as in much of Latin America, resources have not been mobilized as extensively to alleviate existing problems or to prevent new ones. Further, the situation in developing countries is more critical because the onrush of urbanization is more rapid than it was in previous developing areas of the world. Thus it is more urgent to provide the resources for guiding urban environmental planning and development.

By late 1965 the need for the Organization to improve its capability to meet its emerging environmental engineering responsibilities was becoming very evident. Realignment of some of the existing resources to create a core structure that would concentrate on environmental problems in urban areas was proposed. This consolidated operation was to concentrate its energies to serve Member Governments on a Regional basis. Its functions would emphasize technical assistance and would include:

1. Central intelligence on urban problems, including the collection and dissemination of basic data and information.

2. The development of procedures for analyzing urban problems and the application of these procedures in preparing master plans, determining priorities and producing sets of program approaches.
3. Production of technical information materials.
4. Conduct of selected seminars and symposia in new areas of development.
5. Providing expert technical consultation on request of Member Governments.
6. Stimulation and support of high-quality teaching, research and service programs in the major universities of the countries.

(While the newer urban problems are stressed here, it is recognized that there are major and difficult rural problems that also must receive attention.)

This new resource would be a supporting arm of the Zone Offices just as the Zone Offices support the Country offices and they in turn the countries. It would complete our technical support structure. Its services would be available on request of the Zone Offices to meet requests from the Member Countries that the Zones could not meet with their staff or with short-term consultants. Emphasis would be on providing specialized assistance in the development of national programs rather than on specific technical problems. Some consultation of the latter type

would be provided especially where it had broad significance, but the "fire-fighting" type of request would be discouraged in view of the highly limited resources. The types of services provided would be those that could not be afforded on other than a Regional basis.

Further discussions of this proposal resulted in the concept of a Regional Sanitary Engineering Center, whose initial functions would be as outlined. In subsequent stages of development, the Center would engage in technical training and research activities.

The Present Stage of Development

The present status of the Center is as follows:

1. A small group of specialists has been assembled in Lima, Peru. One specialist is provided in each of the following subject areas:
 - a. Industrial Hygiene
 - b. Air Pollution
 - c. Housing and Urbanization

Specialists in three additional areas are to be provided in 1968:

- a. Water Supply
- b. Sewerage and Industrial Wastes including Water Pollution
- c. Education and Training

Space sufficient for the present staff of three professionals is being provided in an auxiliary building at the location of the

location of the Zone Office. This space is not very adequate and provides no room for additional staff. Space is needed to accommodate the additional staff planned for 1968, to begin the assembling of a library and to initiate production of technical information materials. Accommodations for small seminars and technical conferences would be very desirable.

Establishment of a Center now is considered timely. The meeting of the Presidents at Punta del Este emphasized strongly the need to strengthen Latin American capability in science and technology. Subsequent establishment of the Regional Scientific and Technological Development Program and establishment of a Latin American Group of Experts on Science and Technology have given effect to the recommendations of the Presidents.

Many proposals for multinational programs and centers have been developed as a result of this stimulus. The mechanism for selection and funding of proposals has not yet been established. We believe the need for a Center of Science and Technology in the environmental field is sufficiently urgent and lasting to justify going ahead with our own resources.

Environmental Science and Engineering in Latin America Today.

A review of the present status of science and technology in the environmental field in Latin America indicates the need for significant improvement.

The improvements needed coincide closely with the principal goals of the Regional Scientific and Technological Development Program namely "to advance science and technology to a degree that would contribute substantially to accelerating the economic development and well-being of their peoples and make it feasible to engage in pure and applied scientific research of the highest possible quality".

Empahsis is placed on the production of scientific and technical manpower, expansion of research, and extension of technical assistance.

Sanitary engineering manpower in Latin America is still far below the estimated needs and "real demand", especially at advanced academic levels. Various estimates of need range from five to ten thousand additional sanitary engineers and related scientists. Very few good graduate programs exist, but the potential for activating several more is considered very good. Stimulation and support by the Center should yield gratifying results.

For all practical purposes sanitary engineering research may be considered to be at a baseline level of near zero. A few very modest applied research projects have been started, largely with PAHO and United Nations Development Program assistance, in the last two years. But in relationship to the opportunities and needs the research effort has to be considered negligible.

