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INTERNATIONAL PROGRAM
IN SANITARY ENGINEERING DESIGN
EVALUATION AND RECOMMENDATIONS

by

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Prepared for the
AGENCY FOR INTERNATIONAL DEVELOPMENT

July 1971

NOTE

Although this study was made possible by an allocation of funds by the Office of Health, Agency for International Development, the views and recommendations expressed herein are those of the consultants and should not necessarily be interpreted as representing the official policy of the Agency for International Development.

INTERNATIONAL PROGRAM
IN SANITARY ENGINEERING DESIGN
EVALUATION AND RECOMMENDATIONS

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FOREWORD

In 1962 the Agency for International Development (A.I.D.) launched the International Program for Sanitary Engineering Design (IPSED) at the University of North Carolina (UNC) and has sponsored the program since its beginning. The program has been modified and improved during the decade to meet the changing needs of the sanitary engineers of the developing world for whom it was originated.

As a part of A.I.D.'s continuing evaluation of the programs it sponsors, the Agency authorized, in 1971, a study of the International Program for Sanitary Engineering Design. A team of four consultants were invited to appraise the program. This report contains the results of their study with their conclusions and recommendations.

The evaluation was under the general direction of Mr. A. Dale Swisher, P.E.; Mr. Charles S. Pineo, Consultant, coordinated the work of the consultants:

Dr. John Logan, President, Rose-Hulman Polytechnic
Institute

Dr. Edward Cleary, Professor, Environmental Health,
University of Cincinnati

Dr. George Hanna, Jr., Dean of Engineering,
University of Nebraska

(See Appendix G for biographical sketches of each of the above consultants.)

I. INTRODUCTION

Historical Background

Since the start of the United States technical assistance program in 1942 emphasis has been placed on assisting in the improvement of environmental sanitation of the countries of the developing world. At first much of the emphasis was placed on the design and construction of potable water supply systems on a project-by-project basis. However, as early as 1958 the International Cooperation Administration (predecessor of the Agency for International Development - A.I.D.) started planning for a global community water supply program to spearhead a worldwide attack on the widely prevalent gastrointestinal diseases through the stimulation of national water supply programs. The purpose was to assist countries develop efficient, self-sustaining and self-generative water supply institutions to plan, aid in financing, construction, and management of water supply systems.

In 1959 the Director of the World Health Organization proposed, and the 12th World Health Assembly endorsed, a global water supply program. Authorized by the 86th Congress, the community water supply program of A.I.D. was initiated in 1960 and has had a significant impact on the water supply activities in the developing world.

The program of A.I.D., WHO and other assistance agencies have stressed the importance of preparing the professional and technical personnel required to build the institutions and to carry out the national community water supply programs. Scholarships provided by these agencies have financed the graduate education of sanitary engineers from all the countries of the developing world. Much of this education has been furnished through the established graduate sanitary engineering programs at universities in the economically developed world.

In 1962 A.I.D., responding to a demand for a course oriented to the specific needs of sanitary engineers from the developing countries, arranged with the University of North Carolina for the development of the International Program for Sanitary Engineering Design. The unique program was created to train practicing engineers from the developing countries in the conception, design, construction, management, and operation of water supply and sewer projects of a nature appropriate to the needs in the engineers' countries.

In addition to an intensive academic phase at the University of North Carolina the IPSED program arranges for each participant to receive on-the-job practical experience in well-managed water supply and sewage treatment plants followed by experience in consulting engineering offices under continued university supervision.

The IPSED program encompasses the following:

Academic Phase - A curriculum has been set up for a one semester course (the academic phase was scheduled for twelve weeks during the first seven sessions of the program) of both refresher and new material. Much of the material is written specifically for the course and is issued to participants for reference. The program includes courses in (a) design of hydraulic structures; (b) sanitary engineering design in developing countries; (c) groundwater hydrology; and (d) water resources planning in developing countries. Participants in IPSED can receive up to eleven hours postgraduate credit for successful completion of three courses.

Municipal Phase - The participants are assigned individually, for one month following the academic phase, to waterworks and sewage treatment plants to learn, on the job, of the intricacies of operation and management problems. (See Appendix A, IPSED brochure, for a list of the sixteen municipalities which have cooperated in this phase.)

Consulting Office Phase - After the municipal phase, the participants are assigned individually to sanitary engineering consultant offices for an internship varying in length but ordinarily about six months. The offices are selected with the participants' needs in mind and in relation to the work being carried out in the particular office. (A list of the twenty-three collaborating engineering firms is given in Appendix A - IPSED brochure.) See Attachment III for a more detailed report of the IPSED program contained in the UNC Report on the Eleventh Session. One hundred and three engineers from thirty-six different countries in Africa, the Middle East, Asia, and the Americas have enrolled for the program from its inception in 1963 up to the present time. (See Appendix C for a map of the distribution by countries.) Fifty of the participants have been sponsored by A.I.D., forty-five by WHO (twelve of these were PAHO sponsored) and eight have been sponsored by other agencies (including two who were self-financed). See Appendix B.

Most of these engineers hold positions of responsibility in the water authorities, ministries of public health and public works, universities and private consulting firms in their own countries. Many of them are at decision making levels in their agencies, while a number are working at national level.

Purpose of Study

The IPSED program has been modified from time to time to meet, more effectively, the needs of the participants. As these modifications have been made on a piecemeal basis, A.I.D. decided, in 1970, to make an overall study of the program with the following objectives:

To evaluate: (a) the suitability of the IPSED program in content and level to the needs of sanitary engineers in the developing countries; (b) the impact of the program on sanitary engineering in the developing countries and (c) the efficacy of the methods used in the program,

Based on the evaluation to obtain recommendations for improving and strengthening the IPSED program.

Study Procedure

To obtain a better understanding of the strengths and weaknesses of the IPSED program it was decided (a) to study the three phases of the program in the United States; and (b) to supplement that study by a review with former participants, in their own countries, of the effectiveness of the IPSED program in their own particular situations. This review with the participants adds a dimension to the study which is not usually included in an evaluation of a university program.

It was not feasible to try to talk with all of the former participants because there are many cases of only one participant from a country. A goal was set of interviewing 50% of the participants.

A team of four consultants was invited to assist with these interviews as well as to study the three phases of the IPSED program in the United States. In addition, the World Bank was invited to interview former participants in countries where the Bank has activities and WHO agreed to solicit the opinions of appropriate government officials in the countries of the former participants. The findings of the four consultants and of the representatives of the two organizations are summarized in the present report.

Activities During the Study

The consultants visited 15 countries and interviewed 50 of the former participants from the First through Eleventh Sessions (participants in the Twelfth Session were in Phase III of their program at the time of the study.)

RESUME OF STUDY*

	LATIN AMERICA CARIBBEAN	AFRICA	NEAR EAST & SOUTH ASIA	FAR EAST	EUROPE	TOT.
Countries with Participants	12	7	6	8	1	34
Countries Visited	7	2	2	4	-	15
Distribution of Participants	27	15	24	20	1	87
Participants Interviewed	18	7	10	15	-	50
Interviewed by	Pineo	Hanna**	Cleary & Logan			

*See Appendix D for detail of distribution of participants by country, number of session attended and location of participants interviewed by consultants.

**Also interviewed 5 participants from Turkey who are included in Near East South Asia tabulation.

In many cases the consultants also interviewed the supervisors of the participants. A resumé of each of the interviews is included in Attachment I.

In addition to spending some time with the members of the IPSED staff at the University of North Carolina to review the on-campus academic phase of the program, the consultants visited four of the municipalities most often used for Phase II of the program and seven of the offices of consulting engineering firms which cooperate in Phase III.

Information furnished by the World Bank and the World Health Organization is included as Attachment II.

Organization of Report

The report is structured to facilitate its use by including a General Summary section and a section with Recommendations immediately after the Introduction. These sections provide a) an overall resume of the study; and b) recommendations for strengthening the IPSED program.

Following these sections there is a section Findings Based on Interviews in which is summarized, by regions, the interviews carried out during the survey. Illustrative charts and tabulations are contained in the Appendix.

The details of the interviews are reported in a separate volume of Attachments also arranged by regions of the world.

This organization of this report makes it possible for the reader to obtain a broad understanding of the findings of the survey from a consideration of the first few pages of the report. A more detailed picture may be had by reading the following sections of the report and its attachments.

II. GENERAL SUMMARY

All information gathered by personal observation and interviews with former participants and their supervisors indicates clearly that the International Program for Sanitary Engineering Design was imaginatively planned and has been competently executed to meet the objectives of the program. It offers a combination of theory and practical application which is not available in any other place. The staff and facilities of the University of North Carolina are on a par with those of any university in the world. The cooperation received from the municipalities and consulting firms in providing in-service training testifies to the esteem in which the university is held.

Of the fifth former participants interviewed, three-fifths felt that each of the three phases of the IPSED program was from good to excellent, some feeling that one phase or another was better from his point of view. Five expressed dissatisfaction with Phase II, six with Phase I and seven with Phase III. Hopefully, this report will be of assistance in eliminating points of dissatisfaction and in helping to strengthen the overall program.

The program has already been considerably improved since it was originally established, notably in the academic phase. The latter has been integrated more effectively with the regular fall semester course offerings at the university and the students have the option of taking examinations and in some instances of obtaining academic credits which may be applied toward an M.Sc. degree at North Carolina or at some other universities. Participants may also register for other credit courses at the university.

Upon successful completion of the program a certificate is conferred on the participant. In the majority of cases, particularly for the participants interviewed in Latin America, the lack of a degree does not bother them. They feel that the combination of study and practical application oriented toward problems they are apt to meet in their own countries is much more advantageous for them than a degree based on academic studies alone. However, in some countries, e.g., West Pakistan, the Philippines, Thailand, Vietnam and to a lesser extent in Nigeria and Turkey, a degree is considered most desirable, in fact almost mandatory as it may serve as a stepping stone to increases in grade and possible promotion to more responsible positions. When a degree is essential, arrangements may be made for the participant to continue after his IPSED program using IPSED course credits. This has been done by some of the participants.

One of the many strengths of the program is its flexibility, making it possible to tailor the program for an individual participant to meet his needs and interests. During the academic phase problems may be assigned that are similar to those faced at home. Elective courses may be taken to cover subjects not included in the IPSED program. Night classes may be taken while the participant is assigned to his consulting engineering firm. The participant's assignments for Phases II and III may be influenced by his preferences.

This flexibility makes it all the more important that the participant have a clear idea of (a) what his agency expects him to get from the IPSED program; and (b) what he wants to get from it, personally. These needs and desires must be elicited by the IPSED advisors from the participants and passed on to the rest of the staff including the staff with whom the participant will be working in Phases II and III.

Continuing coordination is essential among the IPSED staff during the academic phase to avoid duplication of material and to be sure that the

needs of the individual are being met. Equally important is regular liaison by the IPSED staff with the municipal and consulting engineering firm staff where the participants are assigned for Phases II and III.

There was evidence that the staff of some of the cooperating agencies did not have a clear understanding of the objectives of the program nor of what was expected of their organizations. Requests were received for a manual covering these details, also details of the responsibilities of the trainees while assigned to the cooperating agencies.

Many of the participants heard about the IPSED program from former participants or representatives of the A.I.D. or WHO offices. Only one learned about the program through an announcement in a technical journal. Indicated is the need for a much more active spreading of information about the program on a regular basis. The information should include details about the program, possible variations and electives, and on the availability of scholarships and how they may be obtained.

The present IPSED brochure (Appendix A) should be brought up to date with the latest changes in the program. Complete information should be included on the electives outside the IPSED program that may be available to the candidate and how he may apply to take the courses offered. He should be urged to consider the possibility of supplementing his program by taking evening classes during the time he is assigned to the consulting engineering phase of his program. The candidate should be encouraged to discuss these possibilities with his supervisor and to work out with him the program which will meet most effectively the objectives of both the participant and his agency. Too often the participant arrives at UNC without a definite understanding of his own objectives nor of the many choices available to help him meet his goals.

The agencies providing scholarships should be urged to (a) provide scholarships for engineers from the private as well as the governmental sector, and (b) to complete processing of the candidates well in advance of the start of the IPSED program to allow the candidates sufficient time to take care of personal arrangements. A few participants arrived late for the opening and missed some of the orientation which is given a lot of emphasis by the IPSED staff. Many of the participants were quite complimentary about the orientation and the extra assistance provided them by both the professional and secretarial staff of the program.

Several of the participants spoke quite frankly about the inadequacy of the stipend provided as part of their scholarships and also about the disparity between the stipend paid by A.I.D. and WHO. Representatives of the consulting engineering firms also mentioned this and the impossibility of finding even minimal quarters for the amounts paid the participants

A satisfactory command of English is essential for a successful program. Without it the participant is handicapped in all phases of the program. He even loses out because he is too timid to ask the questions he should to obtain answers he needs. It was evident that lack of English capability sometimes prevented the development of rapport so essential for a satisfactory experience.

A number of suggestions were made for improving the academic phase of the program, including the addition of new material and the strengthening of the content of the four main courses of the program. Adoption of any of these suggestions will require a careful review of the courses, shortening presentations on some aspects and eliminating material which may be covered in more than one course.

Interest was expressed in the addition of course work on microbiology, chemistry for sanitary engineers including laboratory work, more emphasis on water quality control and on industrial waste. There was considerable

feeling about the need for strengthening the presentation on sewage treatment including processes suitable for the smaller cities and towns as well as those required for the larger cities. As water supplies are expanded and improved the need for sewage collection and treatment facilities becomes more urgent and is being felt in many areas of the world.

Evident throughout the survey was the need for expanding the presentation on the various aspects of management, economic analysis, planning, decision making, and financing to provide the tools needed by those at administrative and planning levels. Twenty-three of those interviewed have prime responsibility at these levels and seven others have a secondary responsibility. Many of them were disturbed by the lack of more extensive material on these subjects. Others were intrigued by what they had learned and anxious to delve deeper for their own benefit. A few took extra courses when they could find them.

Several of the former participants felt that more extensive basic material should be included on the theory and application of computers to sanitary engineering problems. Two or three participants have taken special courses on the use of computers. Interest was also expressed in receiving more exposure to the principles of public relations.

Some of those interviewed said that the courses during the academic phase were not challenging enough and also commented on the non-homogeneity of the education and experience of the participants, some of whom have their M.Sc. degrees in sanitary engineering and a number of years experience whereas others may be recent graduates in civil engineering. This requires the professors to lower the level of their presentations from that appropriate for the better qualified to make it understandable to those less well qualified.

The importance of stressing, throughout the IPSED program, the adaptation of sanitary engineering practices to the needs and possibilities of the developing countries was mentioned by several of the participants. They also petitioned that emphasis be placed on the problems of the smaller communities as well as on those of the cities. Several suggested that time be allowed during the academic phase for the students to work under the personal supervision of the IPSED staff on problems similar to those found in their own countries. This would be in addition to problems which the students would have to work out on their own. The use of visiting sanitary engineers from the developing countries was mentioned as one method of assuring the orientation of the program to the situation in those countries.

The majority of the participants were loud in their praise of the visits to water and sewage treatment plants of different types and sizes. Some mentioned the desirability of visits to equipment manufacturing plants while a number felt that much more emphasis should be placed on the selection of equipment, pointing out the advantages and shortcomings of different types for use in the varying situations in the developing countries.

One of the few former participants who is now working full time as a professor of sanitary engineering suggested that the IPSED program be divided into two programs, one for regular students whose activities are directly related to design and technical problems and a second parallel course for special students who are concerned mainly with teaching and research. As a professor he felt that Phase I should be lengthened to seven months to include more extensive academic coverage including a course on sanitary chemistry and augmenting the groundwater course to include hydrology of surface water. Phase II would be maintained as at present and Phase III would be reduced to four

months. The new program would also be divided into three phases. During the first phase of seven months, the student would be free to attend courses related to his area of interest. During the second phase of three months which might also be at UNC, the student would devote his time to applied work such as solving special problems or carrying out some research project. A report of this work would be required at the end of this period. Inspection visits to installations and agencies of value to the participant's program would be made during the two months of Phase III.

The need of supplementing the present IPSED program by other programs or courses was expressed by some of those interviewed during the study. One suggested the need for a more advanced course to be made available for those who have taken the present program and need more advanced training after several years additional experience. A second suggestion was for the development of intermediate length courses on a regional basis to meet the concrete needs of specific groups of engineers. The participants would be carefully selected to keep the group homogeneous and the material would be prepared to meet their specific needs. The length of the course would be determined by the content and the optimum time of availability of the participants, possibly one month for those in highly responsible positions and up to six weeks for others in lower categories. The course would be given for a region at a university in the region which might cosponsor it with A.I.D., the IPSED staff and the World Bank or a regional bank.

In the municipal phase of the program the more opportunity the participants have had to enter directly into all aspects of management, operation and laboratory work at the water supply and sewage treatment facilities the better satisfied the participants have been with this portion of their programs. It is interesting that several of the former participants who now occupy positions of better than average responsibility are the ones who obtained the greatest benefit

from the municipal phase of their programs. The few who were not satisfied said that they were treated at times as intruders and at best as observers. Municipalities providing the latter type of experience are no longer used. There were indications from both municipalities and participants that there is a need for closer and more regular liaison between IPSED staff and the Phase II municipalities, also for a better understanding by the municipalities of their responsibilities.

A superintendent of one of the plants suggested that the IPSED staff prepare a questionnaire to stimulate the participants to delve into the operation and other activities at the treatment plants to help them obtain a better understanding of the details involved. Each participant would be expected to include the results of his observations in his report on Phase II.

Several of the participants mentioned specific cases of improvement of functioning of their own organizations by adapting practices observed in this part of their program. These improvements ranged all the way from billing procedures to laboratory routines and maintenance practices. Other participants mentioned the need for more actual work in the laboratories at the treatment plants.

The consulting engineering firm portion of the participant's program offers the best opportunity to provide him with an experience tailored to his needs. This can be done only when the participant understands clearly what he wants and the IPSED staff is able to make these wants known to the consulting firm before the participant's assignment is made. There were a few cases of lack of understanding of the participant's desires or of inability to arrange the Phase III program to satisfy those desires. There was also an indication that some of the consulting firms were not aware of the objectives of the IPSED program nor of the cooperation expected of the firms.

Two suggestions were made to avoid these deficiencies. The first was that the consulting firm be furnished, well in advance of the arrival of the participant, with a précis of his interests and objectives in taking the IPSED program. This would include a summary of his education and experience and an outline of his responsibilities when he returns to his country. The resume would assist the consulting firm in preparing a program to fit the needs of the individual participant. The second suggestion proposed a manual to acquaint the cooperating firms with the objectives of the IPSED program and with what is expected of the firms. The manual would also clarify the responsibilities of the participants during their assignment with the consulting firm. It would include a section on the policies of the agencies sponsoring the participants. Such a manual would help to avoid some of the misunderstandings which have occurred in the past.

These documents should be supplemented by close personal contact by members of the IPSED staff with the consulting firms and the participants. The firms are providing a valuable contribution to the IPSED program and the participants by accepting them into the firms' offices and devoting a lot of time to assisting with their training. In many cases the participants make a real contribution to the work of the firms and a mutual benefit results. Once in a while the trainee, either because of lack of experience or indifference, does not become actively involved with the office program and neither the firm nor the participant is satisfied. Closer liaison by IPSED staff might help to avoid this situation. It was also suggested that the firms might pay the participants in which case they would be treated like regular employees and be assigned definite work to be performed. This might aggravate a predicament already mentioned by a few participants where they were assigned tasks to meet the requirements of the consultants without much consideration of the needs of the participants.

It was also evident in this phase that when the participant was able to establish rapport with the members of the firm he was generally able to work out with them a program satisfactory to both parties. The participants should be encouraged to try to establish this type of relationship.

A representative of one of the consulting firms cooperating in Phase III of the program suggested a planned, structured course to be carried out at the start of Phase III. The course would be given by one of the consulting engineering firms at its office for all the participants from one IPSED session. Men with years of experience (from any of the concerned firms or from outside) would be responsible for the material in their field. The objective of the course would be to assure that all the participants had an opportunity to take part in all phases of a consulting engineering firm's activities. After this joint program, each participant would be assigned to his specific firm for the remainder of Phase III.

