

DEPARTMENT OF ENVIRONMENTAL SCIENCES AND ENGINEERING

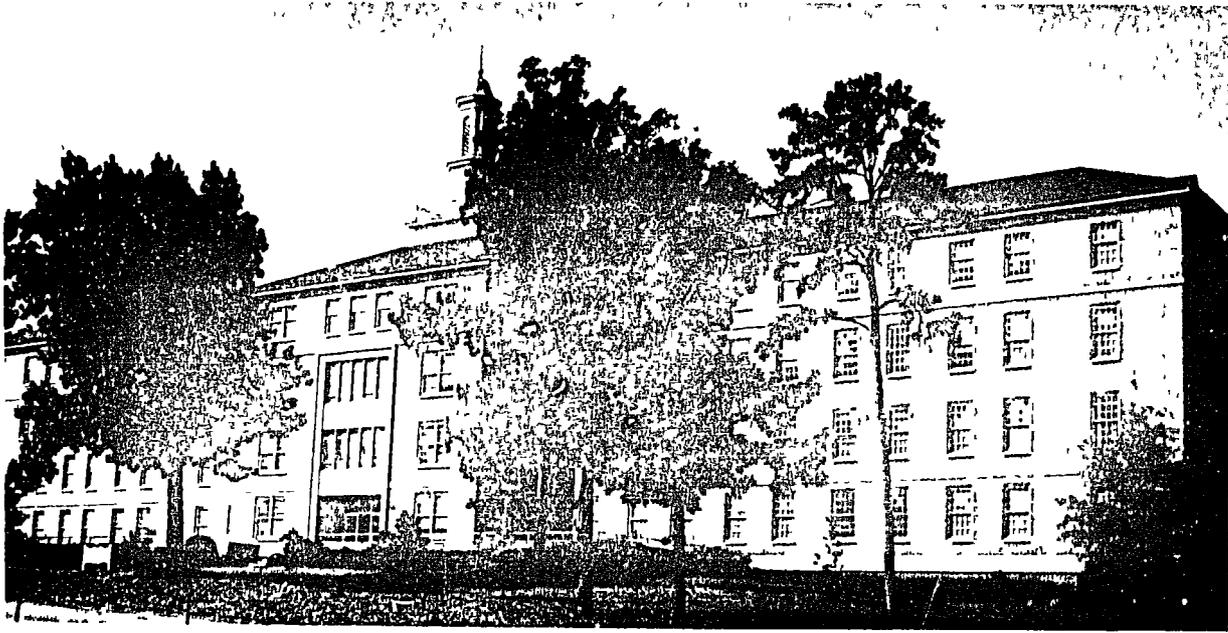
School of Public Health
University of North Carolina
Chapel Hill, North Carolina

REPORT ON THE FIFTH AND SIXTH SESSIONS
OF THE
INTERNATIONAL PROGRAM IN SANITARY ENGINEERING DESIGN

Prepared for

Agency for International Development
Department of State
Washington, D. C.

March 1967



School of Public Health
University of North Carolina at Chapel Hill

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March 15, 1967

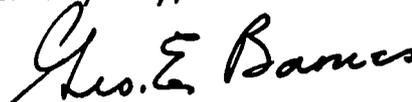
Mr. Arthur Holloway, Acting Chief
Community Water Supply Section
Health Service, TCR
Department of State
Agency for International Development
Washington, D. C. 20523

Dear Sir:

In accordance with our Contract AID/csd-718, we are pleased to submit herewith our report on the Fifth and Sixth Sessions of the International Program in Sanitary Engineering Design. We wish to thank you and your predecessors for your cooperation and support in all aspects of this important work.

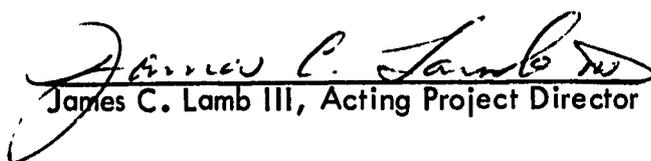
We remain,

Yours very truly,



George E. Barnes
Professor of Sanitary Engineering

Approved:



James C. Lamb III, Acting Project Director

PREAMBLE

The need for more water for more people in developing countries is recognized as a basic one. In fact, meeting this need is prerequisite to all other forms of betterment, whether directed to health, social, or economic improvement. The urgency for providing suitable water supply and sanitation facilities is perhaps too obvious to call for prolonged discussion here, and it is more to the point in this preamble to indicate how a specific program has been established and operated to help in the planning and execution of water supply and related projects in developing countries by training engineers for the work in a way not hitherto attempted.