The important thing is that the potential is much improved. The establishment of graduate programs with full time faculty and laboratory facilities makes research possible. In turn research will produce the new designs, methods and innovations that will accelerate development in and attract support from the public agencies responsible for environmental facilities and services. The importance simply of fostering and developing the research point of view can hardly be over-emphasized here. Latin America is still largely using designs and methods developed for European and North American conditions rather than ones suited to its conditions and contributing in the fullest possible way to Latin America development. Sound, high quality indigenous teaching and research institutions are an absolute necessity for full economic and social development.

The Sanitary Engineering Center would be expected to play a key role in bringing about the improvement needed. As a multi-national scientific and technological center it would strengthen national scientific and technological institutions. Most of these in the sanitary engineering field need supplementing; a number of new ones need to be created. The framework for support and for interchange of ideas and staff already exists in the Latin American training network which PAHO has developed with the Universities.

As a multi-national institution the Center can bring to the attention of political heads the importance of national

institutions and of international collaboration by laboratories, universities, and other institutions. Increased national strength also can result from international affiliation. These and other benefits have been identified in discussions of "centers of excellence".

Future Plans

Hopes and aspirations for the Center are not bounded by nor rooted in conventional sanitary engineering activities. There is the need, of course, to stay in touch with reality and to serve tangible purposes -- but the success of the Center will depend more on its ability to generate unconventional approaches, different and better ways of meeting traditional problems, and imaginative ways of solving new problems.

In addition to the technical assistance functions which constitute the Center's initial activities it would be desirable to undertake some other tasks. First among these is a quantitative and qualitative study of existing scientific and technological teaching and research programs, and a projection of their potential. The information assembled is not sufficient for specific planning to meet future manpower or research needs. In the course of this study a reasonably accurate picture of the need for textbooks and teaching aids should be obtained. Similarly, research resources and research needs would be assessed. An appraisal of research facilities and an estimate of fellowship needs for graduate teaching and research staffs at the Universities would be part of this assessment.

Much work needs to be done also in the development and application of standards. This activity is closely related to revision of designs for both large and small scale public works in the sanitary engineering field. It is important also in stimulating the development of new industry such as for plastic pipe and fittings, since these products will not be used widely nor move freely in commerce until accepted standards of quality and performance, and accompanying certification procedures, are developed. The collaboration of professional groups such as the Inter-American Association of Sanitary Engineering would be important to the success of such an undertaking.

Beyond the sponsoring of selected symposia in new areas, training courses would be sponsored in such subject areas as comprehensive pollution control planning, organization and management of sanitary engineering works and services, environmental aspects of river basin development, and systems engineering. Training methodology and programs for training PAHO professional staff, are other potential areas for attention.

Several world wide reference center programs such as air pollution measurement, radiation monitoring and water supply research are being activated by WHO Headquarters at Geneva. The Center would be expected to be the focal point in this Region for such programs. Likewise, there are being established throughout the world new centers under the Water for Peace Program. For Latin America this Center could serve naturally as the Regional resource for the sanitary engineering aspects of water.

Finally, the Center should have a facility that will enable it to engage in a respectable program of in-house research. The firm conviction is that the Center will not achieve real leadership in research until it is engaged in research, has a true reciprocal base for communication with national research institutions in Latin America and with international research institutions throughout the world.

The rate of growth of the Center, beyond that scheduled for 1968 and 1969 (essentially out of existing funds) will depend both on internal and external support.

With respect to internal financing we propose to pursue two paths. The first is the one that is being used to get the Center started -- redeploying existing resources. To the extent practical, this would be extended. However, this cannot be expected to carry the development much farther. The second is to seek orderly increases in the regular budget. The plan is to place major emphasis on the Center in the 1970 budget, and to provide reasonable increments in the subsequent years until a level of support that can be sustained is reached.

At the same time external funds will be sought. It is realized that it is necessary to reach a sort of "critical mass" level of activity in order to attract certain kinds of external support (such as research grants). This makes initial support of the Center a highly critical item.

At this time a firm target goal for the size of the Center has not been set, nor its morphology highly described. This outline is intended to convey something of the need, the form, and the substance of what is proposed.