A number of participants stressed the desirability of a more extended firsthand exposure to actual construction and supervision of construction, an aspect in which they felt very weak. The same applied to the selection, installation and maintenance of equipment. Other participants, while acknowledging the usefulness of experience in the consulting office on larger systems, suggested that they should also have an opportunity to get some experience in the concepts and design used for smaller systems.

Two participants, who were assigned to the sanitary engineering department of the Ohio State Health Department for their Phase III experience, were so well pleased with this arrangement that consideration should be given to this possibility for other participants in the future, particularly when they are to work with Public Health ministries in their own countries after their IPSED program.

Many of the participants appreciated the wealth of useful engineering literature furnished them throughout the program. A number supplemented the reprints, catalogues and other material by the purchase of text and reference books which, added to their course notes, are in daily use by the participants. Several of them urged that they be sent up-dated material as it is added for the current IPSED program. They also asked that they be kept informed, on a regular basis, of new publications with brief resumes and information of how to obtain the publications. Much interest was expressed in a newsletter issued quarterly with news of the IPSED program, the participants, and new developments in the sanitary engineering field.

The IPSED program has added to the strength of the overall environmental health program at UNC and is providing a continuing resource to A.I.D. and other users. The Department has built up and can maintain a staff of unique breadth and depth oriented toward the international field as well as to the needs in the United States. The program has developed a large circle of contacts and friends around the world which should be maintained and strengthened. The UNC staff is enthusiastic about the IPSED program and is desirous of continuing it.

The difficulty of planning and carrying out a continuing program at UNC with year-to-year financing has handicapped the IPSED program. It should be avoided in the future by forward financing at a slightly higher annual rate which will make it possible to institute some of the improvements suggested in this report and remove the uncertainties which have plagued the program in the past.

The survey revealed a remarkably low rate of attrition of former participants away from the sanitary engineering profession. Fifty-nine participants have attended the IPSED program from the fifteen countries visited by the consultants. Of this number, one had died and five have left their countries. Only four of the fifty-three participants

remaining in their own countries are no longer working in sanitary engineering activities. Twenty-three of the former participants are primarily concerned with management and planning, eighteen with design and four are teaching full time while five more teach part time. Twenty-six are directors of agencies or heads of divisions while sixteen more are chiefs of sections. The agencies employing these engineers are responsible for activities totaling many millions of dollars annually. It is evident that money used in support of the IPSED program and of scholarships for its participants is well invested and is providing benefits way out of proportion to the amount involved.

The Agency for International Development, by sponsoring the IPSED program, is making available a unique training experience for sanitary engineers of the developing world which has proved its value and usefulness in preparing them to carry their technical and institution building responsibilities in their countries. The A.I.D. sponsorship is supplemented by scholarships financed by WHO as well as by A.I.D. and a few furnished by other agencies. There is a continuing need and demand for the program expressed by many heads of water supply and sewerage agencies around the world. The demand is also demonstrated by the annual increase in participants with thirteen in the eleventh session and sixteen in the present session. An increased number of candidates makes it possible to be more selective in singling out those who will benefit most personally and for their country from the program.

Another outstanding side effect of the IPSED program is the universal response of good will toward the United States that the program has generated among the participants. The careful planning, the personal attention given to each participant, and the dedicated teaching that has distinguished this program have produced strong loyalty to the University of North Carolina, pride in having

attended the program and warmth toward this country. Obviously these feelings are conveyed to others whenever IPSED graduates discuss experiences with their colleagues.

III. RECOMMENDATIONS

The IPSED program may be made even more effective by implementing the recommendations contained in this section. Many of them may be installed without additional expense. Others will require increased financing. It is suggested that interested agencies be invited to cooperate in financing the revised IPSED program either by contributing to the overall cost or by financing specific aspects of the program. For instance, WHO and the World Bank, because of their active interest in improving management activities, might be willing to sponsor the regional courses mentioned in Recommendation #22. WHO, which sponsors many participants to the programs, might be interested in sharing in the overall cost of the improved IPSED program, in addition to providing scholarships.

The World Bank has financed one or two scholarships for personnel working on projects financed by bank loans. Other lending agencies should be urged to include provision for financing IPSED scholarships for personnel required for the facilities covered by their loans.

The following recommendations are based on an analysis of the findings of the survey. They are presented in capsule form in related groups for ease of consideration.

Agency for International Development

1. Continue support of the IPSED program at the University of North Carolina for the training of sanitary engineers from developing countries, strengthening the program in accordance with the following recommendations, increasing the financing as may be required.
2. Provide three to five year renewable financing for the program rather than support on a year-to-year basis as funded at present.
3. Limit each session to no more than fifteen participants so that the program for each one may be tailored to his needs.

4. Coordinate with other agencies sponsoring participants to the IPSED program the regulations concerning scholarships by agreeing to:

Select participants qualified to take the program and through whom the greatest benefit will accrue to their institutions and countries.

Provide scholarships to engineers from the private as well as the governmental sector.

Process candidates sufficiently in advance of the start of the program to allow them time enough for personal arrangements.

Equalize the stipend for all participants making it sufficient so that the participants will not be forced to live at welfare levels.

5. Urge the Missions to:

(a) Give a higher priority to programs to meet the water supply and sewage disposal needs in both urban and rural areas in their countries, not only because of the public health benefits involved but also for the economic and social benefits that result from these programs.

(b) Assign sanitary engineers to assist with these programs.

(c) Provide scholarships for training in the IPSED program, to publicize the program, and to look for well-qualified candidates.

IPSED - General

6. Maintain the three phases of the program - academic, municipal and consulting firm - in about the same proportion as presently conducted.

7. Stress throughout the program the principle of adapting sanitary engineering practices to the needs and possibilities of the developing countries.

8. Increase the emphasis on design, financing and operation of systems for the smaller towns in all three phases of the program without decreasing the material presented for the cities.

9. Improve the brochure describing the IPSED program by:
Including more detail about the possibility of electing courses outside the IPSED program.

Urging the candidate to discuss objectives of his study with his supervisor and to develop a resumé of their combined objectives to facilitate the tailoring of the individual program to meet the combined objectives.

Stressing the need for competence in English.

10. Develop a manual for the cooperating municipalities and consulting engineering firms to:

Acquaint them with the objectives of the IPSED program and with what is expected of each of the cooperating agencies.

Clarify the responsibilities of the participants while assigned to those agencies.

Detail the policies of the institutions sponsoring the participants.

11. Indicate on the diploma awarded at the end of the program the degree of proficiency attained by the participant instead of simply stating that a certificate of achievement is being conferred.

12. Develop with each participant an outline of each phase of his program based on the resumé he has developed with his supervisor. Copies of this outline will be furnished the agencies to which the participant will be assigned for his Phase II and III experiences for their guidance.

13. Improve the liaison with the cooperating agencies to maintain continuing contact with them during the participants' assignment with them.

14. Issue regularly a newsletter with information about the IPSED program, participants, recent developments in the sanitary engineering field, and resúmes of new publications of interest to the participants indicating how they may be obtained.

IPSED - Phase I

15. Provide more depth and rigor in the academic phase of the program, making the examinations more meaningful.
16. Expand the presentation on all aspects of management, economic analysis, planning, decision-making and financing.
17. Increase substantially the material on sewage treatment, quality control, including an introduction to industrial waste treatment.
18. Provide some experience in laboratory procedures essential for the sanitary engineer.
19. Stress the selection of equipment and controls pointing out the advantages and weaknesses of each type for installations in developing countries.
20. Arrange for visits to equipment manufacturers to learn how to assemble and maintain pumps and other equipment.
21. Invite visiting sanitary engineers from developing countries with extensive experience in some aspect of sanitary engineering to assist in orienting the program toward the needs of those countries.
22. Supplement the IPSED program with regional intermediate-length courses presented to meet the concrete needs of specific groups of engineers such as those at managerial, decision-making and planning levels.
23. Develop a program parallel to the IPSED program to attract candidates from universities to expose them to the practical aspects of the program and assist them in adapting it for their own use. (See page 12 for details).
24. Prepare a questionnaire to stimulate participants to delve into details of operation and maintenance of municipal water supply and sewage treatment plants.

IPSED - Phase II

25. Encourage the participants to take an active part in all aspects of the management, operation and maintenance of the plants.
26. Develop a regular program for the participants to involve them in each of the functions of the plant, allowing about a week for areas of special interest of the participant.

27. Provide for some time in the laboratory where the participant will carry out some of the routine tests and apply the results.
28. Encourage participants to adapt plant practices to their own needs.
29. Explain why the treatment processes in use were selected for the plant, also why the particular types of equipment were chosen.

IPSED - Phase III

30. Obtain participant's resume well before his program is to start and base his program on his needs and desires. Work the program out with an IPSED staff member and then discuss with the participant when he starts his program.
31. Develop a scheduled program for all participants to introduce them into the various operations of the office including management aspects.
32. Provide an opportunity for supervising construction of treatment plants.
33. Involve the participants in work of the firm, assigning him responsibilities like a regular staff member. The assignments should be oriented to the needs of the participant.
34. Maintain close liaison with IPSED staff and alert them to any incipient difficulties.
35. Hold a seminar for consulting engineering firms cooperating with the program to help them develop familiarity with the total program and have a better understanding to their role.
36. Assign participants to consulting firms which are carrying out work similar to that in which the participant is interested.
37. Take advantage of the possibility of training with State Departments of Public Health particularly for participants who may be working with health departments in their own countries.
38. Arrange with a consulting engineering firm to develop a structured program for all the participants in a session, to be given at the beginning of Phase III, to be sure that all participants have an opportunity to take part in all aspects of a consulting firm's operations.

IV. FINDINGS BASED ON INTERVIEWS

A. Latin America and Caribbean Area

Summary

Latin America and the Caribbean Area are particularly fortunate in the sanitary engineering field because of the human and financial resources it has available to help solve its problems. Naturally this varies widely from country-to-country but the average is comparatively high. Evidences of the situation are to be found in the number of sanitary engineers working in the area; the number of undergraduate and graduate courses available for their training; the amount of water supply and sewage system construction underway during the past ten years as the result of national and international financing (estimated at \$2 billion) unimagined a decade ago. Major advances have been made toward meeting the rapidly expanding water supply needs in the urban areas. The last few years have seen more attention being paid to the sewage needs in these areas. Much less progress has been made in the rural areas with the exception of a few countries.

This rapid expansion of facilities has increased sharply the demand for capable, well-trained engineers at all levels from management, administration, design and construction to operation and maintenance. It has forced younger engineers into positions of responsibility which they probably would not hold in areas of less activity.

All of which points up the urgent necessity of making it possible for some of these engineers to supplement their training and experience by study of theory and practice aimed specifically at their needs. A number of the engineers interviewed in Latin America and the Caribbean said that the IPSED program gave them a confidence in meeting the problems in their own countries which they had not had before. One engineer said his "studies at IPSED matured his ability, his self confidence and added to his self assurance in all fields of sanitary engineering."

The fact that the IPSED program does not lead to a degree was not important to the engineers interviewed. They were more interested in obtaining the combination offered of refresher work at the university and practical application to fit their needs. These features are unique with the IPSED program.

The majority of the participants interviewed in Latin America and the Caribbean evaluated all three phases of the IPSED program from good to excellent. Two expressed dissatisfaction with Phase I while three were not satisfied with Phase II and three did not have a good experience in Phase III. Most of the dissatisfaction with Phases II and III could have been avoided by better pre-planning with the participants and the cooperating agencies before their programs and closer liaison by the IPSED staff during the two phases.

Criticism, by participants in the earlier sessions, of shortness of the academic phase resulted in the expansion of this phase to a full semester with the eighth session. Participants may now receive up to eleven semester hours of postgraduate credit for successful completion of the course. Application for enrollment for credit may be made after arrival at the university.

Several former participants found the work on sewage treatment deficient in Phase I. It is understood that this is being corrected. A large number was critical of the lack of emphasis on the principles of management, planning, economic analysis, decision-making and water resources. This criticism is particularly important as nine of the eighteen interviewed have their principal responsibility in these areas and feel the need for a better understanding of the principles involved. (See Appendix E for an analysis of responsibilities of participants.) In addition to strengthening the presentation on these areas in the academic phase, it was also suggested that short

(approximately one month) intensive courses covering these subjects be presented on a regional basis. The courses would be cosponsored by the university and participants would be invited to attend because of their position and definite need of such training, an attempt being made to include participants with similar education and experience to make the group as homogeneous as possible.

Another suggestion urged the expansion of the IPSED program to include a parallel program to meet the specific needs of the professor and the researcher in sanitary engineering, maintaining the uniqueness of IPSED by adapting the three phases of the program to those needs.

For many participants the municipal phase offered an experience quite new and valuable for them, which was particularly rewarding when they actually participated in the various functions of the water and sewer departments. Dissatisfaction with this phase, as expressed by three of the participants grew out of the feeling that they were treated at times almost as intruders, at best as observers. Several participants were pleased with an opportunity to do some work in the laboratory and others, who had not been so fortunate, suggested that it become a regular feature of Phase II.

Direct involvement of the participants in the regular activities of the consulting engineering firms with which they are assigned for Phase III of the program seemed to be the surest guarantee of a highly satisfactory experience. The few participants (three) who were unhappy about their experience with the consulting firm phase complained that they were used to fill the needs of the firm and little attention was paid to the participants' needs. A few suggested that the participants be assigned as full-time employees and be paid by the firm - in which case the firm would have to be reimbursed accordingly, including a percentage to cover their services. It is felt that this is not necessary

as there are a number of firms, with which participants have had excellent experiences, interested in assisting the IPSED program. An analysis of the participant evaluations of their experiences will indicate these firms as well as the ones which have not proven satisfactory.

The proportion of former participants who are now in decision-making positions in their own countries speaks highly of the careful selection of candidates for the program. It is safe to say that participation in the IPSED program has helped these engineers in their preparation to fill their responsible positions. A number boasted proudly of the assistance received from the program.

One of the strengths of the IPSED program is its ability to tailor-make the problems during the academic phase and the assignments during Phases II and III to meet the needs of the individual engineers. This was successfully done in the majority of cases. An earlier and more searching review with the participants of their desires and interests supported by closer liaison with them and the cooperating people should make the program even more successful.

It is important that the candidates for the IPSED program be advised that they are to take the course well before the opening date. They should be furnished with complete details about the program including information about the possibility of taking elective courses outside the program. This will allow the candidates to plan with their employer for the most effective use of the time during the IPSED program.

A number of former participants expressed a desire for a closer contact with the IPSED program and other former participants after returning home from their studies. They are interested in changes in the program which may have resulted from their suggestions, also in new advances in the sanitary engineering field. They would like to be informed about new publications in their field and how they may be obtained.

Academic Phase

Participants in the first seven sessions of the IPSED program, when the academic phase consisted of three months at the University of North Carolina, were almost unanimous in their criticism of the shortness of the phase. The IPSED staff agreed with the recommendations of the participants in the earlier sessions and extended the academic phase to a full semester which not only allows more adequate time but also fits into the academic structure and makes it possible to offer credits for the courses.

The groundwater course, as now given, was felt to be too theoretical with little time spent on application to practical problems. The course as given formerly was much more valuable to participants and rated highly by many of those interviewed.

The course on hydraulic structures was well received with some of the participants particularly well impressed by the portion on pumps. Most of those interviewed admired the practical approach of the professor of this course and his grasp of the situation in the developing countries.

There was mostly praise for the presentation on design for water supply facilities and of disappointment in the lack of material on sewage treatment plants. With the tremendous backlog of work to be done on sewers throughout the developing world and the increase that is beginning to take place in the construction of such facilities, it is apparent that the IPSED program should be strengthened in this area. Interest was expressed in more material on water quality control, particularly some exposure to laboratory work; also on treatment of industrial wastes.

Most often expressed was the need for more extensive treatment (than given in the academic phase) of the principles of greatest usefulness to engineers at decision-making levels such as those of management and

administration, planning, scheduling, economic analysis, financing and related material. Ten of the eighteen interviewed in Latin America have assignments where they feel the need of a better understanding of these principles. One of the former participants attempted to satisfy his need by taking an evening course in economics during his Phase III assignment.

Very few of the former participants from Latin America were concerned by the non-degree character of the IPSED program. In fact, one who had the choice of a degree program at Harvard or the unique IPSED program opted for the latter. Promotion in Latin America is not contingent on a graduate degree.

Municipal Phase

The majority (thirteen) of those who participated in the Phase II (two omitted it) were well satisfied with the opportunity to spend a comparatively extended period of time in water supply and sewage treatment plants observing not only actual operations but also the administrative and management aspects. Three were critical of the fact that they did not have an opportunity to take part in the activities, were made to feel like intruders. A number were invited to help with the operations and some spent time in the plant laboratories, enjoying both of these in-service training experiences.

It is interesting that the former participants who now occupy positions of above average responsibility are the ones who obtained the greatest benefit from the municipal phase. Several have adapted practices observed during this phase for the use of their own agencies.

Consulting Engineering Firm Phase

Again in this phase of the program it was the ones now holding positions of responsibility who were loudest in their praise of their in-service training with the consulting engineering firms. Of the three who were

disappointed in this phase, two, who criticized their assignment because their program was based on the needs of the firm and not the needs of the participant, are not using their experience while the third, who based his criticism on the fact that he was assigned to work on systems much larger than he will ever need to design, is in a responsible position.

The consensus was that this phase of the program gave the participant an opportunity to work on practical applications of the theoretical principles in an on-the-job atmosphere instead of that of the classroom. It also gave them an opportunity to see at close range the organization, administration and approaches used by successful consulting engineering firms. It gave them the contacts they would probably never make without the IPSED arrangement.

It was evident, however, that more time should be devoted, while in Phase I, to ascertaining the needs and desires of each participant before assigning him to Phases II and III. These should be cataloged and discussed with the contact person where he is to be assigned for these two phases well before the participant is to arrive for his in-service training. The participants should be encouraged to discuss with their supervisors, during these assignments, the aspects of most interest to them and what will be most useful when they return to their countries. IPSED should maintain close and constant liaison during Phases II and III. Before starting on Phases II and III the participant should be carefully instructed about his responsibilities on these assignments. He is to act as a member of the staff, not as a visitor with special privileges.

A representative of one of the firms interviewed as part of the study suggested that Phase III be augmented by a structured consulting engineering program designed to assure that all of the participants have an opportunity to take part in all phases of office procedures.

The participants would go as a group to the consulting engineer's office for an extended period, possibly a month, and various employees of the office would be paid to supervise the participants through each of the firm's activities. This would require additional financing under the IPSED program but might add another dimension to the program by assuring a comparable experience for all participants during at least a portion of Phase III.

After the IPSED Program

Of the eighteen former IPSED participants interviewed in Latin America and the Caribbean, fifteen are still actively engaged in sanitary engineering in their own country. (See Appendix E.) Two of the three not directly involved in such activities are in closely related fields, one in charge of the civic action program of his government and the other as deputy director of a pre-mix concrete plant.

Four of the former participants are with national water and sewer authorities, three are with ministries of public health, one is with a municipal water department, three are in private sanitary engineering companies, one is with a national housing bank which is loaning millions of dollars for water supply and sewage construction and three are teaching in universities full time. One of these is also General Secretary of the Engineering University where he teaches.

Many of the former participants are in positions of responsibility. Nine have assignments where planning and administration are their prime responsibility (tabulated in Appendix R), three are principally concerned with design and three with teaching. It is interesting that in addition to these three, four others are teaching as well as carrying on their regular jobs. In this way, seven of the eighteen are passing their experience and training to their students in the university classrooms. Several said that their IPSED notes were most useful for teaching.

A number of the participants are members of the Inter-American Association of Sanitary Engineering, one being president of his local section. A few belonged to the American Water Works Association but it was generally felt that the dues were too high for what one got out of membership. Several mentioned preparation and presentation of papers at local, regional and international congresses.

There is considerable interest by the supervisors of the participants in sending other candidates to the IPSED program. It is important they be supplied with the latest information about the program and about the possibilities of scholarships. There was considerable misinformation about scholarships and this should be corrected.