This program, the International Program in Sanitary Engineering Design (IPSED), has been in operation since 1962. In view of increasing interest in the program and the experience that has been gained in it, it seems appropriate in writing this report to review the basic concepts which led to its establishment as well as to summarize briefly its accomplishments.

The technical problems associated with the conception, design, execution, and operation of water supply and sanitation projects are inevitably delegated to the engineer for proper solution. Within engineering are many specializations; however, historically and practically, the overall technical responsibility in this type of work has been that of the civil engineer and, more recently, that of the sanitary engineer.

Most of the developing countries cannot provide educational programs for the preparation of this small but important group of sanitary engineering leaders. Traditionally, the relatively few persons in each country who are selected for these leadership roles have been sent abroad for the necessary study, many of them attending schools in the United States or in Europe. Sometimes this has worked out very well; at others, certain shortcomings in the arrangement have led to less than satisfactory results.

The most troublesome factors encountered with prevailing programs for study abroad stem from the radical differences which may exist between the climatic, socio-economic, and technological conditions in the student's home country and those in the country where his education is secured. There may be great disparity in monetary resources, in the nature of the labor to be used in the work, in the absence of manufactured products and the necessity of importing material, and in habits, attitudes, and traditions generally. All of these factors are intimately related to design. In the United States, for example, most academic programs leading to the M.S. or Ph.D. sanitary engineering degrees are necessarily oriented to conditions prevailing in this country because most of our students originate here and will practice here throughout their careers. Accordingly, much of the technology which is taught, especially in the realm of design, is appropriate primarily for application in this country. A foreign student completing such a program and returning to his homeland usually is confronted with the fact that much of his hard earned knowledge would be impractical for direct application under the local circumstances prevailing there. In some instances, the individual views this as a challenge and uses his formal education as a foundation on which to build new technological concepts for developing solutions more appropriate for the local conditions. Obviously, however, much of the effort and expense

of obtaining his education is less effective than it might have been, had the program been tailored more closely to his own specific needs. In other instances, the reaction is much less favorable and leads to increased frustration because of the incompatibility between his educational background and needs of his country. Sometimes, the end result may be an attempt to transfer experience or knowledge not at all appropriate. This in turn, if carried to completion, may lead to most undesirable consequences.

The newly graduated sanitary engineer entering practice within the United States generally must serve an internship of at least four years before he is considered qualified to do independent design work. Because of the many excellent design offices in this country, opportunities for professional growth under the guidance of competent men are abundant. Unfortunately, however, such opportunities are sometimes limited or absent in developing countries. To compensate in part for this lack of opportunity for the engineer's normal professional development, the International Program in Sanitary Engineering Design, in addition to its intensive academic phase, arranges for each participant to receive on-the-job practical experience in first rate municipal and consulting engineering organizations, under continued University supervision, during his stay in the United States. Perhaps as important to each participant as his engineering training is this direct exposure to American engineering organization and procedures.

In the United States, the tendency in water and wastes treatment plant design has been, over the years, to supplant rather simple processes and treatment devices, generally characterized by relatively high investment but low operating charges, by more compact and highly mechanized and instrumented processes and structures, sometimes lower in first cost but higher in operating charges. Overall economy is possible because of the labor saving devices which are incorporated. On the other hand, in developing countries, common labor is cheap and plentiful. More appropriate under such conditions are the simpler concepts of plants more readily constructed and operated with unskilled labor, and not highly mechanized. While generalizations are difficult to make categorically, it is nevertheless obvious that engineering design, construction, and operations in developing countries are not likely to be of the same character as one finds in the more highly developed countries of the United States and Europe.

With all of the preceding considerations in mind, the International Program in Sanitary Engineering Design was established as a unique educational venture, staffed, equipped and planned for specific ends, quite distinct from the ordinary graduate program of study in a university, and in conformity with objectives indicated in the preceding brief discussion. The report which follows describes in some detail the participants from developing countries and what work they do. The reader will note the unique combination of educational discipline and professional internship which has been working so successfully in this program.