ORGANIZACION PANAMERICANA DE LA SALUD
PAN AMERICAN HEALTH ORGANIZATION

Abril 1968

PROGRAMA DE INVESTIGACION, EDUCACION Y ADIESTRAMIENTO
EN INGENIERIA SANITARIA

RESEARCH, EDUCATION AND TRAINING PROGRAM
IN SANITARY ENGINEERING

- 1968 -

(Lista Tentativa - Tentative List)

- I. Programa de Cursos Cortos en Ingeniería Sanitaria
- I. Program of Short Courses in Sanitary Engineering

ARGENTINA

Escuela de Ingeniería Sanitaria, Univ. Nacional de B.A., Buenos Aires

	"Higiene Industrial" (Industrial Hygiene)
November 12 - 22	"Estaciones Elevadoras y Bombas para Abastecimiento de Agua" (Pumping Stations and Pumping Equipment for Water S.)
November 4 - 8	"Lagunas de Estabilización" (Stabilization Ponds)
	"Protección de Cañerías y Materiales Contra la Corrosión" (Protection of Pipes and Materials Against Corrosion)

BOLIVIA

Facultad de Ingeniería, Universidad Técnica de Oruro, Oruro

April 22 - May 3	"Higiene y Seguridad del Trabajo" (Occupational Health and Safety)
	"Disposición de Excretas, Desagües y Basuras" (Excreta Disposal, Sewerage and Wastes Disposal)

Facultad de Ingeniería, Universidad Mayor de San Andrés, La Paz

May 13 - 24	"Estudios de Factibilidad Técnica y Económica de Proyectos de Ingeniería Sanitaria" (Technical and Economic Feasibility Studies for Sanitary Engineering Projects)
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1968 Short Courses

BOLIVIA Cont'dFacultad de Ingeniería, Universidad Mayor de San Andrés, La Paz

 "Control de la Calidad del Agua"
 (Water Quality Control)
BRITISH HONDURASExtra Mural Department, University of West Indies, Belize

 "Public Health Administration"
 (Administración de Salud Pública)
BRASILFaculdade de Higiene e Saúde Pública (FAHISP), Univ. de São Paulo, S.P.

 June 24 - July 5 "Bombas e Estações Elevatórias"
 (Pumps and Pumping Stations)

 August 12 - 23 "Piscinas de Natação"
 (Swimming Pool Sanitation)

 Comissão Inter-Municipal de Contrôles da Poluição das Águas e do Ar
 (CICPAA) São Caetano do Sul

 April 15 - 27 "Ventilação Industrial"
 (Industrial Ventilation)
Escola Politécnica da Universidade Católica de Pernambuco, Recife

 Sept. 30 - Oct. 8 "Operação de Estações de Tratamento de
 Água"
 (Operation of Water Treatment Plants)

 "Administração de Empresas de Água"
 (Water Utilities Administration)
Escola Politécnica de Campina Grande, Univ. de Paraíba, Campina Grande

 Nov. "Cloração da Água"
 (Water Chlorination)
Escola de Engenharia, Univ. Federal de Minas Gerais, Belo Horizonte

 "Qualidade das Águas"
 (Water Quality)
Departamento das Águas e Esgotos, Brasília, D.F.

 "Lodos Ativados"
 (Activated Sludge)

1968 Short Courses

BRASIL Cont'd

Escola Politécnica, Universidade da Bahia, Salvador

"Técnicas de Construção de Sistemas de Abastecimento de Agua"
(Construction Techniques in Water Supply Systems)

Escola de Engenharia, Universidade do Paraná, Curitiba

Sept. "Agua Subterrânea"
(Ground Water)

Superintendência de Urbanização e Saneamento (FENSP) Estado da Guanabara

"Planejamento de Serviços Hospitalares" (Hospital Services Planning)

Escola de Engenharia, Universidade do Pará, Belem

"Qualidade das Aguas" (Water Quality)

COLOMBIA

Facultad de Ingeniería, Univ. Nacional de Colombia, Bogotá

June "Sistemas Tarifarios para Abastecimientos de Agua Potable" (Water Rates Systems for Water Supply)

July 8 - 20 "Higiene Industrial"
(Industrial Hygiene)

November 18 - 30 "Control de Alimentos" (Food Control)

Facultad de Minas, Univ. Nacional de Colombia, Medellín

"Problemas de Hidráulica en Plantas de Tratamiento" (Hydraulics Problems in Water Treatment Plants)

Facultad de Ingeniería, Universidad de los Andes, Bogotá

January 8 - 12 "Systems Analysis in Water Resources"
(Sistemas de Análisis de Recursos de Agua)

Facultad de Ingeniería Sanitaria, Universidad del Valle, Cali

July 22 - August 3 "Análisis de los Desechos y Desarrollo de Información de Diseño"
(Analysis of Wastes and Design Information)

1968 Short Courses

COSTA RICAEscuela de Ingeniería, Universidad de Costa Rica, San José

March 18 - 21	"Perforadores de Pozos" (Well Drillers)
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CUBAEscuela de Salud Pública "Carlos Finlay", Ministerio de Salud Pública, La Habana