A.I.D. and WHO should regularly send out information about the program and scholarships available for it. This information should go to all offices and organizations using sanitary engineers. Many of the participants interviewed heard about the program from a former participant or through contact with an A.I.D. or WHO/PAHO engineer. Only one learned about the program through an announcement in a technical journal. Many of the young engineers do not see the journals, particularly those in English.

B. South Asia and Far East

Summary

Both the participant group and other professional colleagues were impressed and pleased that the Agency for International Development continued to display such intimate concern with the IPSED program and their relation to it. And they seemed most appreciative of the opportunity to discuss matters of mutual interest looking toward improvement of program capabilities.

Problems associated with social and economic development in South-east Asia are of such a magnitude that the tasks faced by environmental engineers are awesome. Living standards are low, population increases are among the highest in the world, the major cities are growing at a frightening pace, and social-capital investment needs for water-resource development, housing, education, transportation, power, and establishment of political stability are staggering.

Despite these conditions the prevailing mood among engineers was one of optimism in overcoming constraints. Sanitary engineering endeavors, while small in comparison to needs, are receiving greater recognition with respect to their contribution in advancing national welfare.

Although it would be imprudent to generalize about national priorities, it appeared that industrial development, agriculture, transportation and power are dominant considerations. Water-resources development related to these needs -- specifically with respect to irrigation and power -- also ranks high for attention. But development of potable water supply is rather far down the list of priorities with waste-water disposal near the bottom.

However, the situation with respect to water supply in the primate (super) cities is somewhat different. Here because of fantastic urban growth it is no longer possible to accommodate -- to make do with existing rudimentary facilities. Ample quantity, potability and reliability of water service is regarded as not only essential for

existence but a basic requisite for the expansion of tourism. Likewise, improved facilities for waste-water disposal is receiving attention, particularly in the core area of cities, in order to prevent intolerable nuisances.

In the rural areas of Southeast Asia the engineer must face the fact that the need for potable water supply is not obvious to the inhabitants, much less the notion of having to pay for water. This has meant that benevolent governments must undertake the subsidy of community water systems; because of the limited availability of financial resources, the installation of new supplies, in most countries, cannot keep pace with the increases in population. Financing, therefore, is the critical issue if significant improvements are to be achieved.

It is within this setting that the IPSED program has been evaluated. First, it can be said that the program has been imaginatively planned and competently executed. The staff and facilities of the University of North Carolina are on a par with those of any university in the world; and the cooperation received from both municipalities and certain U.S. consulting firms in providing internships testifies to the esteem in which the University is held. Second, the program does fill a need for the training of junior engineers in the principles of design of community water supply and treatment facilities, and to a lesser extent the elements of sewerage design.

As now operated the program has been considerably improved since it was originally established, notably in the conduct of the academic phase. The latter has been integrated more effectively with the regular fall semester course offerings at the university, and more of the students have the option of taking examinations and in some instances obtaining academic credits which may be applied toward an M.Sc. degree at North Carolina or at other universities.

However, it became evident that the program does not hold much appeal for the more highly qualified civil engineers in many countries because it does not offer an M.Sc. degree or its equivalent on completion of the course. Additionally, senior engineers are seldom interested simply in design of small water supplies because their concerns embrace water-resources management, finance, planning and administration.

Another factor to be reckoned with in considering the future of IPSED is the broadened availability of educational opportunities for qualified engineers in various parts of the world. For example, a sanitary engineering design program offered at Delft University in Holland may be regarded as being in direct competition with IPSED; furthermore, Delft awards a diploma rather than a certificate of attendance and this is negotiable, at least in Vietnam, as the equivalent of an M.Sc. degree. Scholarships are now available in increasing number from the Asian Institute of Technology in Bangkok. And the Colombo Plan offers scholarships for tenure in the United Kingdom, Australia, Canada and India. Meantime, other countries are becoming increasingly active in offering scholarship support, notably Israel and Japan. In the United States there is also a broad range of educational opportunities with a wide variety of M.Sc. programs in sanitary engineering and environmental health engineering; a number of these U.S. programs offer assistantships or the possibility of WHO support. Nevertheless, IPSED is unique in its specialization in sanitary engineering design and its future role will, in large measure, depend on continued emphasis of this characteristic.

In weighing the future of IPED, one must be mindful that it is essentially a program for design of water supplies (and to a lesser extent sewerage) for small communities. The preparation offered at North Carolina can hardly be considered adequate for the design of major projects, which normally must be undertaken by consulting engineers.

This leads to the suggestion that the program should focus on design simplicities that favor the development of standardized plans for water and sewerage facilities.

Internships with large consulting firms in New York, Boston or Chicago have not been altogether successful in offering appropriate background for the tasks confronting engineers in Southeast Asia. It would appear, therefore, that the consulting phase of the program should be drastically modified, perhaps substituting internships with state health departments, in such places as Ohio, Arkansas, Oklahoma or Georgia. It might be noted that in the countries on which this report is based all of IPSED participants were employees of ministries of health or public works. In these situations they seldom become involved in design responsibility for large cities.

In most of the countries visited in Southeast Asia there was no shortage of engineers with some background in design of small water systems as related to the amount of available work. Consequently, engineers exhibited frustration because of the lack of opportunities to apply their talents. Installation of small water systems is superseded in priority because finances have to be stretched to satisfy other needs and the conviction is not yet strong among the people that potable water is essential to their health and well-being.

One of the outstanding side effects of IPSED is the universal response of good will toward the United States that the program has generated among participants. The careful planning, the personal attention given to each participant, and the dedicated teaching that has distinguished this program has produced strong loyalty to the University of North Carolina, pride in having attended the program and warmth toward America. Obviously these feelings are conveyed to others whenever IPSED graduates discuss experiences with their colleagues.

Regarding the academic phase of the program the participants were unanimous in the view that this was the most desirable part of the course. Many felt that it should be extended to occupy two semesters, that it should include more attention to waste-water disposal, including consideration of industrial wastes, and that the groundwater course in recent years was too theoretical. Since most of the participants are engaged primarily in the design, construction and operation of waterworks facilities for communities of 500 to 25,000, it can be questioned whether participants should spend much time in reviewing plans, designs and specifications for large cities. More emphasis should be placed on the development of standard designs and plans for small water and sewer systems. Although it would probably be difficult to include another (sixth) course in the curriculum, consideration should be given to modifying or replacing the course entitled "Special Topics" with one that embraces engineering administration, including organization, management, financing and economic analysis.

The municipal phase of the program was regarded with mixed feelings. Apparently it deserves more careful structuring. A number of participants thought it should be shortened. However, if this phase is designed to include rigorous review of text books and materials dealing with operation of water and sewage treatment plants, it would not appear that one month is too long, particularly if time is spent in the laboratory to perfect skills in chemical, biological and bacteriological analytical procedures.

As indicated previously, a majority of participants concluded that the internship in consultants' offices did not offer rewards commensurate with the time applied. While there were notable exceptions, many consulting firms failed to devote sufficient time or attention to the needs of the participants. Presumably these were firms whose activities did not embrace the interests of the participants with the result that they were shunted to routine tasks on the

drafting boards, the review of specifications or to elementary structural or hydraulic design.

However, where the internship was spent with a state health department, the response was quite different -- participants were enthusiastic. It appears that the variety of experience offered in a state board of health agency more nearly coincides with the interests and needs of participants. This suggests that there would be much merit in substituting state health agency affiliations for the internships rather than consulting engineering firms.

The relatively low priority accorded by provincial and national development of potable water systems belies the importance that should be attached to this effort in the control of communicable disease. This was confirmed by Dr. Francisco Dy, regional director of WHO for the Western Pacific, who stated that the availability of potable water would reduce the communicable disease rate by at least 50 percent. Emphasis on promotion of potable water supply facilities has been adopted as official WHO policy. UNICEF also supports development of potable rural supplies for Southeast Asia, but its programs have been limited to demonstration projects. The constraints in advancing potable water schemes are limited by availability of financial resources, reluctance of people to pay for water, and the low priority such programs must assume in terms of other national needs.

Concerning the "multiplier" effect of the program, there was little evidence that IPSED graduates had been assigned to develop formal training courses that would communicate what they had learned to other engineers. This provokes the question: Should the IPSED program be oriented in some fashion that would stress preparation of its participants to assume a more active role as teachers when they return to their countries?

Knowledge concerning the availability of the IPSED course was quite limited in many agencies that should have been acquainted with it. This suggests that publicity should be expanded. Toward this end some of the names listed in the appendices might be placed on a regular list.

Academic Phase of IPSED Program

Virtually all participants felt that they would have profited from a longer period of exposure to lectures and design courses.

Only a few said that work at the University taxes their capabilities. Those that were not fully challenged suggested that interest and effort in the courses would have been enhanced if they had been graded on their work.

An integrated program of instruction was much preferred over the series of short courses originally offered.

The groundwater course was regarded as of limited usefulness because of its emphasis on theory rather than practice.

There was general dissatisfaction over the small allotment of time to sewerage and wastewater disposal, and interest was expressed in orientation on industrial waste treatment.

While it is understandable that sanitary engineers would be interested in sewerage, the fact is that in the countries visited there is little likelihood that IPSED engineers will be called upon in the near future to plan such facilities. However, it does appear that because of increased industrialization the governing authorities are giving consideration to the treatment of industrial wastes, particularly those that have been recently identified with toxic characteristics (mercury, for example). Therefore, some basis exists for providing a short course dealing with principles and current practice in industrial-waste control.

(One student (Tseng) took night courses in industrial wastes at NYU during his consultant internship).

Quite dominant was the desire for a course that would deal with the management, maintenance and operation principles applicable to small water and sewerage utilities.

Likewise, there was interest in a course on field construction procedures and practice. A WHO field representative said that generally the design of sewers was excellent but construction was so shoddy that sometimes sewers were laid "uphill" and seldom was pipe properly bedded.

The criticism voiced most often was that the program offered small opportunity for obtaining a Master's degree, either in content of courses or within time limitations. The M.S. degree is negotiable in Delft University. But the certificate offered by University of North Carolina has small value for either salary increases or promotion in grade.

Initial difficulties of some participants to adapt to conversational English suggested that the orientation period be extended for a few days with emphasis on acquiring skill in listening to and becoming familiar with American vernacular.

High regard was expressed for the calibre of instruction received and particularly for the sympathetic attitude of the professors in their endeavors to meet individual needs of the participants. Great value was placed on the notes and other handouts given to the students; this material is of inestimable reference value in areas of the world where few text books are available.

Course work identified with design of large community water supplies leaves something to be desired in terms of the needs and future activities

of participants. Most of them (with possible exception of those from Taiwan) are destined to be involved with the conception, installation and operations of small rural water supply systems where simplicity and standardization of facilities is the desideratum. Projects involving communities of more than 10,000 population generally are serviced by consultants.

Municipal Phase

There was widespread agreement that the opportunity to become familiar with day-by-day operations of a water or sewage treatment facilities had virtue.

It was questioned, however, that three weeks or a month should be devoted simply to observations. For this purpose one week, or at the most a period of 10 days, was said to be adequate by some participants.

If it was not practical to telescope this phase of the program, the suggested alternate was to divide the time among several small municipalities.

Justification for a full month at a municipality would be strengthened if the participant could be assigned to field construction and maintenance activities as well as plant operation and laboratory work.

Internship with Engineering Firms

This phase of the program was subject to almost universal criticism and disappointment. Some doubts were expressed concerning the usefulness of the "performance" reports that the consultant filed monthly with the University of North Carolina. The question was: Did they adequately convey what was transpiring and what action did they trigger?

Few firms were prepared to offer a structured series of tasks. Indeed, some apparently were so overburdened with work at the time of arrival of the participant that the most they could do was provide desk room and reading material, such as sets of specifications and reports.

In a few cases the participant was assigned to routine drafting jobs or simply left to his own devices. Those who were aggressive did manage to establish contact with individuals who were working on some aspect of design that was of interest and thus became involved.

Several participants mentioned that they acquainted Professor Barnes with their problems and he visited them at the firm's headquarters. This personal attention was much appreciated by the participant and presumably Professor Barnes elicited a more sympathetic response by the firm to the participant's aspirations.

There were exceptions, of course, to this general situation. It appears that firms who had wide experience in foreign work readily understood what kind of activities in their office might best be suited to the interests of the participants and a happy relationship was promptly established.

Probably the most useful internship in terms of adaptability and profitability to the participant was the arrangement to join the sanitary engineering division of a state health department.

Reports from two participants suggest that the experience offered by the Ohio State Health Department was outstanding in this regard. The arrangement provided for assignments in the central office as well as in all of the district offices. This offered the widest variety of exposure to review of water and sewer facility designs, inspection of construction, and surveillance of operation and laboratory procedures.

Particularly important were the opportunities afforded to become familiar with operations in small communities and rural areas. Incidentally, the chief engineer of the Ohio program, George Eagle, has had experience in Brazil dealing with rural sanitation problems and thus he has a nice understanding of what should constitute an appropriate internship for IPSED participants.

One participant suggested that consultants should offer a salary to those they accept for internship. His reason: "If they don't pay you they don't feel a compulsion to ask you to do anything."

An alternative to the internship in a consultant's office was suggested. It involved an arrangement whereby several consulting engineers at different times would be invited to accept residence at the University for a few days. During this period they would give lectures on their experiences, describe a project on which they were engaged and otherwise be available for discussion with individual participants in the course.

Experiences After IPSED Program

What must be reassuring to the sponsors of IPSED is that virtually every participant in this program has continued in the field of water supply and sewerage design and operation, and remains dedicated to tasks that require application of the increased competence he has gained from specialized training.

Only two of the 21 participants interviewed have become formally involved in a teaching role since completion of the IPSED course. In both cases this teaching is done on a part-time basis and only one of the participants taught design courses. It cannot be concluded, therefore, that there is much evidence of a "multiplier" effect.

Although all of the participants during their stay in the USA attended meetings of professional societies and became acquainted with publications

of these groups, virtually none of them could entertain ideas of becoming members because the cost was beyond their means. In their home countries there is virtually no regular access to journals of such organizations as AWWA, WPCF and ASCE. Engineering books published in the USA are so costly that it is beyond the means of civil service employees to acquire them; however, relatively inexpensive reproductions of some books are now becoming available from Japan and in Taiwan. Arrangements in Taiwan have been made with American publishers to permit production of offset-printed copies of engineering texts that sell for as little as \$1.00 in Taiwan but they cannot be sold for export.

There was little evidence that completion of the IPSED program automatically confers in their home country any special distinction to the participants either in job status or salary increments. While some have advanced professionally, this appears to reflect fulfillment of seniority requirements rather than exposure to specialized training.

Supervisors of those who have taken the IPSED course said they were pleased with the broadened knowledge and viewpoints acquired by those who had taken the course. Their principal regret was that under prevailing civil service procedures it was not possible to utilize the University of North Carolina certificate of attendance to negotiate higher ratings for the participants. Nevertheless, it appeared that the supervisors were giving increased responsibilities to the IPSED participants.

Administrators of sanitary-engineering programs in several places expressed the view that organizations such as USAID, WHO and the World Bank should consider the merits of sponsoring occasional short courses in their countries. What they envisioned was the possibility of obtaining a professor or expert in some specialty (perhaps attached to a local university during his stay) who would spend a month studying conditions. Then he would offer lectures for about two months on ways

of improving these conditions. Employees of federal, provincial and local governments would be selected to attend these lectures, preferably given in the mornings so that the employee could return to his regular duties during the afternoon. General seminars are offered from time-to-time by WHO and the United Nations, but they are of a regional nature and not necessarily focussed on specific problems in a single country.

C. Near East (Turkey)

Five of the six IPSED participants were interviewed. None of the five completed the entire conventional IPSED program, and thus the generalizations from their interviews should be viewed with some caution.

Academic Phase: With the exception of one participant, (Mr. Isleyen, who had just completed a masters program), all interviewed felt that the academic phase was beneficial. He indicated that the course material was repetitious and unrewarding to him. Specific interests appeared to dictate which course was considered most beneficial as opposed to the least beneficial. The preponderance of feeling was the "Water Resources Planning for Developing Countries" was the most beneficial. A comment was made that the Sanitary Engineering Design course, although very good, was too short to provide the necessary fundamentals of design. It was also suggested that the design course should emphasize equipment and controls, and must include principles and criteria for choosing equipment.

Each of those interviewed saw the needed emphasis for future training within his own perspective, and suggested that such training follow the pattern as he visualized it for his own needs. Three of the five interviewed felt that sewerage should be emphasized. This was also suggested by the administrators of Ilbank, one of the water development agencies, who foresee future developments in this field. The two participants now employed by YSE saw more need for emphasis on rural sanitation and on design and operation of small systems. It was also suggested that simpler methods of design and construction be stressed.

The participant remaining with DSI, whose responsibilities include development of water supplies for major cities (over 100,000 population), suggested that the academic program should emphasize water supply and development and not broaden into other fields.

In general the participants indicated that the instruction was very good, facilities excellent, and that the instructors were most understanding of the students' problems and needs. Two indicated that more academics were desirable, while three said they were not. Mr. Arapoglu, who suggested more academics, spent two semesters in the IPSED program, and was thus able to avail himself of more course depth than the normal IPSED student. All suggested that the program should stress technical work as opposed to management and financing.

Municipal Phase: Only two of the five interviewed participated in the normal municipal training phase. A third, Mr. Isleyen, spent two weeks with the Hackensack Water Company. The least emphasis was placed by the participants on this phase of training. Mr. Isleyen felt that it was a valuable experience. Mr. Unal felt that the length of the training phase was about right, and stated that he was interested in both water and sewage utility training. The third participant, Mr. Arapoglu, who had experienced the municipal training felt that three weeks was sufficient for this phase.

Consulting Engineering Phase: Only two of those interviewed, Mr. Takaolgu and Mr. Unal, participated in the regular consulting phase of training, although Mr. Arapoglu spent two and a half months with Camp, Dresser and McKee before taking the academic phase. Mr. Arapoglu stated that his experience with the consultant was rewarding, but evidenced more interest in the design phase. The two who participated in the normal IPSED consulting phase indicated that it was beneficial and fitted their needs. Mr. Takaolgu suggested that his program of eight months in the consulting phase was too long. Mr. Unal suggested that students should be put to work on consulting jobs, and not left as mere observers. Participation in feasibility studies were viewed as good experience, and the construction supervision portion of the consulting phase was recommended.

Administrators of both DSI and YSE stated that design and construction experience were valuable to their employees, and they suggested that the participants should be assigned to firms where they would be given work responsibilities.

Present Employment and Benefits of Program; It is interesting to note that all six of the Turkish participants are employees of government water entities in Turkey. Four are with the original agency for whom they worked before attending the IPSED program, and the other two transferred to YSE, the government agency responsible for roads, water supply and electricity in rural areas (towns below 3,000 population), when this water responsibility was shifted from the larger directorate.

All five interviewed indicated that the program was beneficial, although Mr. Isleyen's answer was qualified. Most felt that completion of the program was contributory to their advancement. Mixed feelings were evident about the advantages of this program versus a degree granting one. In general the value of IPSED was recognized as an integrated practical program. One participant expressed the feeling that IPSED is an excellent program for emerging countries where a rapid degree of upgrading of personnel is necessary, but suggested that for Turkey a degree granting program may now be more useful. Supervisors of these participants in the major water agencies were unanimous in their praise of the IPSED program, and in general expressed the feeling that this type of practical program is more advantageous than a degree granting one.

With the exception of Mr. Isleyen, who chose to remain in Bursa rather than take a more responsible position in Ankara, all of the participants in the IPSED program appear to be progressing well. Three of the five interviewed now have as their principal responsibility the planning and administration functions of their organizations, and this is the secondary responsibility for a fourth man. Mr. Arapoglu is now Chief Engineer at the section level for DSI in Ankara. He has responsibilities for design of the Ankara water distribution system, is well thought of by his supervisors, and should go far.

Mr. Takaoglu, Head of Planning, Training and Coordination Department for Ilbank, praised the IPSED program highly. He stated that it assisted in his professional development, and gave him the confidence to design plants based upon modern design criteria. He suggested that other engineers from Ilbank be supported in the program.

Mr. Unal, Assistant Chief, Department of Planning and Survey, YSE, stated that the program helped him very much, and that he received valuable experience in dealing with modern systems.