Another problem associated with study abroad is that sometimes the engineer is tempted to stay abroad, and so the investment in his education is lost to his home country. In the International Program in Sanitary Engineering Design, commitment and orientation is such that all participants, after completing the program, have returned as intended, to do the work needed at home.

For a more comprehensive statement relative to what has been set forth in this preamble, the reader is referred to Appendix J. Appendix J is a reproduction of a paper on this topic submitted to the International Water for Peace Conference to be held in Washington, D. C. during the spring of 1967.

REPORT

REPORT ON THE FIFTH AND SIXTH SESSIONS OF
THE INTERNATIONAL PROGRAM IN SANITARY ENGINEERING DESIGN

SECTION I - GENERAL

1. Authority: The work herein reported has been carried out under the provisions of Contract AID/csd-718 and amendments, between the U. S. Department of State and the University of North Carolina. The contract is an extension of and supersedes the earlier Contract AID/csd-362.
2. The International Program in Sanitary Engineering Design: The International Program in Sanitary Engineering Design (IPSED) came into existence under this Contract in 1962. The program was a joint conception of (1) the Department of Environmental Sciences and Engineering of the School of Public Health, University of North Carolina at Chapel Hill, and (2) the Agency for International Development of the U. S. Department of State, as part of the latter's global water supply program.

The contract as amended in accordance with Paragraph 1 contemplates work which may be divided into four categories. These are (1) engineering training, (2) investigations, (3) publications, and (4) export of engineering training to foreign countries. The major category is (1), and in this category we have had six successive groups of foreign engineers who have completed the training program up to and including the present writing. Work in the latter three categories was more recently initiated and will be discussed in subsequent reports. The engineering training program itself encompasses the following:

- (a) academic phase: a curriculum is set up for a twelve-week course of both refresher and new material in such categories as hydraulics, chemistry, pumps and treatment plant equipment, hydrology, treatment processes for water and sewage, etc. Much of the material is written for the course and issued to participants for reference, together with reprints of technical articles, manufacturers' bulletins, handbooks, and the like, so that the participant has a wealth of material to keep for future reference. In general, mornings are devoted to classes and lectures and afternoons to problem work and design. One day or one afternoon per week a field trip is made to a waterworks or sewage treatment plant, generally within North Carolina, a state which is well supplied with excellent municipal utilities of this character. At the end of the course the participant will have worked out and submitted a project design. Since the groups are limited in size (twelve men or less), individual attention is given in the work.
- (b) field trips during academic phase: field trips as mentioned above have been made at various times to plants at Chapel Hill, Durham, Raleigh, Greensboro, Fayetteville, Siler City, Lumberton, Charlotte, Winston-Salem, High Point, and Asheville. Most trips are not to exceed one day's duration, although overnight trips have been made.

- (c) municipal phase: in the municipal phase, following the academic phase, the participants are assigned individually to various waterworks for operating experience to learn the intricacies of operating and sometimes of management problems. Most of the municipalities selected are within the State; at times, for special reasons, men have been sent as far afield as Philadelphia, the Hackensack Water Company, and Dayton, Ohio. A list of collaborating municipalities is given under Par. 6 (g).
- (d) consulting office (internship) phase: here again the participants are individually assigned to engineering offices for an internship period of about seven months ordinarily. These are selected with the participant's needs in mind, in relation to the work done in the indicated office; sometimes he will be working on projects which the firm is handling for the participant's home country. A list of collaborating engineering firms is given in Par. 5 (h).

Both in the municipal phase and in the design phase, the staff at UNC is in touch with the participant and his superiors, and monthly reports are received on his work. He is also visited during the stay at his place of work. He is not allowed to drift; every effort is to make his experience cumulatively worthwhile by keeping it under constant supervision.

- (e) corollary activities (professional and social): as part of their program, the participants are escorted by a member of the UNC staff to one national meeting of the major technical societies, both to listen to important papers and to enlarge their professional acquaintance. In the past, national meetings of the American Water Works Association, the Water Pollution Control Federation, and the American Society of Civil Engineers have been attended by participant groups. They have also attended some state and regional meetings of these societies closer to Chapel Hill, such as at Raleigh and Charlotte. On the social side, the UNC staff has been host to the various groups, all of which have been in the faculty homes on occasion for informal get-togethers. Perhaps even more attention has been given to married couples where men are accompanied by their wives, as has happened occasionally. Shopping trips have been arranged, as have attendance at church and participation in university student activities.