January 22 - February 3	"Diseño y Construcción de Lagunas de Estabilización" (Design and Construction of Stabilization Ponds)
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CHILEFacultad de Ciencias Físicas y Matemáticas, Escuela de Ingeniería, Universidad de Chile, Santiago

	"Conducción en Tuberías de Acero" (Flow in Steel Pipes)
	"Redes de Alcantarillado y Tratamiento de Aguas Servidas" (Sewerage and Sewage Treatment)
	"Instalaciones Domiciliarias" (Equipment for Homes)
	"Curso para Técnicos de Industria Sobre Residuos Industriales" (Course for Industrial Technicians on the Subject of Industrial Wastes)
	"Administración de Servicios de Agua Potable" (Administration of Water Supply Services)
	"Computación en Empresas de Agua Potable" (Computation as Used by Potable Water Supply Agencies)
	"Análisis de Sistemas de Agua" (Water Systems Analysis)

Escuela de Salubridad, Universidad de Chile, Santiago

	"Vivienda" (Housing)
	"Fluoruración del Agua" (Kellogg Foundation) (Water Fluoridation)

1968 Short Courses

ECUADOR

Facultad de Ingeniería, Universidad Central del Ecuador, Quito

July 14 - 19 "Seminario Regional Sobre la Enseñanza de la Ingeniería Sanitaria" (Regional Seminar on Teaching of Sanitary Engineering) (AMRO-6409)

"Diseño de Lagunas de Oxidación"
Oxidation Ponds Design)

Facultad de Ingeniería, Universidad de Guayaquil, Guayaquil

September 3 - 14 "Diseño de Plantas de Tratamiento de Agua" (Design of Water Treatment Plants)

EL SALVADOR

Facultad de Ingeniería y Arquitectura, Universidad Autónoma de El Salvador, San Salvador

April 1 - 15 "Planificación y Diseño de Centros de Salud" (Health Centers Planning and Design)

October 1 - 15 "Lagunas de Estabilización" (Stabilization Ponds)

GUATEMALA

Facultad de Ingeniería, Universidad San Carlos de Guatemala, Guatemala

October 1 - 8 "Curso Regional Sobre Fluoruración del Agua" (Regional Course on Water Fluoridation) (AMRO-4409)

June 15 - 30 "Operadores de Sistemas de Abastecimiento de Agua" (Water Supply Systems Operators)

April 22 - May 4 "Proyectos de Instalación de Equipos de Hospitales, Operación y Mantenimiento" (Hospital Equipment Projects - Operation and Maintenance)

1968 Short Courses

HONDURAS

Facultad de Ingeniería, Universidad Nacional Autónoma de Honduras,
Tegucigalpa

August 1 - November 15 "Perforación de Pozos"
(Well Drillers)

MEXICO

Facultad de Ingeniería, División del Doctorado, Universidad Nacional
Autónoma de México, México, D.F.

February 19 - 24 "Sistema de Abastecimiento de Agua"
(Water Resources Systems)
"Fluoruración del Agua"
(Water Fluoridation)

February "Diseño de Sistemas de Abastecimiento
de Agua" (Design of Water Supply
Systems)

May 21 - June 5 "Agua Subterránea" (Ground Water)

October 16 - 28 "Control de la Contaminación de Aguas
Receptoras" (Stream Pollution Control)

Escuela de Post-Graduados de la Facultad de Ingeniería Civil, Uni-
versidad de Nuevo León, Monterrey

August 14 - 16 "Higiene Industrial y Contaminación
Atmosférica" (Industrial Hygiene and
Air Pollution)

Facultad de Ingeniería, Universidad de Chihuahua

April 9 - 21 "Administración y Operación de Sistemas
de Abastecimiento de Agua" (Operation
and Administration of Water Supply
Systems)

NICARAGUA

Facultad de Ciencias Físicas y Matemáticas, Universidad Nacional de
Nicaragua, Managua

"Diseño de Sistemas de Abastecimiento
de Agua para Comunidades Rurales"
(Design of Water Supply Systems for
Rural Communities)

"Sistemas de Alcantarillado"
(Sewerage Systems)

1968 Short Courses

URUGUAY

Facultad de Ingeniería y Agrimensura, Universidad de la República
Oriental del Uruguay, Montevideo