D. Africa (Nigeria and Ghana)

Five of the seven participants from Nigeria and the two from Ghana were interviewed. Of the seven interviewed, only Mr. Quaye (Ghana) did not participate in the complete IPSED program. He took the academic phase and then went elsewhere for a masters degree.

Academic Phase: All participants interviewed agreed that the academic phase was very useful. Some diversity of opinion emerged regarding the most useful courses, but most comments appeared to favor Water Resources Planning in Developing Countries, and Sanitary Engineering Design in Developing Countries. Comments were also made that the groundwater course was too academic and too theoretical, and perhaps the least useful. More orientation in the waste water field was suggested by several students, and also more emphasis on planning and design of smaller systems, which would relate to small towns and rural areas. Simpler methods of solving waste problems should be discussed as opposed to more sophisticated systems. Concern was also evidenced for broadening out into the area of environmental control. One participant suggested some computer training, sanitary chemistry and sanitary microbiology in the academic phase. The Nigerian participants stressed the need for more technology in the academic training, while both participants from Ghana stressed that some principles of management and financing should be included.

Municipal Phase: Less interest was evidenced by the participants in this phase than in the academic and consulting phases. All agreed that the experience was valuable, and that the length of the training was about right to obtain an overview. None suggested more emphasis in this phase. Comments were generally favorable, one of the participants stating that he learned considerable about water quality monitoring, and another that he observed for the first time repair work on a service main being accomplished without service interruption.

Three Photographs Omitted

Three Photographs Omitted

Consulting Engineering Phase: Six of the seven former students interviewed participated in the consulting phase. All felt it was important and valuable, but some felt that it might be limited to six months or less. Two of the six felt that the consulting phase should be extended. Most felt that the experience satisfied their needs. One expressed the feeling that he now "appreciates reasons for doing things". Another indicated that the experience gave him a better insight into design capabilities. Mr. Adeyemi stated that he was fortunate in being able to work on the Ibadan water project with Gilbert Associates. He felt that he was able to grow with the program. One participant stated that the students had to want to participate and ask questions to get more out of the program.

It was suggested that better experience in design of small systems might be achieved by placing the participants with smaller consulting engineers. It was also suggested that a portion of the consulting phase might be arranged with equipment manufacturers so that the participants would learn how to select equipment for various tasks, and would understand the assembly of pumps, clarifier equipment, etc.

Present Employment and Benefits of Program: Only one of the seven participants interviewed, Mr. Osobamiro, is not working in the water field. The others are currently working in the water area, and appear to have progressed well. All have either design or planning and administration functions as their prime responsibility. Mr. Adeyemi (Nigeria) has left the government service for the consulting field, and Mr. Quaye (Ghana) intends to follow suit.

Mr. Ojo is now Principal Design Engineer for the Western Nigeria Water Corporation in Ibadan. He is well respected by his peers and his supervisors. He stated that the IPSED program had helped him in his personal development, and gave him an understanding of the problems. He would like to have some of his own subordinates go through the program.

Messrs. Agboola and Omolegbe were in one of the recent (11th) sessions of IPSED. They are both Water Engineers with the Ministry of Works and Survey, Kwara State, Ilorin. They both consider the program to be of much value, and feel that they gained confidence and a basic understanding of design from it. They both feel that the advanced degree is important, but also stated that the IPSED program offered much in practical knowledge that could not be gained from a degree program. Mr. Adeyemi stated that the program was most beneficial, and aided him in his personal growth and development.

Mr. Addison, now Regional Manager, Ghana Water and Sewerage Corporation in Kumasi, feels that the program is responsible for his having been delegated additional responsibilities when he returned to Ghana. He stated that IPSED is useful for bringing engineers up to date, and that practical training of this type is needed in developing countries.

The participants' supervisors also felt that the program was beneficial. Mr. Andu of the Western Nigeria Water Corporation favors the practical program with more consulting experience. This was echoed by Mr. Daniels of the Ministry of Works and Survey, Kwara State, Ilorin. He would have preferred a two-year program with more consulting experience for his employees. He stated that the program has given them the capability to design small water systems and has given them confidence in their work.

Mr. Annan, Managing Director, Ghana Water and Sewerage Corporation, stated that he wanted his engineers to work for their masters degree, but he felt that the IPSED program, particularly the consulting phase, was very valuable. He also suggested that IPSED provide some measure of management and finance training in its program. He further recommended more training in how to develop, design and manage rural water supplies, and more stress on pollution control.

E. United States

IPSED - Staff University of North Carolina

The visit to the University of North Carolina (UNC) was made on May 16-17, 1971. The consultants and representatives of A.I.D. met with several of the staff of the IPSED Program. Among these were Dr. Daniel Okun, Director of the International Program, and Head of the Department of Environmental Sciences and Engineering, Professors George E. Barnes, James C. Brown, Richard F. Cole, and Frederick E. McJunkin, and Miss Betty Marks, Project Coordinator.

This staff reviewed the program for the consultants, and the following is a compendium of pertinent points of the staff presentations and dialogue with the consultants.

The IPSED program is non-degree granting and of one year duration for graduate engineers currently working in the sanitary engineering field in their respective countries. The program currently consists of three phases, academic, municipal and consulting. Usually the student comes to the University first, and remains for one semester, during which time he takes a series of four formal courses as follows:

- ENVR 172 - Design of Hydraulic Structures (3 cr)
- ENVR 175 - Sanitary Engineering Design in Developing Countries (3 cr)
- ENVR 181 - Groundwater Hydrology (2 cr)
- ENVR 182 - Water Resource Planning in Developing Countries (3 cr)

These courses are taken jointly with students enrolled in the regular graduate program, and thus a desirable integration function is performed in introducing the international student into the American academic life. The IPSED student can obtain graduate credit for the courses taken if he desires. He may take up to 11 graduate credit hours in this program. If he desires to remain for a degree, he must go through all the formal steps of application and enrollment. Dr. Okun discourages their remaining at UNC for completion of the Masters degree, and makes arrangements for them to go elsewhere.

During the academic phase of training a number of guest lecturers are invited to give seminars in their areas of expertise, however, funds are limited for much of this guest lecturing.

For the municipal phase of their experience, each student is assigned individually to a given municipality for a view of operations and management of a water utility. This phase of the training lasts about one month. Participants are then assigned individually to selected reputable engineering offices for the design or "internship" phase of the program. This assignment is usually for about six months. In this phase the students are encouraged to actively participate in the design and other work of the consulting firm. The staff stressed the point that the needs and wants of the individual students were considered especially when making the municipal and consulting assignments.

In addition to the three phases of the program described, the participants are taken by a UNC faculty member to at least one national meeting of a major technical society in order to broaden their views and enlarge their professional acquaintance.

The original goal of the program was oriented toward practical design. Problems in the various countries generally related back to basic design failures, such as hydraulic design, inability to select proper pumps, etc. Most of the participants are employees of agencies responsible for design and operation. Because of the necessity of assuming an early responsibility, some chief engineers may never have designed a system. The instruction also covers financing, water rates, economic planning, etc., always with an orientation toward designs for the underdeveloped countries, such as consideration of use of local materials and labor, both in construction and operation.

The staff at UNC feel that the participants on completing the program are self sufficient, and understand enough design essentials so that with their continuing design experience on their jobs, they will continue

to progress in design capability. In the consulting phase of the program, it was stressed that it would be desirable for each student to have experience in preparation of preliminary reports, design of systems, and construction follow-up.

Upon completion of the program the student must submit a final report in order to receive his certificate. A review of a number of these reports revealed that the students in general are very well satisfied with the program when they leave. Several, however, suggested lengthening of the academic phase and shortening of the consulting phase. Most of the reports indicated an interest of the students in the water utility field. The majority of reports were well written, and the attitudes and ideas of the students were clearly expressed.

The particular program sequence was selected because it was felt that presentation of the academic phase first to the group of international students reduces the cultural shock that many would experience if they were immediately isolated at their municipal or consulting assignments. During the first few sessions an attempt was made to start two groups per year. However, this was found to be difficult to support because of space and staff limitations, and because the number of students was too limited to carry on two separate sessions. There is a critical mass for interplay of the students. The optimum size of each group is from 8 to 12. If the group has greater than 15 students, it may become unwieldy, and it reduces the ability to devote as much personal attention as is desirable to each student. There are now some 14-15 perspective students on the list scheduled for next year. There must be a limit put on this enrollment to insure the personal attention necessary.

A host family is selected for each student to provide him a social contact with American life. Each student is also assigned a bicycle, if he desires one, for his local transportation.

A.I.D. and WHO have provided the majority of scholarships for participants in the IPSED program. The Ford and Rockefeller Foundations and the World Bank have also some participants for the program. To date there have been about 100 participants in the program. Only one did not return to his own country, in contrast to most degree programs that only return some 50% to their own countries. Both A.I.D. and WHO specify that the students be government employees. This limits the enrollments. An effort should be made to open up the enrollments to both private engineers and to those working for corporations, in order to upgrade all who are working in the water field. Financing on a year-to-year basis has been a handicap to maintaining a continuum in the program. Also, payments arrive well after the program has begun, causing further fiscal problems in temporary use of other funds.

Support for the program by A.I.D. amounts to \$90,000 plus \$5,000 per student. The \$90,000 is expended on faculty salaries, rental of the IPSED building, travel money, etc., including a 50% overhead charge. The budget includes some 21 man-months of faculty for 12 months service. A school cannot conduct a program oriented to the specific needs of the students without more assistance than just tuition from the students. The employer of the participant pays his salary while he is in the program. One of the problems of recruiting is that A.I.D. has no field missions with any understanding of the program. (There are only three sanitary engineers in the field.) Much of the recruiting has to be done through contacts when the faculty are abroad on other duties. It has, however, been found that men coming into the program now have much more clearly defined objectives than those enrolled in the earlier sessions.

One of the major problems brought to light is the disparity in subsistence allowance between the A.I.D. supported student (\$8.00 per day), and those supported by other agencies which reach \$12.00

per day. It must be recognized that the men selected for this program are professionals, and that the low allowance of A.I.D. is not adequate to maintain them in accordance with their professional and social stature. It has been found that this disparity in allowances between different agencies is confusing to the students, and creates undue problems of morale among them when they are already under stress while entering a new phase of learning and social experiences.

It was pointed out that the ultimate objective of A.I.D. is very broad, to provide economic aid for development in foreign countries. Dr. Okun suggested that in the long run a program in management is needed. During the discussion it was asked if we should not be taking a broader and more statesmanlike view of our possibilities, and be promoting the broad concepts of water resources viewing the overall environmental relationships. It was, however, pointed out that any recommendations for new programs must be justified by showing a demand for these programs in the underdeveloped countries.

A question arose regarding the influence of English, French and German design on the foreign construction. It was pointed out that we are losing out in influence because of our equipment prices which are continually going up. It was pointed out that the IPSED design program is now exclusively tied to American equipment and experience.

It was further pointed out by the UNC staff that the IPSED program has added to the strength of the overall environmental program at UNC, to provide a continuing resource for A.I.D. and other users. The Department has built up and can maintain a staff of unique breadth and depth. The department has also been able to develop task reports on given subjects that have particular use in the field. In general, the program has built up a large circle of contacts and friends around the world and is providing service, morale boosts, and many other benefits to these people.

The writer was fortunate in contacting Mr. Y. M. Liu, recently from WHO assignments in Turkey and Ghana. Mr. Liu pointed out some of the problems in both countries, and provided a list of key personnel to see when visiting there.

Reviewer's Comments

The Department of Environmental Sciences and Engineering at the University of North Carolina has developed a sound international program in sanitary engineering design, and has mustered a formidable array of talent in faculty well versed in international affairs, and responsive to the needs of underdeveloped countries, and to the needs of the students participating in the program. Many persons on this faculty have international reputations in their respective fields; e.g. Dr. Daniel Okun, Professor George Barnes, Professor Emil T. Chanlett, etc. Current updating and awareness of the international problems is maintained through frequent international travel to participate in international meetings, and to act as consultants on various projects. A prime example of this activity is evident in the recent report to A.I.D. by Professor Frederick E. McJunkin on "Engineering Measures for Control of Schistosomiasis". All of the faculty have spent some time abroad, and are well versed in relations with international students.

All individuals in the Department are enthusiastic about the IPSED program, and are desirous of continuing it. They also expressed the desire for more feedback in order to modify the program as needs be, and indicated that their feedback to date has been limited to visits with former students they encountered while on other international assignments. Another evidence of interest and concern that the University of North Carolina has for the underdeveloped countries is manifest in its joint publications with A.I.D. "Water Supply and Sanitation in Developing Countries" IPSED Series Items dealing with various technical aspects of water supply and treatment.

The Department of Environmental Sciences and Engineering at UNC offers programs at the masters and doctors levels in the areas of Sanitary Engineering and Water Resources, Environmental Chemistry and Biology, Air and Industrial Hygiene, Environmental Food Protection, and Radiological Health. A wide range of courses are offered in these areas, thus providing a very broad overall training capability. Laboratory facilities include some 20,000 square feet of space. Two laboratories are available for water and waste treatment pilot plant investigations, in addition to laboratory facilities at the University Water Filtration Plant. The Department also has substantial laboratory space at the UNC Wastewater Research Center, where many types of treatment process studies, both small and medium pilot scale and full scale are carried out. Other laboratories include a constant temperature laboratory, adjacent to which are preparation rooms and analytical laboratories for evaluation of experiments undertaken there, a limnology laboratory, a facility at University Lake where sampling and research are conducted, chemical and microbiological laboratories, a chemical instrumentation laboratory, an air hygiene laboratory, industrial hygiene facilities, a radiological health and radiation biophysics laboratory, and electron microscopy laboratories.

The Department appears to maintain the necessary size, strength and vitality, and to have the facilities and the backing of the University to successfully handle programs of the IPSED type, or other programs relating to environmental sciences and engineering.

Municipal Water and Sewer Departments

Four of the water and sewer departments used in Phase II of the IPSED program were visited and the contact person was interviewed to obtain (a) his reactions to the program and (b) suggestions for improving the in-utility portion of the program.

The training procedure varies from municipality to municipality. One department has a well-defined schedule with water, sewerage, and

management each allotted a week. The schedule for the fourth week depends on the interest of the individual participant. Another department leaves the schedule flexible, allowing the participant to spend time in the areas in which he has more interest.

In some places the participants are urged to take part in actual operations including laboratory procedures and they like them. Most of the participants are not interested in merely observing; they want to learn by doing.

Generally the participants spend time in both water and sewerage treatment plants, although some with a preference may concentrate on one or the other.

One superintendent suggested that the IPSED staff develop a questionnaire that would stimulate the participants to inquire about the details of the department instead of placing all the responsibility on the treatment plant personnel. This questionnaire could be used to help the participant understand why certain types of equipment are used, how it was selected in preference to some other type, how it is maintained and other details about the plant.

The consensus was that one month is an optimum time for this phase of the program. It was suggested that the participants be well briefed on their responsibilities while assigned to their particular departments. Some seem to expect special treatment such as transportation to the plants. This puts an undue burden on plant personnel. More regular contact and liaison with IPSED staff was requested.

The feeling was that the plant personnel gain from contact with the participants and want to continue cooperating with the program.

Consulting Engineering Firms

Of the many consulting engineering firms which have cooperated in Phase III of the IPSED program, seven have handled four or more participants. Each of these firms was interviewed concerning its experiences with the participants and for suggestions to strengthen this aspect of the program.

In several cases a participant has been assigned to a particular firm because it is consulting on a project in the participant's country. This has generally been a successful experience as both parties have a personal interest.

Some firms, after a brief introduction to the firm's organization, policy, and administrative procedures, assign the participant to a particular engineer who arranges for the participant to work on feasibility study views, project design criteria, project designs and sometimes on supervision of construction. Sometimes experience is provided on both water supply and sewage treatment works, depending on the participant's interest and the work that may be available in the office.

One firm assigns each participant to its regularly scheduled orientation course for the firm's new employees. This exposes the participant to all phases of the firm's operation, both administrative and technical. After this preliminary phase a program is developed with the participant to meet his needs.

Several firms suggested that they should be supplied with a resume¹ of the participant's interests and of what he hopes to gain from his Phase III expenses. This should be developed by the participant and his IPSED advisor during the academic phase and finished with the consulting firm to which the participant will be assigned well in advance of Phase III. In this way the consulting firm will be able to prepare for the participant and provide him the type of experience he wants.

The firms also urged that the IPSED staff maintain closer personal contact with the consulting firm and the participants assigned to them. The firms are providing a valuable contribution to the IPSED program and the participants by accepting them into their offices and acquainting them with the practical applications used by the consulting firms' staff. In many cases the participants are able to make a very real contribution to the firms and a mutual benefit results. In these cases the participant has a good experience. In a few cases the participant, either because of lack of experience or indifference does not enter into active involvement with the office work and neither the firm nor the participant is satisfied. After a number of years of experience the IPSED staff is well aware of the firms that provide a good experience and are not using the others.

One or two firms and several of the participants suggested that the firm pay the participant for his services in which case the participant would be expected to work as a regular member of the firm's staff. This might have some advantages but might well lead to the firm assigning the participants to suit the needs of the firm and not the participant.

An alternate suggestion was a planned, structured program of 30 days to 6 weeks to be carried out at the start of Phase III. The program would be given by one of the consulting engineering firms at its offices for all of the participants from one IPSED seminar. The program would supplement the work of the academic phase by practical applications from the point of view of the consulting engineer, carried out as he would on one of his projects. One week might be devoted to management, planning, economic analysis and financing, followed by a week on groundwater problems, soils mechanics, water pollution, supervision of construction or other areas that might need special attention. Men with years of experience from the firm or some other firm would be responsible for the material in their special fields. The firm would be reimbursed for its costs in developing and carrying out the course in close liaison with the other phases of the IPSED program.

The policies of the agencies sponsoring the participants should be included in a manual for the guidance of the consulting firms in dealing with the participants. The manual should also outline the purpose of the training programs with emphasis on Phase III and what is expected of the consulting firms.

Some of the firms exhibited a real missionary spirit in their willingness to participate in the program even though they might get no direct benefit from the participants assigned to them. They expressed the desire to help the participants develop not only the technical capability but the confidence to use their capability so that they could help their own countries to improve their water supply and sewage systems. All of the companies interviewed are looking forward to receiving more participants. One or two expressed the hope that a screening process would be set up in the countries to assure that only candidates capable of benefiting from the IPSED program will be selected.

F. World Health Organization - Geneva

Dr. Hanna visited WHO in Geneva, Switzerland on June 21-23, 1971 to obtain information on the needs of the countries to be visited as viewed by the various unit heads who are directing various programs in these countries.

Contacts were made with the following WHO Personnel:

Dr. Bernd Deiterich, Director, Division of Environmental Health
Mr. G. Etienne, Sanitation and Housing Services
Mr. Prescott Stevens, Acting Head, Waste Disposal Unit
Mr. Paul W. Bierstein, Chief, Preinvestment Planning
Mr. Renato Pavanello, Sanitary Engineer

Dr. Deiterich expressed interest in the IPSED program. He expressed disappointment that specific formats had not been developed for the field interviews. I showed him the guide questions provided by Mr. Pineo, designated to be responsible for obtaining information on the IPSED program from countries that will not be visited by the consultants. He felt that more explicit formats would assist in obtaining the same information from all sources.

Dr. Deiterich also expressed his disappointment with several of the consulting engineers who have recently been used on the WHO programs. He indicated that the Americans were not the best. He implied that they want to finish the job, get their money, and get out and suggested that in general they do not consider the overall project financing and management problems in their studies. He further expressed the view that we must be concerning ourselves with the overall environmental problems of the countries, and made reference to the 1972 international meeting in Sweden which is planned to consider the total world environment.

He implied that unless the engineers are willing to assume the responsibility for the total environmental studies, they will lose out to other disciplines who will assume this overall responsibility.

Mr. Etienne is handling the A.I.D. request to secure information on IPSED participants in certain countries that have not been visited by consultants. So far he has had word that three reports will soon be provided from the field. He has established a July 10 deadline for his receipt of all reports that he will forward to A.I.D. headquarters in Washington.

Mr. G. Etienne had considerable experience with WHO on the Ivory Coast. He stated that much of his earlier work was frustrating in attempting to develop training and environmental programs. He feels that Ghana can become a country of the future. It is cheerful, gay and hospitable. It was one of the first countries to have come forth with a request for aid in water supply development programs jointly administered by WHO and the United Nations Development Program (UNDP) special fund. The UNDP-WHO joint water supply program is now some sixteen years old. The projects have been most useful in developing master plans, strengthening educational facilities in various countries, and developing the habit of working with consulting engineers.

Mr. Etienne stated that basic training is most valid for one's development. (He is a civil engineering graduate (MS degree) from the University of Michigan). He feels, however, that cultural attitudes cannot be changed by university training, but cultural changes must come from within the society. Further, one cannot decide for the people without their involvement. The active leaders of a community must be influenced before changes can be made. The colonial powers did not effectively use the local family and tribal leaders to achieve changes. He stated that in general there is more sanitation progress in the English-speaking African countries than in the French-speaking, for the English-speaking colonies were made more aware much earlier of the significance of sanitation and health.

Mr. Etienne feels that we should now view the overall problems of the countries, and feels that WHO should now be placing more emphasis on other phases of environmental pollution such as sewage and solid wastes handling and disposal. He stated, however, that the approach of WHO in the past can be well justified because one had to start with water supply development as the first thrust, and over the years lack of finances and personnel have prevented delving into other environmental areas. He suggested that the visiting consultants to the IPSED program may very properly investigate the attitudes in the countries visited to determine the proper perspectives regarding water, sewerage, solid wastes, etc., and to see what can be developed in the environmental field.

Mr. Etienne suggested that contacts be made with the following personnel in the countries visited:

Turkey: Mr. A. Vogel - Project Director, WHO, water and supply and sewerage program in Istanbul.

Nigeria: Mr. O. O. Oladapo - Deputy Senior Engineer, Lagos Executive Development Board, Lagos, Nigeria. Mr. Oladapo knows the problems of Nigeria well; he is on the WHO Expert Committee on Planning, Organization, and Administration of National Environmental Health Programs.

Mr. A. O. Craig - Senior Planning Officer, Lagos Executive Development Board, Lagos, Nigeria.

Mr. W. Finley - Project Engineer, WHO in Ibadan.

The writer reviewed the suggested questions for interviews with former IPSED participants and their supervisors with Mr. Etienne as per Dr. Deiterich's request.

Mr. Prescott Stevens has the impression that the IPSED program is a good one, and likes the concept of including theoretical work with the practical municipal and consulting training. He prefers the IPSED program to a degree granting one. He feels that in many instances

those who get the masters degree may be pushed up the ladder too fast without having the necessary field experience to know the problems.

The Waste Disposal Unit was created in 1966, and now in almost every case the master plans for development include sewerage. He stated that about one-third of the world population with piped water now have sewerage. The goal is for two-thirds in the next 10 years, but he remarked that this was obviously too high.

In Ibadan, "the biggest native village in the world", the plan covers sewerage, drainage, and solid wastes. They are now concentrating on the immediate measures, with relatively small expenditures and volunteer assistance whenever possible. Comfort stations have been planned for sub-tribes. One has been built on a pilot scale and is being used effectively. UNDP is now providing the construction funding for 25 more. There is still a serious cholera situation in Ibadan. A solid waste pick up is now being developed. The overall project is now entering its second year. It is now staffed by a health educator, two engineers, and one additional engineer and one management consultant provided by the contractor, (MacLaren International, Toronto).

Mr. Stevens mentioned that in the Sudan WHO attempted to get a sanitary engineering competency into several agencies.

He feels that the problems of the communities may now be centered in the management and financing. The master plans for many cities are completed, but there is little activity toward their implementation.

Mr. Stevens was familiar with the metro plan in Manila. The writer mentioned that Black and Veatch were unhappy with the removal of nationals from the program to attend school. He stated that WHO was aware of this, and that they would try to prevent any future occurrence of this kind. He stated, however, that often WHO could not plan ahead for program participants because the governments would not indicate

specifically who was to be assigned to a program until it was underway.

Mr. Paul W. Bierstein, Chief, Preinvestment Planning (PIP) stated that he likes the IPSED program, and has been promoting it all over the world when he can. He deplored the fact that WHO has only a few sanitary engineers in the field, and that others would not promote sanitary engineering fellowships. He feels that there is a definite input of former IPSED students into the feasibility plans promoted by UNDP. He stated, however, that the groundwater course in Minnesota may have reached an end-point and may now be of considerable less value.

Mr. Bierstein suggested that the IPSED consulting visitors might explore gingerly reactions to the fact that the program does not award a degree. He also suggested exploring the following:

1. Are there goals to the program in various countries in terms of training given numbers of individuals in each field; such as government, teaching, etc.
2. What proportion of the IPSED students have gone into academic life?
3. How many of the trainees have stayed in the sanitary engineering field? How many are with their governments, and how many are now WHO staff members?

Mr. Bierstein suggested that if ever there should be a reorientation of the North Carolina program consideration might be given to development of a course for the "training of trainers". Here the emphasis would be on educating young faculty members of engineering schools in developing countries on the appropriate course content and most effective ways of teaching design of sanitary facilities. The object of such a program would be to enhance the multiplier effect of men who are sent to the USA for training. Too few of these people are either encouraged or prepared to regard themselves in the role of teachers when they return to their native lands.

Mr. Bierstein prepared a list of WHO representatives, WHO project managers, and UNDP Resident Representatives to see in each country visited.

Mr. Bierstein closed by requesting a copy of the final report that will be made on the evaluation of the IPSED program.

At the suggestion of Mr. Etienne, Dr. Hanna visited Dr. Benjamin D. Blood, International Health Attaché, Mission of the U.S.A. in Geneva. Dr. Blood outlined the objectives of the Mission, and also expressed the feeling that WHO through its regional offices should be looking at the overall environmental picture. He stated that we will be hearing much more of the "International Union for Conservation of Nature and Natural Resources". Dr. Gerard Ogudowski of Venezuela is its General Director. Dr. Blood stated that WHO is making progress in the population control area, but this is slow, and must depend upon impetus from each individual country.

Reviewer's Comments

The visit to WHO and the American Mission in Geneva was most informative and rewarding. It was particularly apropos at the beginning of the trip, since much information was obtained on conditions in the countries to be visited, suggestions were made for interviews, and a number of additional contacts were suggested for each country.

It appears to the reviewer that as WHO embarks on the second decade of its community water supply development program a significant shift in thinking is taking place. In part this reflects a recognition that small communities in most of the developing countries are not destined to undertake self-supporting water-service projects because people simply lack sufficient income to pay for such service when other needs of higher priority are not being satisfied. Social-reform measures in many countries are moving toward the concept that in rural areas, at least, the national government has a responsibility for providing "free" potable water.

With respect to improvement of rural water supplies WHO is promoting the establishment of national agencies in various countries to deal with this matter. Such national agencies are already operating in Ghana, Uganda, Algeria and Morocco.

Another significant development -- this concerned with large water and sewerage projects -- is the creation of a new unit in the WHO Division of Environmental Health responsible for "pre-investment planning". The unit was activated in November 1970 and is now in the process of being staffed with a multi-disciplinary team of sanitary engineers, financial analysts, sociologists, epidemiologists, ecologists and other experts in the legal and management fields.

Arrangements are contemplated whereby the World Bank will subsidize a substantial portion of the salaries for the pre-investment unit staff.

The type of work to be performed by this new unit presumably will supplant the ad-hoc arrangements previously employed by WHO in supervising feasibility studies made under contract with consultants.

**INTERNATIONAL PROGRAM IN
SANITARY ENGINEERING DESIGN**



**DEPARTMENT OF ENVIRONMENTAL
SCIENCES AND ENGINEERING
SCHOOL OF PUBLIC HEALTH**

WATER

COLLECTION STORAGE TREATMENT DISTRIBUTION

WORKS

CONCEPTION DESIGN CONSTRUCTION OPERATION

ENGINEERING

UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL

I.P.S.E.D. Participants
at UNC at Chapel Hill

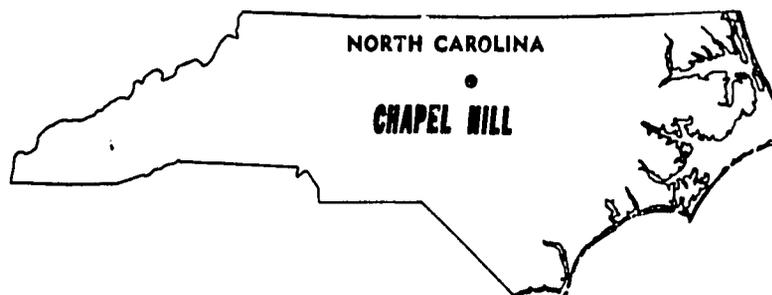


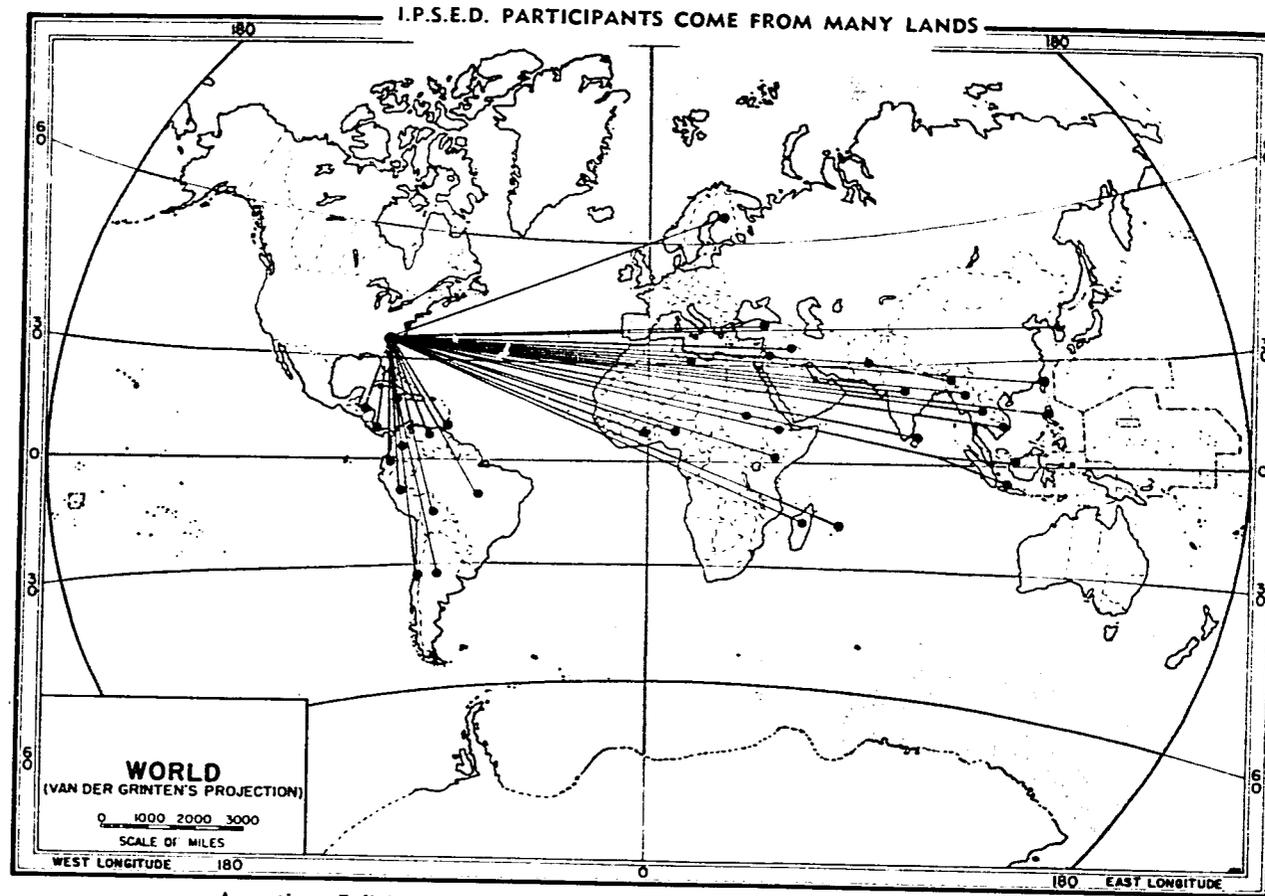
I. P. S. E. D.

The International Program in Sanitary Engineering Design (IPSED) of the University of North Carolina at Chapel Hill was created to train practicing engineers in the conception, design, construction, and operation of water supply projects and related works of a nature appropriate to needs of developing countries. The training is accomplished in six to twelve months of residence in the United States. Residence is in part at the University, in part at a municipal water works, and in part in office and field work with one of several selected consulting engineering firms active in international work. At each session, participants do their work at the University in classes, seminars, and special projects. Assignments to municipalities and to consulting engineering offices are made individually with a view to providing experience of the most rewarding kind to each participant.

IPSED is an independent program at the University and is designed specifically to meet the needs of graduate sanitary engineers with an interest in developing countries. Accordingly, it is considered that the training and experience received in this rigorous certificate program should be of more immediate and practical value to such engineers than would be the type of training normally offered in an academic program leading to the Master of Science degree.

As originally conceived, IPSED was intended primarily for practicing engineers only. However, experience has indicated that, with modification of the municipal and design phases, IPSED offers a unique program of faculty study for professors responsible for teaching sanitary engineering in educational institutions located in developing countries. For faculty participants, the field phases are shortened and more time is spent at the University in observation and participation in ongoing university instruction and research activities and in visiting other educational and research institutions. This program, previously on an ad hoc basis, has been enthusiastically received and is now available during each IPSED session to qualified participants.





Argentina, Bolivia, Brazil, Burma, Ceylon, Chile, Colombia, Costa Rica, Ecuador, Ethiopia, Finland, Ghana, Honduras, India, Indonesia, Iraq, Jamaica, Jordan, Kenya, Korea, Libya, Malagasy Republic, Mauritius, Nigeria, Pakistan, Peru, Philippines, Republic of China, Sudan, Thailand, Trinidad, Turkey, Venezuela, Vietnam.

Many engineers from abroad receive their undergraduate or graduate education in U.S. institutions. For these persons, IPSED offers an ideal opportunity to blend their theoretical, abstract, academic program with the intense practicality and actual experience of the IPSED program, thus strengthening their capacity to proceed immediately to positions of technical leadership in their home country. For this group of participants, arrangements and timing are relatively flexible. One option, for example, for the young engineer receiving a U.S. Bachelor's degree in May or June would be to enroll immediately in IPSED, undertake an abbreviated field phase during the summer, then undertake the academic phase beginning in September. The engineer interested in enrolling in a U.S. school, for work leading to a Master's degree, may find it advantageous to first complete the IPSED academic phase. IPSED course work is accepted for credit towards a degree at several other U.S. institutions. The unique arrangements of IPSED virtually eliminate "cultural shock" and also make it possible for the participant to delay a decision on further academic studies until he has actual exposure to a U.S. academic and cultural environment and a real test of his language skills. Some past participants have entered degree programs following the IPSED academic phase, but the great majority find the field phases better suited to their needs.

Eighty-seven engineers, ranging in age from twenty-four to fifty-five years, have participated in the Program during the seven years of its existence. These men have come from thirty-four different countries in Africa, Asia, the Americas, and the Middle East. All have returned to their countries of origin to occupy positions of responsibility.

The International Program in Sanitary Engineering Design was instituted in 1962 as part of the participation of the United States in the global Community Water Supply Program. It is sponsored by the Agency for International Development, U.S. State Department, and is conducted by the Department of Environmental Sciences and Engineering, School of Public Health, University of North Carolina at Chapel Hill.

THE PROGRAM

The Program consists of three integrated phases, briefly described below—the Academic, the Municipal, and the Design.

Academic Phase: Participants generally report to a U.S. office of their sponsor in Washington or New York for briefing; they are then sent to Chapel Hill, N. C., for the academic phase of training.

The academic phase is a full semester which begins the second week in September* and ends in late January. Four separate

* Participants for the 1970 session are expected to be in Chapel Hill on September 9 and for the 1971 session on September 8.

courses, supplemented by special instruction in such topics as chemistry and biology, constitute the academic offering. Participants in IPSED can receive, at their option, up to eleven semester hours of postgraduate credit for successful completion of these courses. Application for enrollment for credit may be made after arrival at the University. Those students not enrolling for credit attend all lectures but may have a lighter work load, at the option of the instructor. These courses are also elected by regular academic students in the Department.

IPSED instruction encourages class participation, and, in fact, an important aspect of this work is the interchange of experience and discussion of the participants relative to common problems. Participants are encouraged to bring with them engineering reports that cover projects with which they have been involved, as a basis for exchange of experiences. Classes are held in the morning, five days per week. Afternoons are devoted to study and discussion of problems and design, including a number of field trips to projects of interest and a design problem in which each participant individually plans a water works project and makes a comprehensive preliminary report on all engineering aspects of the venture (plans, specifications, cost analyses, and financing).

The Courses for which credit may be received include:

- ENVR 173—DESIGN OF HYDRAULIC STRUCTURES (three credit hours). Hydraulic design for waterworks and sewerage projects: open channels; backwater curves; siphons; transition sections; dams and outlet works; stilling basins; networks; centrifugal pumps; transients in unsteady flow.
- ENVR 175—SANITARY ENGINEERING DESIGN IN DEVELOPING COUNTRIES (three credit hours). Design of public water and sewage facilities including intakes, pumping stations, treatment plants, distribution systems, and wastewater collection works. Design criteria, equipment, and systems for use in developing countries are stressed. Process, mechanical, electrical, and control aspects of design are included. Students prepare complete designs.
- ENVR 181—GROUNDWATER HYDROLOGY (two credit hours). Groundwater occurrence and exploration; design, hydraulics, drilling, construction, and testing of water wells; operation and maintenance of groundwater supply systems.
- ENVR 182—WATER RESOURCES PLANNING IN DEVELOPING COUNTRIES (three credit hours). Preliminary planning of public water supply and sew-

erage facilities. Planning objectives and design criteria for developing countries are considered. Course topics include collection and analyses of data, rate studies, capital budgeting, decisions on water quantity, quality, needs for sewage treatment, location, systems analysis and optimization procedures, sizing of facilities, scheduling (CPM), and financing. Preliminary plans, cost estimates, and planning reports are prepared by students.

Municipal Phase: Participants are individually assigned to one month's residence at a municipal water works for operating and management experience. In this phase of the Program, the municipal water works officials cooperate by directing the activities of the participant to give him a good engineering insight into plant operating routines, process control, record-keeping and reporting, and, often, management, financing, and planning for the future.

Design Phase: Following the municipal phase, participants are again individually assigned to the office of a well-known international consulting engineer specializing in water and wastewater projects, industrial and municipal. Here, insofar as the capacity of the participant permits, he shares in the work of the firm in the planning, reporting, specification writing, and design of projects currently in the office. Supervision of construction is often an important part of the work. Field phases of the Program are monitored by IPSED faculty.

The Program enlists the services of professors and professionals of very high competence. The spread and diversity of the influences

University of North Carolina at Chapel Hill

School of Public Health

Department of Environmental Sciences and Engineering

To all persons to whom this writing may come, Greeting:

Be it known that in recognition of the completion of the course of study in the

International Program in Sanitary Engineering Design,

we confer upon

Augusto A. Navarro

this Certificate of Achievement

This 1st day of April 1965.

Wm. Fred Joyce
Dean, School of Public Health



Amel A. Khan
Head, Department of Environmental
Sciences and Engineering

under which the participant works is indicated by the large number of consulting firms, municipalities, other agencies and organizations, and individuals, listed on Pages 11, 12, 13 and 14, sharing in IPSED. Participants have worked in some fifty-seven agencies and other organizations in the United States and Canada, in eighteen states from coast to coast.

The participants, sometime during their training, attend one or more national meetings of such organizations as the American Water Works Association, the American Society of Civil Engineers, and the Water Pollution Control Federation.

Terminal Assignment: At the close of the Program, the participant submits a complete report on his total experience in IPSED.

The participant receives a special certificate showing that he has completed all work expected of him, in a satisfactory manner.