<u>June</u>	"Lagunas y Zanjas de Estabilización de Líquidos Residuales - Diseño y Operación" (Oxidation Ponds and Ditches - Design and Operation)
<u>August</u>	"Aplicación de las Computadoras Electrónicas en la Solución de los Problemas de Ingeniería Sanitaria" (Use of Electronic Computers in Solving Sanitary Engineering Problems)
<u>October</u>	"Instalaciones Sanitarias Domiciliarias" (Sanitary Equipment for Homes)

REP. DOMINICANA

Instituto Nacional de Agua Potable y Alcantarillado, Santo Domingo

<u>November 19 - 30</u>	Diseño de Sistemas de Abastecimiento de Agua" (Design of Water Supply Systems)
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Anexos

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PROYECTOS DE INVESTIGACION ACTUALMENTE EN DESARROLLO
RESEARCH PROJECTS IN DEVELOPMENT

ARGENTINA

Escuela de Ingeniería Sanitaria, Univ. de Bs. Aires, Buenos Aires

Apr. - Dec. "Investigación sobre Lagunas de Estabilización en el Tratamiento de Residuos de la Industria de la Carne"
(Research on Stabilization Ponds in the Treatment of Meat Residues)

"Investigación sobre Incineradores Domiciliarios de Basuras"
(Research on Domiciliary Garbage Incinerators)

BRASIL

Faculdade de Higiene e Saúde Pública, Univ. de São Paulo, São Paulo

Apr. - Dec. "Pesquisa sobre Aspectos Sanitários e Economicos nos Processos de Destino Final do Lixo"
(Refuse Disposal)

"Comportamento e a Aplicabilidade de Filtros Lentos no Brasil"
(Research on Functions and Uses of Slow Sand Filters in Brazil)

COLOMBIA

Centro de Estudios de Desarrollo Económico, Univ. de Los Andes, Bogotá

Apr. - Dec. "Investigación sobre Aspectos Económicos de las Obras de Agua y Alcantarillado"
(Research on Economic Aspects of Water and Sewage Works)

Facultad de Matemáticas e Ingeniería, Univ. Nacional de Colombia, Bogotá

Apr. - Dec. "Investigación sobre Tipos de Medidores de Agua Domiciliar"
(Research on Water Meters)

CHILE

Depto. de Ingeniería Sanitaria, Esc. de Ingeniería, Facultad de Ciencias Físicas y Matemáticas, Univ. de Chile, Santiago

Apr. - Dec. "Investigación sobre Determinación de Datos Básicos de Diseño"
(Research on Basic Factors for Water Supply Design)

"Investigación sobre la Evaluación de la Influencia de la Tasa de Filtración en la Calidad del Agua de la Planta de Tratamiento para Santiago en las Vizcachas y Vizcachit.
(Research on Rate of Filtration in the Vizcachas and Vizcachitas Water Treatment Plants and its Influence on Water Quality).

CHILE

Depto. de Ingeniería Sanitaria, Esc. de Ingeniería, Facultad de Ciencias Físicas y Matemáticas, Univ. de Chile, Santiago

Apr. - Dec. "Lagunas de Estabilización"
(Stabilization Ponds)

"Sedimentadores"
(Settlings)

"Inhibidores de Evaporación"
(Evaporating Inhibitors)

"Hipocloradores"
(Hypochlorinators)

Escuela de Salubridad, Univ. de Chile, Santiago

Apr. - Dec. "Investigación sobre Elaboración Económica de Composting para una Municipalidad, incluyendo Aspectos de Diseño, Economía y Financiamiento"
(Research on Economic Composting Plant, including Design, Economic and Financial Aspects)

"Investigación sobre Incremento de las Tasas de Filtración en la Planta de Lo Castillo, su Influencia en la Calidad del Agua y su Posible Generalización a Plantas Convencionales"
(Research on Increase of Filtration Rates in Water Treatment Plant of Lo Castillo, its Influence on the Water Quality and its Possible Generalization to Conventional Water Treatment Plants)

MEXICO

Instituto de Ingeniería, Univ. Nac. Autónoma de Mexico, Mexico

Apr. - Dec. "Floculadores Hidráulicos de Flujo Helicoidal"
(Research on Hydraulic Flocculators)

"Lagunas de Estabilización"
(Research on Stabilization Ponds)

"Aplicación de Materiales Plásticos en Sistemas de Agua Potable"
(Research on Application of Plastic Pipes in Potable Water Supplies)

PERU

Facultad de Ingeniería, Univ. Nac. de Ingeniería, Lima

Apr. - Dec. "Lagunas de Estabilización"
(Stabilization Ponds)