PREREQUISITES

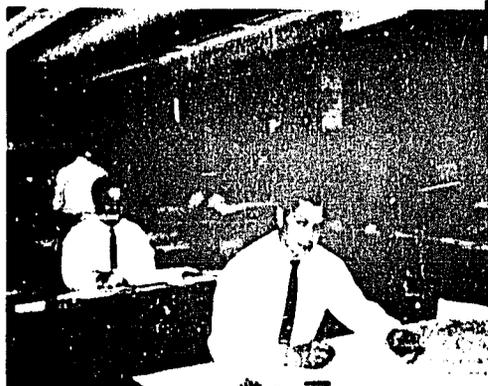
Participants entering the Program should have an engineering degree, some specialized experience or advanced education in sanitary engineering, and ability to communicate competently in English. The applicant must submit for review a college transcript and a completed application form, a copy of which is enclosed.

Information as to the present occupation and title of the applicant is also required, as well as assurance from his employer that he will be assigned, on returning to his country, to a position at least equal to that held prior to his training, in which the newly acquired knowledge can be applied.

Francis Obodoechina, of Enugu, Eastern Nigeria, at work in the offices of Gilbert Associates, Reading, Pa.



Hugo Tejerina, of La Paz, Bolivia, in the offices of Whitman, Requardt & Associates, Baltimore, Md.



APPLICATIONS

The U.S. Agency for International Development missions in various countries, in cooperation with host governments, select participants. Those qualified for participation in this program may apply to the A.I.D. mission in his country, generally located near the U.S. Embassy. In countries where there is no A.I.D. mission, inquiries should be directed to the nearest U.S. diplomatic or consular office.

The World Health Organization also sponsors participants in this program, and inquiries may be directed to their headquarters in Geneva, Switzerland, or to any one of their regional offices located in Copenhagen, Denmark; Manila, Philippines; Alexandria, Egypt; Brazzaville, Republic of the Congo; Delhi, India, or their regional office in Washington, D.C. The Ford and Rockefeller Foundations, the Organization of American States, and other such agencies may also sponsor participants.

Inquiries may be addressed to Dr. Daniel A. Okun, Project Director, International Program in Sanitary Engineering Design, P.O. Box 630, Chapel Hill, N.C. 27514, U.S.A.



Ahmet Takaoglu of Ankara, Turkey, on assignment at the Puerto Rico office of Buck, Seifert and Jost.

ARRANGEMENTS

FINANCES

Tuition charges and all fees at the University are included in the support provided by the sponsoring agency. In some cases, an allowance for books is made.

Less than first-class overseas travel is arranged by the sponsoring agency, with an excess baggage allowance of twenty-two pounds during travel to and from the United States. Official travel within the U. S. is supported by the sponsoring agency or by IPSED.

The sponsoring agency provides a subsistence allowance to cover the cost of living while in residence in Chapel Hill, with a special allowance while in field residence. From this, participants are expected to pay for their own food and lodging.

Sickness and Accident Insurance is provided by sponsoring agencies.

LIVING ACCOMMODATIONS

While in residence in Chapel Hill, participants are housed in University dormitories, two men in a room. Dormitory reservations are made and paid for, by IPSED, in advance (as is required by the University), and participants reimburse the Program upon their arrival in Chapel Hill. The cost of these accommodations, including rental of bedding and linen, is approximately \$195 per semester.

If a participant plans to have his family with him in Chapel Hill and will not need dormitory space, this should be indicated so that the danger of forfeiture of prepaid dormitory room rent will be eliminated. (The participant is held responsible for payment of room rent if a room is reserved and he comes to Chapel Hill but does not occupy the space; if, on the other hand, a prospective participant for whom a room has been reserved finds that he cannot attend IPSED and notification is received to this effect, his room can be cancelled, the prospective participant is not held responsible for payment.)

University dormitories are conveniently located to campus eating facilities. Meals can be obtained (on a prepaid basis) for approximately \$250 a semester in a University cafeteria or for about \$4 to \$5 a day elsewhere on a day to day basis.

DEPENDENTS

If a participant plans to have his family with him in Chapel Hill, this should be indicated at the earliest possible time. The Program will do what it can to assist the participant in making arrangements for his family, but the responsibility of locating private living accommodations is the responsibility of the participant. University housing

is scarce, and locating housing in town (especially that within walking distance of the campus) is difficult.

A participant planning to bring his family should come to Chapel Hill in advance of the beginning date of the Program and locate housing, or come without his family, locate housing, and then have his family join him. Temporary quarters in the Carolina Inn or in a private home can be arranged in either case, if the participant lets his needs be known.

All costs pertaining to any dependents, such as travel, housing, insurance, etc., are borne by the participant. It should be remembered, too, that the need for the participant to absent himself during the required field phases of the Program could work a hardship on his dependents.

GENERAL

Participants have full student academic privileges and are entitled to attend lectures, sports programs, films, concerts, and other activities sponsored by the University.

Except under unusual circumstances, foreign participants are not permitted to drive automobiles during their training in the United States.

PARTICIPANTS

Argentina

Andres Angel Bacigalupi,
Mar del Plata

Bolivia

Carlos Guerrero, La Paz
Pedro Antonio Perdriel Parada,
La Paz
Mario Pena, La Paz
Hugo Tejerina, La Paz

Brazil

Alir Doria, Sao Paulo
Francisco Leopoldo Carvalho
de Mendonca, Belo Horizonte
Henrique de Mello, Rio de
Janeiro
Nilo Leite Nassar, Goiania
Benedito Pereira, Sao Paulo
Marina Rosa e Silva, Rio de
Janeiro

Burma

Jeff E. Flanagan, Rangoon

Ceylon

Velupillai Mahathevan,
Ratmalana

Chile

Felipe Guillermo Ruiz
Troncoso, Santiago

Colombia

Eduardo Garcia, Bogota
Luciano Pena, Cali
Mauricio Alfonso Rivera,
Bogota

Costa Rica

Walter Brenes Fabian,
San Jose

Ecuador

Enrique La Motta, Quito

Ethiopia

Aberra Messele, Addis Ababa

Finland

O. Perakyla, Helsinki

Ghana

Kofi Mensah Addison,
Akropong
Benjamin A. Quaye, Accra

Honduras

Luis Armando Moncada,
Tegucigalpa

India

Ajit Kuman Bhunia,
Mohanpur

Indonesia

Richardus Harjoko, Bandung
Pedi Natasuwarna, Pontianak

Iraq

Luckman Abdul Rahman Al-
Abaddy, Baghdad
Abdul Al Mahmoud, Baghdad
Salmon Malik El-Rawi,
Baghdad
Ali Hussain Shubber, Baghdad
Muwaffaq B. A. Sulaiman,
Mosul

Jamaica

Horace Lloyd Beckford,
Kingston
Vincent Egbert St. Anthony
Hemming, Kingston

Jordan

Najeeb Foteh Tleel, Amman

Kenya

Andrew Moche, Nairobi

Korea

Chang Sang Yong, Pusan City

Libya

Ali Rida Mohamed El-Hingari,
Tripoli

Malagasy Republic

Armand Razafy, Tananarive

Mauritius

Leekrazsingh Hurpaul,
Port Louis

Nigeria

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Ibadan
Sylvester D. Agboola, Kwara
State
Penrose K. Johnson, Ekwete
Metta
Francis Obodochina, Enugu
Emmanuel Adesina Ojo,
Ibadan
Gabriel Babs Omolegbe,
Kwara State
Samuel A. Osobamiro,
Lagos

Pakistan (East and West)

Zafar Ahmad, Dacca
Syed Husain, Lahore
Mohammad Nijat Khan,
Damas-Gilgit
Sharifullah Khan, Chittagong
Muhammad Khokhar,
Rangpura
Mirajuddin Nagi, Lahore
Ismail Razee, Dacca
Abdul Wahab Soomro,
Shikarpur
Khurshiduz Zaman, Dacca

Peru

Raul Ernesto Atala, Lima
Leopoldo Bracale, Lima
Oscar Vicente Campos, Piura
Emilio de La Guente, Lima
Augusto A. Navarro, Lima

Philippines

Tomas V. Argente, Manila
Benigno C. Ayson, Jr., Manila
Eliseo P. Corpus, Quezon City
Antoliano Diaz, Iloilo City
Reynaldo A. Florendo, Manila

Republic of China

Ta-Ka Chen, Taipei
Yau-nan Chen, Taipei
Philip Peng-fei Kuo, Taipei
Yen-min Liu, Taipei
Jen-chei Tseng, Taipei

Sudan

Siddig El Abbas Mustafa,
Khartoum

Thailand

Thira Kunavipakorn, Bangkok
Boonsong Seuyouyong,
Bangkok

Trinidad

Frank G. Chu Cheong, St.
Joseph

Turkey

Halil Uslu Arapoglu, Ankara

M. Zeki Aygen, Kayseri
Zekai Huseyin Gurgul, Ankara
Yuksel Isleyen, Bursa
Ahmet Takaoglu, Ankara
Semih Turker, Ankara
Sacit Oguz Unal, Ankara

Venezuela

German Sanchez

Vietnam

Tran Phuoc Tho, Saigon
Truong Nhu Tu, Saigon
Nguyen Danh Vang, Gia Dinh
Nguyen Dinh Vien, Saigon



Studying sewerage plans in the Civil-Sanitary Division of Black & Veatch, Kansas City, Missouri, consulting engineering firm, are (left to right) Benigno Ayson, Eliseo Corpus, and Reynaldo Florendo.

ACKNOWLEDGMENTS

For the service of special lecturers in the academic phase, for cooperation in the municipal phase, and for significant contributions to the training of the participants by the consulting firms and other organizations that share in the Program, we make grateful acknowledgment to the following:

Consulting Firms

Albright and Friel
Philadelphia, Pennsylvania

Alexander Potter Associates
New York, New York

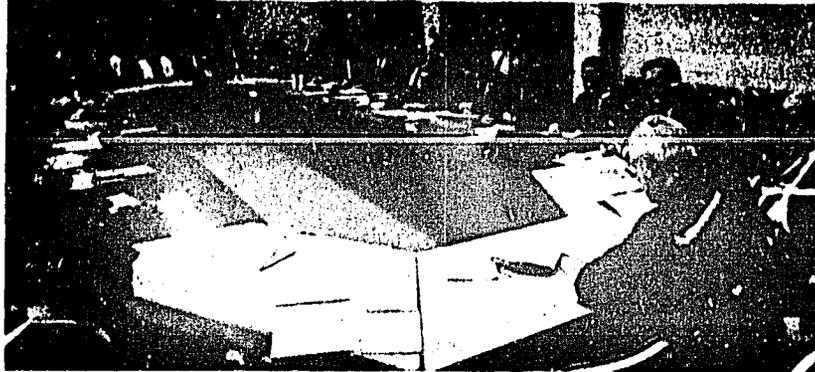
Camp, Dresser & McKee
Boston, Massachusetts

The Chester Engineers
Pittsburgh, Pennsylvania

Alvord, Burdick & Howson Chicago, Illinois	Engineering-Science, Inc. Arcadia, California
Burgess & Niple, Limited Columbus, Ohio	Gannett, Fleming, Corddry & Carpenter Harrisburg, Pennsylvania
Black & Veatch Kansas City, Missouri	Gilbert Associates Reading, Pennsylvania
Brown & Caldwell San Francisco, California	Greeley & Hansen Chicago, Illinois
Buck, Seifert & Jost Englewood Cliffs, New Jersey	Havens & Emerson New York, New York
Hazen & Sawyer New York, New York	Metcalf & Eddy Boston, Massachusetts
Hennison, Durham & Richardson Omaha, Nebraska	O'Brien & Gere Syracuse, New York
Horner & Shifrin St. Louis, Missouri	Piatt, Davis & Associates, Durham, North Carolina
Lalonde, Girouard & Letendre Montreal, Quebec	Whitman, Requardt & Associates Baltimore, Maryland
Malcolm Pirnie Engineers New York, New York	

Municipalities

Chapel Hill (North Carolina) Water Filtration Plant	Hackensack (New Jersey) Water Company
Charlotte (North Carolina) Water Department	Hartford (Connecticut) Metropolitan District Water Bureau
Dayton (Ohio) Municipal Water Works	Los Angeles (California) County Sanitation District
Durham (North Carolina) Department of Water Resources	Philadelphia (Pennsylvania) Water Department
Fayetteville (North Carolina) Water Department	Raleigh (North Carolina) Department of Public Utilities
Greensboro (North Carolina) Water Treatment Plant Sewage Treatment Plant	St. Louis (Missouri) City Water Department



Consultants from Engineering Firms Cooperating in the I.P.S.E.D. Program Meet in Chapel Hill to Discuss Engineering Practices in Developing Countries.

St. Louis (Missouri)
County Water Company

Wyoming (Michigan)
Water Treatment Plant

Winston-Salem (North Carolina)
Department of Public Works

Other Agencies and Organizations

Dorr-Oliver Company
Stamford, Connecticut

Tennessee Valley Authority
Knoxville & Chattanooga,
Tennessee

Indiana State Board of Health
Indiana, Indianapolis

U.S. Department of Housing
and Urban Development
Washington, D.C.

National Sanitation Foundation
Testing Laboratories, Inc.
Ann Arbor, Michigan

U.S. Public Health Service
New York, New York

Ohio State Department of Health
Columbus, Ohio

Water and Wastewater Technical
School
Neosho, Missouri

School of Public Health
University of Minnesota
Minneapolis, Minnesota

*Participating Staff Members of the University of North Carolina
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Frederick E. McJunkin
Engineering Associate and Instructor in Sanitary Engineering
Daniel A. Okun, Project Director
Professor of Sanitary Engineering
Head, Department of Environmental Sciences and Engineering
Jabbar K. Sherwani
Associate Professor of Hydrology and Water Resources

CHAPEL HILL

The Town of Chapel Hill, where a participant spends approximately five months of his total program in the academic phase of IPSED, is located in central North Carolina, 500 feet above sea level. The Chapel Hill area has about 20,000 permanent residents and some 16,000 college students, many of whom are in graduate programs at the University. Raleigh, the capital of the State of North Carolina, is thirty miles to the east and the city of Durham is twelve miles to the northeast. The three cities—Chapel Hill, Raleigh, and Durham—are situated at separate points on a triangle in which is located the famed Research Triangle, where governmental agencies and industries have a concentration of research personnel and facilities unique in our southern states and of great potential for the nation.

Chapel Hill climate is mild, with annual rainfall being about forty-seven inches; daily temperature extremes are 31-52°F in January (the coldest month) and 68-88°F in the warmest month (July). Snowfall is light, averaging but seven inches per year.

The University at Chapel Hill, which was founded in 1793 and is the oldest state university in the country, comprises thirteen colleges and schools and eight institutes. There are professional schools of medicine, law, dentistry, pharmacy, and others, including the School of Public Health. The latter was founded in 1940 and incorporates, among its ten departments, the Department of Environmental Sciences and Engineering which has approximately ninety students, including students from other countries, who are candidates for advanced degrees. The Department has a strong program in both teaching and research and conducts the International Program in Sanitary Engineering Design as one of its major activities.

The Department of Environmental Sciences and Engineering conducts graduate programs leading to the Master of Science in Sanitary Engineering, Master of Science in Public Health, Master of Public Health, and Doctor of Philosophy degrees in the following program areas:

Sanitary Engineering and Water Resources
Environmental Chemistry and Biology
Air and Industrial Hygiene
Environmental and Food Protection
Radiological Hygiene.

The Department is also engaged in assisting with the development of a graduate program in sanitary engineering at San Carlos University in Guatemala to serve Central America and Panama.



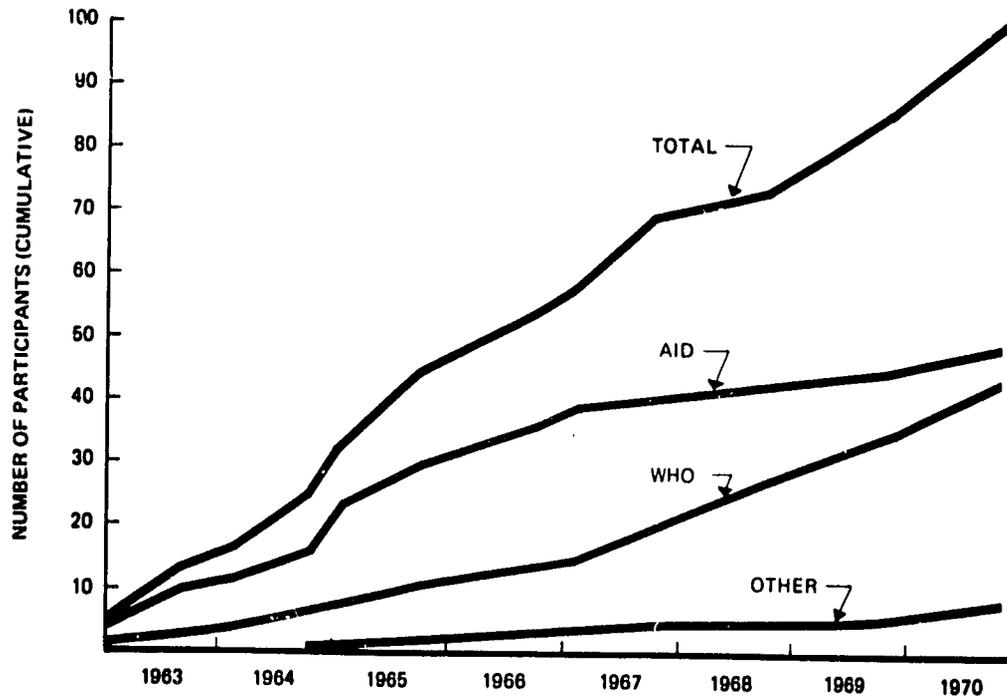


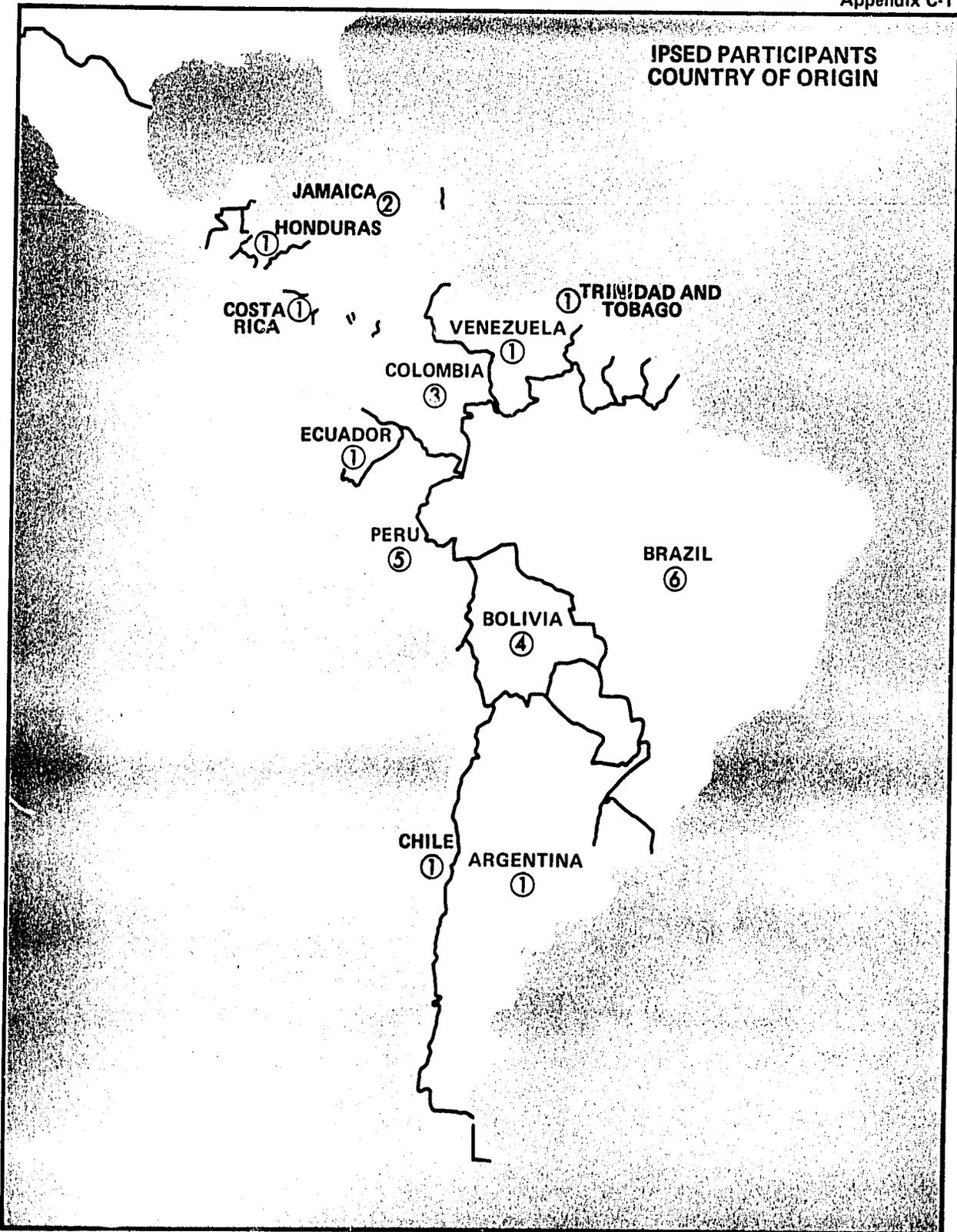
I.P.S.E.D. Participants
at UNC at Chapel Hill

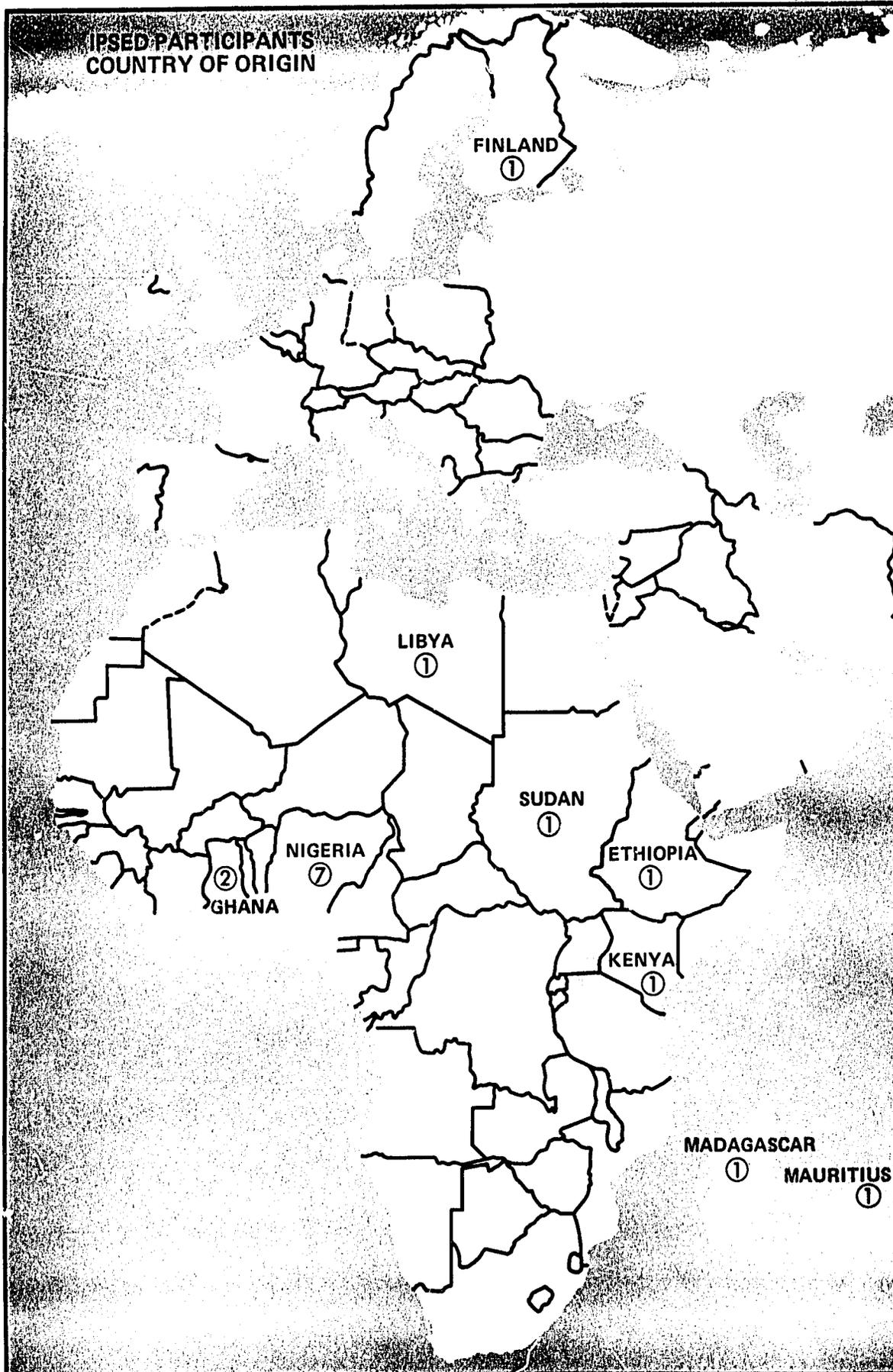


AGENCIES SPONSORING PARTICIPANTS IN IPSED PROGRAM

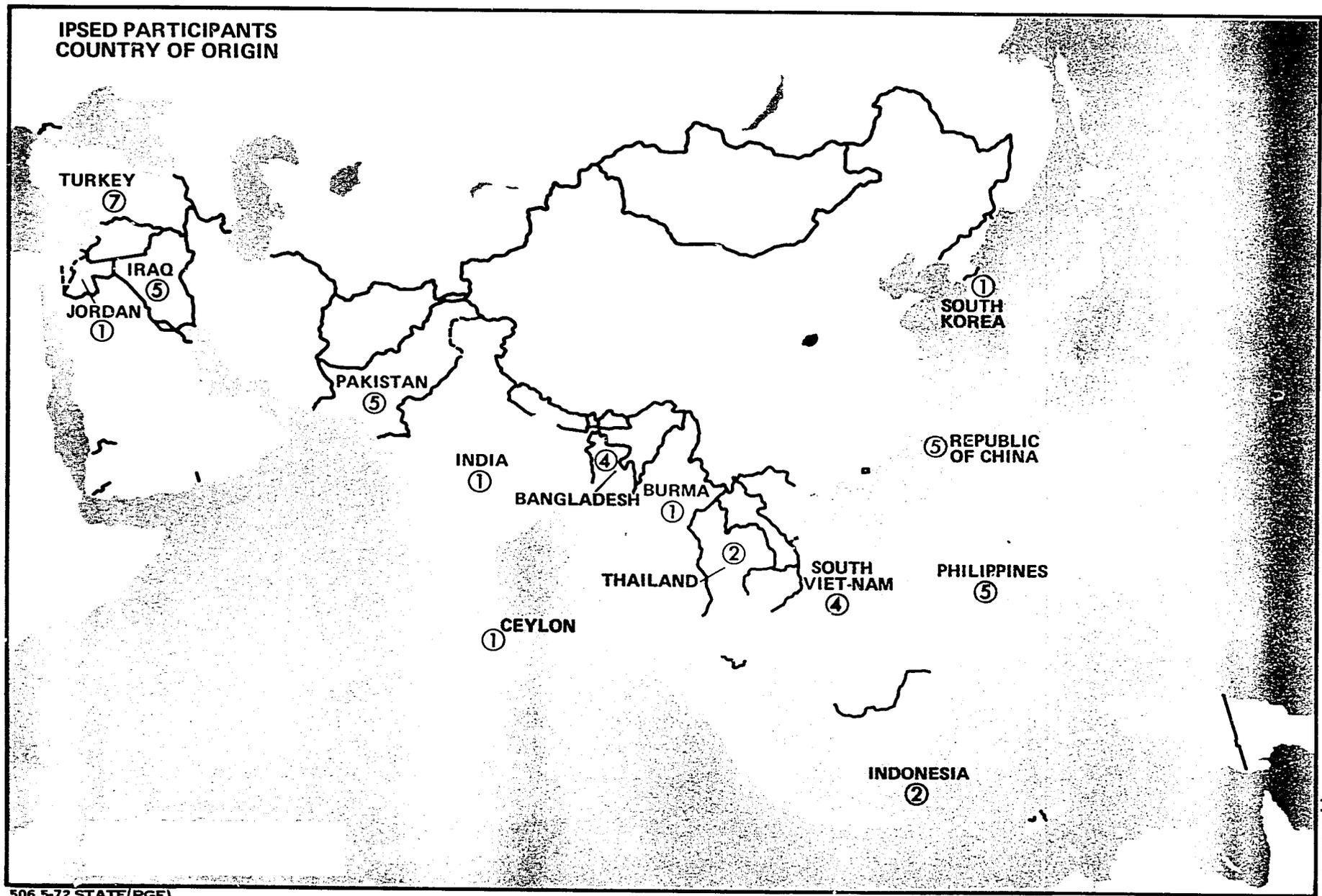
Session	Dates	AID	WHO	PAHO	Other	Total
1st	Jan. 1963	4		1		5
2nd	Sept. 1963	8				8
3rd	Feb. 1964	1	1	2		4
4th	Sept. 1964	3	1	2	1-Ford	7
5th	Feb. 1965	7	1			8
6th	Sept. 1965	7	2	1	1-OAS	11
7th	Sept. 1966	7	2	1		10
8th	Feb. 1967	3	1		1-Ford	4
9th	Sept. 1967	1	8	2	1-Self	13
10th	Sept. 1968		3	1	1-UN	4
11th	Sept. 1969	4	5	2	1-Self	13
12th	Sept. 1970	5	9		1-Loke 1-IDA	16
Total		50	33	12	8	103







**IPSED PARTICIPANTS
COUNTRY OF ORIGIN**



DISTRIBUTION OF PARTICIPANTS AND INTERVIEWS

Country of Participant	Session Participant Attended IPSED												Total	Participants Interviewed		
	1	2	3	4	5	6	7	8	9	10	11	12				
<u>AFRICA</u>																
Ethiopia							1							1	1	2
Ghana			1							1				1		1
Kenya													1			1
Libya													1			1
Malagasy Rep.						1										1
Mauritius						1	1						1			1
Nigeria		1			1	1	1						3			7
Sudan									1							1
Uganda														2		2
<u>NEAR EAST-</u>																
<u>SOUTH ASIA</u>																
Ceylon								1								1
India								1								1
Iraq		2	1	1		1										5
Jordan				1												1
Pakistan													2			2
East						2		2					1			5
West						2		2					1			6
Turkey	3				2	1							1			7
<u>FAR EAST</u>																
Burma		1														1
China				1				1	3					2	2	7(a)
Indonesia													2			2
Korea								1								1
Philippines									4	1						5
Singapore														1		1
Thailand								2						3		5
Vietnam					3			1								4
<u>CARIBBEAN</u>																
Jamaica		2														2
Trinidad																1
<u>CENTRAL AMERICA</u>																
Costa Rica		1														1
Honduras													1	1		2
<u>SOUTH AMERICA</u>																
Argentina			1													1
Bolivia		1			1	1			1							4
Brazil	1			1		2										6
Chile			1													1
Colombia	1									1		1		2		5
Ecuador										1						1
Peru				2					3							5(b)
Venezuela				1												1
<u>EUROPE</u>																
Finland					1											1
TOTALS	5	8	4	7	8	11	10	4	13	4	13	16	103			50

Notes.

(a) One participant not in Taiwan at time of study.

(b) Three participants not in Peru at time of study.

STATUS OF PARTICIPANTS (At time of Study)

LEGEND: P = Principal Responsibility

S = Secondary Responsibility

REGION COUNTRY	PARTICIPANT	WHERE EMPLOYED								TYPE OF WORK RESPONSIBILITY						REMARKS	
		WATER AUTHORITY	MINISTRY PUBLIC WORKS	MINISTRY PUBLIC HEALTH	MUNICIPALITY	PRIVATE SAN. ENG. FIRM	BANK	UNIVERSITY	OTHER NON. SAN. ENG.	PLANNING ADMINISTRATION	DESIGN	OPERATION	QUALITY CONTROL	TEACHING	RESEARCH		OTHER
LATIN AMERICA BOLIVIA	Parada	X		3	1	3	1	3	3	P-3 S-1 P	P-3 S-5	S-1	S-1	P-3 S-4	S-1	P-3	
	Guerrero								X	P							Civic action
BRAZIL	Tejerina				X						P			S			Could not be reached
	Pena, M.																
	DeMendonca			X							S			P			
	Nassar							X						P			Environmental Sanitation
COLOMBIA	Doria					X				P	S						
	Silva			X													
	DeMello	X								P	S					P	Maintenance Buildings
	Pereira						X			P				S			Housing bank-loans for water supply and sewerage
	Garcia								X	P							
	Pena, L.							X						P	2		Pre-mixed concrete Sanitary engineering

STATUS OF PARTICIPANTS (At time of Study)

LEGEND: P = Principal Responsibility

S = Secondary Responsibility

REGION COUNTRY	PARTICIPANT	WHERE EMPLOYED								TYPE OF WORK RESPONSIBILITY							REMARKS	
		WATER AUTHORITY	MINISTRY PUBLIC WORKS	MINISTRY PUBLIC HEALTH	MUNICIPALITY	PRIVATE SAN. ENG. FIRM	BANK	UNIVERSITY	OTHER NON. SAN. ENG.	PLANNING ADMINISTRATION	DESIGN	OPERATION	QUALITY CONTROL	TEACHING	RESEARCH	OTHER		
<u>LATIN AMERICA (Cont'd.)</u>																		
COLOMBIA	Rivera	X								P								
COSTA RICA	Fabian			X							S						P	
HONDURAS	Moncada					X					P							
JAMAICA	Beckford					X				S	P							
	Hemming	X								P	S	S	S					
PERU	Delafuente																	
	Atala																Left country	
	Campos																Left country	
	Navarro							X		P				S			General Secretary at University	
	Bracale								X								P	Farming
<u>SOUTH ASIA</u> <u>FAR EAST</u>		5	13	3						P-9 S-2	P-8 S-7	S-5		P-1 S-1				
PAKISTAN(w)	Hussain		X								P	2						
	Khokhar		X								P	2						
	Khan		X							P	S							

STATUS OF PARTICIPANTS (At time of Study)

LEGEND: P = Principal Responsibility S = Secondary Responsibility

REGION COUNTRY	PARTICIPANT	WHERE EMPLOYED								TYPE OF WORK RESPONSIBILITY							REMARKS	
		WATER AUTHORITY	MINISTRY PUBLIC WORKS	MINISTRY PUBLIC HEALTH	MUNICIPALITY	PRIVATE SAN.ENG.FIRM	BANK	UNIVERSITY	OTHER NON.SAN.ENG.	PLANNING ADMINISTRATION	DESIGN	OPERATION	QUALITY CONTROL	TEACHING	RESEARCH	OTHER		
<u>SOUTH ASIA</u> <u>FAR EAST</u>																		
PAKISTAN(W)	Nagi		X															Maintenance
	Soomro	X																
PHILIPPINES	Ayson	X							P	S								
	Corpus	X								P	2							
	Diaz			X						P	2							
	Florendo	X							P	S								
	Argente	X							P	S								
TAIWAN	Chen, Ta-Ko		X															Unassigned
	Kuo		X						S	P								
	Chen, Yao-Nan		X						P	S								
	Liu		X						S	P'								
	Tseng		X						P	S								
THAILAND	Boonsong			X										P				Short course

STATUS OF PARTICIPANTS (At time of Study)

LEGEND: P = Principal Responsibility S = Secondary Responsibility

REGION COUNTRY	PARTICIPANT	WHERE EMPLOYED								TYPE OF WORK RESPONSIBILITY						REMARKS	
		WATER AUTHORITY	MINISTRY PUBLIC WORKS	MINISTRY PUBLIC HEALTH	MUNICIPALITY	PRIVATE SAN. ENG. FIRM	BANK	UNIVERSITY	OTHER NON. SAN. ENG.	PLANNING ADMINISTRATION	DESIGN	OPERATION	QUALITY CONTROL	TEACHING	RESEARCH		OTHER
<u>SOUTH ASIA</u> <u>FAR EAST</u>																	
THAILAND	Thira		X							P	S						
VIETNAM	Tho		X							P				S			Sanitary engineering
	Vang		X								P						
	Vien		X							P							
	Tu		X											1			
<u>AFRICA</u>			2	4		1			1	P-2 S-3	P-5 S-2	S-3	S-2				
GHANA	Addison		X							P	S						
	Quaye		X							S	P						
NIGERIA	Johnson																Left country
	Obodoechina			X													Could not be reached
	Adeyemi					X				S	P						
	Agboola			X							P	S	S				
	Ojo			X						S	P	S					
	Omolegbe			X							P	S	S				

STATUS OF PARTICIPANTS (At time of Study)

LEGEND: P = Principal Responsibility

S = Secondary Responsibility

REGION COUNTRY	PARTICIPANT	WHERE EMPLOYED								TYPE OF WORK RESPONSIBILITY							REMARKS
		WATER AUTHORITY	MINISTRY PUBLIC WORKS	MINISTRY PUBLIC HEALTH	MUNICIPALITY	PRIVATE SAN. ENG. FIRM	BANK	UNIVERSITY	OTHER NON-SAN. ENG.	PLANNING ADMINISTRATION	DESIGN	OPERATION	QUALITY CONTROL	TEACHING	RESEARCH	OTHER	
NIGERIA	Osobamiro								X	P	S						Highway Division
NEAR EAST		5								P-3 S-1	P-2 S-2	S-1					Could not be reached
TURKEY	Gurgul	X					1			S	P						
	Arapoglu	X								P	S	S					
	Aygen	X								P	S						
	Isleyen	X								P	S						
	Takoaglu						X			P	S						Iller Bank-funding and designing waterworks
	Unal	X								P							
TOTALS		16	17	6	1	4	2	3	4	P-23 S-7	P-18 S-16	P-0 S-10	P-0 S-3	P-4 S-5	P-0 S-1	P-3 S-0	

SUMMARY OF PARTICIPANT INTERVIEWS

REGION COUNTRY PARTICIPANT	PRESENT TITLE OF PARTICIPANT	PREV. DEGREE DATE	IPSED SESSION DATE	PARTICIPANT COMMENTS					
				FINAL NOTICE	PHASE I	PHASE II	PHASE III	IMPORTANCE OF DEGREE	OTHER
<u>LATIN AMERICA & CARIBBEAN</u>									
<u>BOLIVIA</u>									
Parada, Pedro A.	Director Corpaguas	1945	2nd 9/63	15 days	Too short. Practical problems useful. Weak on admin. pract.	Very helpful. Adapted much to his work.	Good experience. Followed project from start to const. Adapted.	Not mentioned.	Responsible for nationwide water prog.- admin. & tech.
Guerrero, Col. Carlos	Chief, National Civic Action Prog.	cert/S.E. 1959	5th 2/65		Treatment plant design & admin. pract. Most useful.	Week spent on admin. pract. most useful.	Participated in design, super. of const. Useful.	Not mentioned.	Suggested participation in work on small systems.
Tejerina, Hugo	Chief, Dist. Syst. Section, SAMADA, LaPaz System.	B.S.C.E. 1962	6th 9/65		Too short. Gndwater & pumps best. Should strengthen sewers.	Little direct contact with oper., admin.	Excellent experience. Applying much he did and observed.	Not mentioned.	Teaches 2 S.E. courses at Univ. using ITSEP material & experience
Peña, Mario	(not in LaPaz - could not reach.)								
<u>BRAZIL</u>									
De Mendonca, Francisco	In charge of trng. Min. P.H. St. MINAS GERAIS	1958 M.S.S.E.	1st 2/63		Enlarged his capacity in water plant design.	Already had exp.- extended in this phase.	Most of time on water design. Satisfied though could be better.	Not mentioned.	Head of Dept. interested in sending other candidates.
Nassar, Nilo L.	Prof. Environ. Sanit. Fed. Univ. of GOIAS	1997 M.S.S.E.	4th 9/63		Good gnd water course economic considerations useful.	Lacked direct participation. Length O.K.	Obs. of const good. Felt not useful to him. Poor experience.	Not mentioned.	Interested in air pollution control. Formerly used design.
Doria, Alir	Tech. Director-Private Water Supply, waste consultant.	1957 S.E.	6th 9/65		Wanted more applied design. Stress adaptation to situation.	Omitted.	Suggest assign as employce & pay. Best results for all.	Not mentioned.	Divide class into groups by experience for homogeneity.
Silva, Marina	Eng. in charge of bldg. maint. Min. P.H.	1960 P.H.E.	6th 9/65		Too short. Good program.	Excellent experience.	Poor experience - filled firm's needs. Not hers.	Not mentioned.	Not using her trng. Should change offices for mutual good.
De Mello, Enrique	Asst. Chief, Special Plans Sect. - Guenabara Water Co.	1964 C.E.	7th 9/66	3 days	Need oport. to study special problems. Planning weak. Need public relations.	Excellent experience. What he wanted.	Got all aspects, well-satisfied, good balance t. & p.	Not mentioned.	Took special computer course. Suggest highly special course.
Pereira, Barbosa	Coordinator-S. Brazil Nat. Housing Bank	1964 P.G.S.E.	7th 9/66		Pract application best part. Need more on planning, water res.	Worked on actual operation, lab. good.	Need well-planned prog. before arrival at off. Experience good.	Not mentioned.	Has held number of highly responsible positions.

REGION COUNTRY PARTICIPANT	PRESENT TITLE OF PARTICIPANT	PREVIOUS DEGREE DATE	IPSED SESSION DATE	PARTICIPANT COMMENTS					
				FINAL NOTICE	PHASE I	PHASE II	PHASE III	IMPORTANCE OF DEGREE	OTHER
LATIN AMERICA (Cont'd)									
COLOMBIA									
Garcia, Eduardo	Dep. Manager Pre-mix Conc. Co	1952 M.S.S.E.	1st 2/63		Need more admin and economics. Too many short lectures. Level low.	Felt like intruder. Wanted to participate.	Part of team. Excellent experience. Saw actual applic. of principles.	Not mentioned.	Formerly tech. sub-director INSFOPAL. Left to go into private business.
Peña, Luciano	Prof. San. Eng. Univ. del Valle	1946 M.S.S.E.	10th 9/68		Lengthen course, add san. chem. Course well planned. Visits good.	Program planned specially for part.	Program planned specially for participants-professor.	Not mentioned.	Suggest special program for teachers, adapt present program.
Rivers, Mauricio A.	Tech. Subdirector Nat. Inst. Munic. Dev.	1964 M.S.S.E.	11th 9/69		This part less important. Ground water too theoretical. Administration weak.	Preventive maint. adapted to INEFOPAL.	Applied course theory to actual situation.	Not mentioned.	Need more on equip. selection, op. and maint. Liaison needed IPSED
COSTA RICA									
Fabian, Walter	Chief Const. Section Min. Public Health	1960 C.E.	2nd 9/63		Too short, very good. Sewerage weak. Good intro. to planning, admin.	Participated in all op. maint., admin., finance.	One of staff. Half water, half sewer. Has applied ideas and principle.	Not mentioned.	Wants regular contact with IPSED, info. on latest publications.
HONDURAS									
Moncada, Luis A.	Asst. Dir., San Pedro Suca; member consortium.	1963 S.E.	11th 9/69		Make groundwater more practical; more sewerage. Planning most used.	Well satisfied with this phase.	Because of experience 2 mo. was sufficient for him.	Not mentioned.	Program helped mature him professionally. Public Rel. imp.
JAMAICA									
Beckford, Horace L.	Partner, San. Eng. Consulting Firm.	1960 C.E.	2nd 9/63		Very good. Sewage weak. Need water qual. lab.	Worked in lab. Obs. admin., rates, const.	Not too useful. Plants too large. Too long. Saw some management.	Not mentioned.	Assign time for supervised design on developing country project.
Hemming, Vincent E.	Dep. Ch. Eng. Nat. Water Authority	1963 C.E.	2nd 9/63		Helpful, good. water good. Admin., econ., qual. cont. weak.	Excellent, has adapted much to NWA.	Part of staff, excellent. Worked in all aspects admin. to design.	Wants to return for degree.	Suggest add. course of microbio and chem; develop more adv. course.

REGION COUNTRY PARTICIPANT	PRESENT TITLE OF PARTICIPANT	PREVIOUS DEGREE DATE	IPSED SESSION DATE	PARTICIPANT COMMENTS					
				FINAL NOTICE	PHASE I	PHASE II	PHASE III	IMPORTANCE OF DEGREE	OTHER
LATIN AMERICA (Cont'd)									
PERU									
De la Fuente, Emilio Atala, Raul E. Campos, Oscar V.)	Not in Peru		4th 9th 9th						
Navarro, Augusto A.	Exec. Sec. - Univ. of Eng. Peru	1957 M.S.S.E.	4th 9/64		Too short. All parts useful to him. Gnd. w. good. Admin. weak.	Interesting and valuable.	Beneficial experience. Became acquainted with off. practice and proj.	Not mentioned.	Invite prof. from develop. countries to bring pract. prob.
Bracale, Leopoldo	Self-employed on farm	1966 B.S.C.E.	9th 9/67		Hyd. not enough application. Course easy. Sewage most interest.	Omitted.	Observed operation and admin. NSF - possibility for Peru.	Not mentioned.	Taught at Univ., research. Left to go into farming.
SOUTH ASIA-FAR EAST									
PAKISTAN (WEST)									
Husain, Syed	Asst. Eng.-P.H. Eng. Div. Comm. & P.W. Dept.	1955 E.S.C.E.	6th 9/65		Course easy, valuable. Sewage neglected all phases.	Good exposure all phases incl. lab.	Worthwhile exp., little supervision.	Preferred degree.	Degree provides eligibility for two increments in salary.
Ehokhar, Muhammad S.	Senior Eng. Comm. & P.W. Dept.-Prov. Sind	1953 C.E.	6th 9/65		Limited usefulness. Sewage weak. Need degree for incentive.	Too long. Could have acquired knowledge 10 days.	Disappointing-did not structure for him. Should be on payroll.	Preferred opp. to get M.Sc.	Degree does not give automatic change, worth two increments.
Khan, Mohammad N.	Exec. Eng. & Asst. Dir. Off., Roads, Bldg., and P.W.	1960 B.S.C.E.	7th 9/66		Too short. Need degree for incentive.	Valuable broad exp.	Enjoyed assignment. Was kept busy. Design work not app. his country.	Would have liked to work for degree	Has received one promotion from asst. to exec. eng.
Hagi, Mirajuddin	Exec. Eng. Dept. P.H. Eng., Punjab Prov.	1960 B.S.C.E.	7th 9/66	7 days	Course did not challenge him.	Adequate exp. to all phases. W. & S.	Most of his time on hyd. calculations.	Prefer full acad. yr. leading to degree.	Given immediate promotion from asst. to exec. eng.
Socorro, Abdul W.	Asst. Eng.-P.H. Div. Comm. & P.W. Dept., Sind	1960 B.S.C.E.	11th 9/69	3 wks. late	Sewage weak.	This and Phase III best part of IPSED.	Enthusied by exp. with Ohio State Bd. Health-variety of exp.	Needs degree to be eligible for prom.	Frustrated by lack of promotion and non-application of training.

SERIES PRIMARY PARTICIPANT	PRESENT TITLE OF PARTICIPANT	PREVIOUS DEGREE DATE	I/SED SESSION DATE	PARTICIPANT COMMENTS					
				FINAL NOTICE	PHASE I	PHASE II	PHASE III	IMPORTANCE OF DEGREE	OTHER
SOUTH ASIA-FAR EAST (Cont'd)									
PHILIPPINES									
Ayson, Jr., Benigno C.	Senior Civil Eng.- N JA	1956 B.S.C.	9th 9/67		Sewerage content slighted.	Omitted.	Not happy with this experience. Shunted off on routine work.	Prefers full year leading to M.Sc.	Working on master sewage plan for Manila.
Corpus, Euseo P.	Chief of Sect.-Water Wks Mains Ext.	1952 B.S.C.E.	9th 9/67		Same.	Omitted.	Same.	Same.	Until 1969 on master plan sewerage for Manila.
Diaz, Antoliano C.	Senior San.Eng.-Reg. Off. in Iloilo - Min. P.H.	1951 B.S.S.E.	9th 9/67		Has done some design work based on course material.	Omitted.	Enthusiastic about assignment with Ohio Bd. Health. Worked with staff.	Would have preferred degree prg.	Member of Assoc. of P.H. Eng. of Phil. Feels isolated in Iloilo.
Florendo, Reynaldo A.	Senior Eng. NWSA	1962 B.S.C.E.	9th 9/67			Omitted.	No comment.	Not mentioned.	
Argente, Tomás V.	Act. Prov. Manager- NWSA		10th 9/68					Would have preferred longer acad. degree.	Questioned why UNC requires 21 mo. for M.Sc. degree.
TAIWAN									
Chen, Ta-K	(Not in Taiwan)		9th						
Kuo, Philip P.F.	Chief, Water Supply Plan., Taiwan P.W. Bureau	1956 B.S.C.E.	4th 9/64		Too short. Wanted more on industrial waste.	Least valuable. Wanted sewerage not water.	Most valuable part of program.	Not mentioned.	Slated for early pro- motion Chief Sewerage Sec. Teaches.
Chen, Yao-Man	Chief, Water Supply Div., Taiwan P.W. Bureau	1953 B.S.C.E.	7th 9/66		Orientation excellent. Wanted more on finance, management.	Least valuable part.	No comment.	Not con- cerned by lack of degree.	Would have welcomed chance to learn more English.
Liu, Yen-Min	Asst. Leader-South Field Corps-S.E.Div.	1953 C.E.	9th 9/67	Too short.	Not long enough. Add time for English study.	Could be shortened.	Most valuable part of program.	Not mentioned.	
Tseng, Jen-Chei	Chief, Design Sect. Water Supply Div.	1959 B.S.C.E.	9th 9/67				Profited much from this phase.		Would have preferred option of transfer- ring to MSc program.

REGION COUNTRY PARTICIPANT	PRESENT TITLE OF PARTICIPANT	PREVIOUS DEGREE DATE	IFSED SESSION DATE	FINAL NOTICE	PARTICIPANT COMMENTS				
					PHASE I	PHASE II	PHASE III	IMPORTANCE OF DEGREE	OTHER
AFRICA (Cont'd)									
NIGERIA (Cont'd)									
Adeyemi, Benjamin	Partner, San.Eng. aspects of Eng.Firm	1958 C.E.	5th 2/65		Gnd.water least use- ful. Need more sewage and poll. control.	No comment.	Fortunate to work with engineers on Nigerian Water Proj. Good exp.	Degree not necessary.	Program most benefi- cial. Helped him in his growth and development.
Agbcola, Sylvester	Water Eng., Min. of Works & Survey, Ilorin	1968 B.S.C.E	11th 9/69		Planning useful, more on S.E. design. Gnd. wtr. too theoretical.	Right length. Good monitor water quality.	Most valuable but too short. Would have pre- ferred all on water supply. No imp. const.	Degree pref- erable but got much anyway.	Liked program sequenc Suggest 2 yr with 1 yr more Phase III, paid.
Ojo, Emmanuel A.	Principal Design Eng. Corp. of Ibadan	M.S.Hy.	2nd 9/63		Short. Design & Plan- ning best. Need more depth, exams more serious.	About right length.	Had 5 yrs. exp. so this phase less important. Had better understand- ing.	Not mentioned.	Suggest add computer training- sanit. microbio. and chem. Took night course.
Odelegbe, Gabriel	Water Eng., Min. of Works & Survey, Ilorin	1963 B.S.En.	11th 9/69		Gnd. water too theo- retical. Planning good & useful. Length O.K.	Right length to get overview.	Good experience, suggest use for other participants.	Degree pref- erable but got much anyway.	Program of much value built up his confi- dence, broadened view.
Okun-iro, Samuel	Supt. Eng. on high- ways and bridges.	1957 B.Sc.	7th 9/66		Courses well balanced. Should be expanded to other environment phases.	Enjoyed this phase, important and right length.	Met his needs very well. Learned much in design practices.	Not mentioned.	All of group men- tioned difficulty to live with stipend paid participants.
NEAR EAST									
TURKEY									
Gurral, Zekai Arasoglu, Halil	(Could not be reached) Chief Eng. Section DSI in Ankara	1962 C.E.	11th 9/69		Planning most useful. Hyd. structures least. Should stress design.	Three weeks long enough.	Took 2nd semester of design instead of Phase III.	Not mentioned.	Exp. of considerable benefit. Need more emphasis on equip. selection.

REGION COUNTRY PARTICIPANT	PRESENT TITLE OF PARTICIPANT	PREVIOUS DEGREE DATE	IPSED SESSION DATE	PARTICIPANT COMMENTS					
				FINAL NOTICE	PHASE I	PHASE II	PHASE III	IMPORTANCE OF DEGREE	OTHER
NEAR EAST (Cont'd)									
TURKEY (Cont'd)									
Aygen, M. Zeki	Reg. Director YSE Kayseri Region		5th 2/65		1½ mo. after U. of Oklahoma. Practical good exp. after M.S.	Omitted.	Omitted.	Not mentioned.	IPSED good as follow up after university degree program.
Isleyen, Yuksel	Chief Designer, Asst. Hd. Reg. Off. DSI	1965 M.S.S.E.	5th 2/65		Only 3 wks., repeti- tious of U. of Okla- homa, not rewarding.	2 wks. valuable experience.	Omitted.	Course should grant degree.	Spent short time at IPSED after Master's program at Oklahoma.
Takoaglu, Ahmet	Head, Planning, Train- ing, Coord. Dept. Iller Bank	1949 C.E.	6th 9/65		Need more on sewers, theory and practice. Course useful.	Omitted.	Most useful. Need more on super. of const. Feasibility studies good.	Not mentioned.	Acquired confidence in design methods. Suggests IPSED for others.
Unal, Sacit Oguz	Assist. Chief, Plan- ning & Survey Dept. YSE.		1st 2/63		Program very good. Field trips helpful. Courses useful.	Length right. Water and sewers beneficial.	Because no opp. to work was transferred for better exp.	Master's degree imp. Pract. good.	Should stress simple const. and oper. during academic phase.

BIOGRAPHICAL SKETCHES OF CONSULTANTS FOR STUDY

EDWARD J. CLEARY

Edward J. Cleary has been engaged in the administrative aspects of environmental engineering for some 35 years, notably in matters relating to water resources development.

For more than half this period he served as executive director and chief engineer of the Ohio River Valley Water Sanitation Commission (ORSANCO), which is a regional agency established by eight states. He resigned from this post in 1967 to engage in consulting work and to accept a faculty appointment in the department of environmental health of the University of Cincinnati.

Currently he is chairman of the water-quality management committee of the National Academy of Engineering. He has served as a consultant to the International Bank for Reconstruction and Development, the World Health Organization, the Federal Republic of West Germany and the United States National Water Commission.

He is also a member of the Board of Directors of Resources for the Future, Inc., and past-president of the American Public Works Association.

Mr. Cleary is a graduate of Rutgers University in New Jersey where he received degrees in civil and sanitary engineering and a doctorate in science.

GEORGE P. HANNA, JR.

George P. Hanna, Jr. has worked in several areas of the civil and sanitary engineering fields since 1942 when he started with the U.S. Army Engineers as Assistant Engineer and separated from active duty as a Captain in 1946. This was followed by 4 years with consulting engineering firms and 2 years as Sanitary Engineer and Director of the Bureau of Sanitation of the Syracuse, New York Department of Health. While in the latter position he also served as Assistant Professor at Syracuse University instructing sanitary engineering and fluid mechanics courses.

In 1954 he went to Venezuela for 5 years with an oil company, with responsibility for design and supervision of construction and maintenance of utilities, structures and harbor facilities.

Since his return to the United States in 1959 he has devoted himself to the teaching, research and administrative aspects of sanitary engineering and water resources at the university level. He was Professor and Director of the Water Resources Center of the Ohio State University for 10 years and then transferred to the University of Nebraska as Professor and Chairman of the Civil Engineering Department. Early this year he was appointed Interim Dean of the College of Engineering and Architecture at the same University.

His recent research interests have been in acid mine damage activities; toxicity of heavy metals to biological treatment process; coagulation studies; symbiotic algal-bacterial studies; wastewater treatment procedures. He has published extensively on these and other subjects.

Mr. Hanna received his civil engineering degree from the Illinois Institute of Technology; his masters in civil engineering (sanitary) from New York University and doctorate in environmental science from the University of Cincinnati.

JOHN A. LOGAN

John A. Logan, President of Rose-Hulman Institute of Technology, has held this position since 1962 when he relinquished the chairmanship of the Department of Civil Engineering at Northwestern University, Evanston, Illinois. As Chief Administrative Officer at Rose he is responsible for all phases of its academic, fiscal and physical development. Since graduation from the University of Saskatchewan (B.Sc. 1929), Dr. Logan has devoted his time between teaching, public service and private practice. Further formal education includes a B.Eng. at the University of Saskatchewan (1934), M.Sc. Harvard (1935), and a D.Sc. degree, under Gordon Fair's direction, from Harvard in 1942. He was awarded an honorary D.Sc. from Indiana State University in 1964 and an honorary LL.D. from Wabash College in 1970.

His special interest has been the development of a rational approach to the conservation and control of man's environment. Overseas assignments have sharpened this concern, and include service with the United States Army in Brazil as Chief Engineer of the Amazon Valley Project. Eight years with the International Health Division of the Rockefeller Foundation in Europe and Africa, and consulting assignments for the State Department in Libya, Indonesia and Peru have helped to develop an appreciation of the inter-relationships between man and his environment, and a firm conviction that civil engineers, with a broad understanding of their professional responsibilities, should provide leadership in making the world a more attractive, convenient and healthy place to live.

Teaching assignments include Iowa State College, the University of Missouri and Northwestern University; private practice with Greeley and Hansen in Chicago and Russell and Axon in St. Louis. He has served on World Health Organization Expert Committees on Environmental Health,

JOHN A. LOGAN

Engineering, Education, Metropolitan Planning, Malaria Eradication and Quarantine. He was a member of the USPHS Gross Committee on Environmental Health, Chairman of the 1963 Engineering Foundation Research Conference on Urban Transportation, the Surgeon General's Committee on Urban Health Planning and Chairman of the National Academy of Sciences Committee reviewing Corps of Engineers Research Programs. He is currently serving on the Surgeon General's National Advisory Disease Prevention and Environmental Control Council. A Fellow of ASCE and of APHA, a member of APWA and of Tau Beta Pi, he is one of the few United States members of the Institution of Civil Engineers (London), the oldest professional engineering society in the World. He is also a member of the National Academy of Engineering.

CHARLES S. PINEO

Charles S. Pineo has been involved in the international sanitary engineering field for nearly 30 years, starting with the Institute of Inter-American Affairs (predecessor Agency of A.I.D.) in 1942, a year after it was established. He served as engineering advisor with that Agency in Costa Rica, Mexico, Peru and Honduras until 1954 when he was assigned as Chief of the U.S. Public Health Mission in Costa Rica. From 1961 through 1964 he was in charge of the worldwide community water supply office of the Agency in Washington. During this period he played a major role in the development of the Regional Graduate School in Sanitary Engineering at the University of San Carlos in Guatemala; the course in Engineering Management of Water Supply Systems at the University of Akron, Ohio; and the International Program in Sanitary Engineering Design at the University of North Carolina.

Following retirement from A.I.D. in 1964 he spent 5 years as sanitary engineering consultant with the Pan American Health Organization which published his "Community Water Supply and Sewage Disposal Programs in Latin America and Caribbean Countries" in 1969.

At the present time he is serving as short term consultant for the Pan American Health Organization, the World Health Organization and the Agency for International Development.

Mr. Pineo did his undergraduate work in civil engineering at Worcester Polytechnic Institute in Worcester, Massachusetts, and his graduate work in sanitary engineering at Harvard University in Cambridge, Massachusetts.