3. Qualifications and Support of Participants: Prospective participants must be graduate engineers with some practical experience. They must have competence in English, and must have authorization from home governments to be on leave of absence for the duration of the assignment period. They must have the recommendation of appropriate USA or WHO agencies. Following acceptance by the parties to this Contract, they come to this country for a nominal period of a calendar year, during which time they are paid living and travel expense or stipend. These stipends are financed by AID or by others who may offer scholarships for the purpose (see Par. 4).
4. Supporting Agencies: The agencies which have given scholarship and financial aid to participants include the Agency for International Development of the U. S. State Department, Pan American Health Organization of the World Health Organization, the World Health Organization itself, the Organization of American States, and the Ford Foundation.

5. Facilities for Conduct of the Program: Facilities for the conduct of the program include:

- (a) campus classroom: there is set aside for the exclusive use of the participant groups a classroom especially equipped for their convenience, with individual knee-hole office desks for each man. The room has visual aid equipment including projectors for motion pictures and slides and screen.
- (b) extra classrooms: on occasion, especially with guest lecturers who come to the program for selected topics on which they are particularly well known experts, a larger classroom is used and the regular graduate students (degree candidates) are invited to attend along with the participants.
- (c) office facilities and clerical: office facilities include a room usually occupied by one full-time and one half-time secretary, with complete files on all applicants, on all correspondence, and on all engineering firms or others associated with the work. A larger office is given over to the project coordinator, whose duties encompass transportation and housing arrangements for the participants and for those who instruct or otherwise take part in the Program. An adjoining office serves one person generally occupied with program routines.
- (d) shop and laboratory facilities are available and have been used for building special equipment for the Program.
- (e) car pool: frequent field trips for inspection of municipal treatment plants demand the use of cars from the University car pool, or from other sources such as chartered buses, on occasion.
- (f) lodging and transportation: participants are housed in one of the newer dormitories on campus. Married couples are found apartments, as provided for the University on campus, or in private homes if so desired. Participants are issued bicycles, if they so wish, for use around campus and in town.
- (g) collaborating municipalities: a number of municipalities, principally in North Carolina, have been most cooperative in receiving participants for experience at the local treatment plant, during their "municipal phase". Among these have been cities listed below:
North Carolina: Chapel Hill, Charlotte, Durham, Fayetteville, Greensboro, Raleigh, and Winston-Salem.
Dayton, Ohio; Hackensack, New Jersey; Hartford, Connecticut; Philadelphia, Pennsylvania; St. Louis, Missouri
- (h) collaborating consulting engineering offices for design phase: for taking participants during their design or engineering internship phase of the program, we are indebted to the following organizations, many of whom have collaborated in this phase of the program on more than one occasion:

Consulting Firms

Albright and Friel Philadelphia, Pa.	Gilbert Associates Reading, Pa.
Alexander Potter Associates New York, N. Y.	Greeley & Hansen Chicago, Ill.
Alvord, Burdick & Howson Chicago, Ill.	Havens & Emerson New York, N. Y.
Black & Veatch Kansas City, Mo.	Hazen and Sawyer New York, N. Y.
Brown & Caldwell San Francisco, Calif.	Horner & Shifrin St. Louis, Mo.
Buck, Seifert & Jost Englewood, N. J.	Jones, Henry & Williams Toledo, O.
Burgess & Niple Columbus, O.	Lalonde, Girouard & Letendre Montreal, Quebec
Camp, Dresser & McKee Boston, Mass.	McIcolm Pirnie Engineers New York, N. Y.
The Chester Engineers Pittsburgh, Pa.	Metcalf & Eddy Boston, Mass.
Engineering-Science, Inc. Arcadia, Calif.	O'Brien & Gere Syracuse, N. Y.
Gannett, Fleming, Corddry and Carpenter Harrisburg, Pa.	Whitman, Requardt & Associates Baltimore, Md.

6. Professional Staff: The following list includes those who have taken part either on a full-time basis or less than full time, in the instructional or academic phase of the program. Some of those listed at the University are predominantly occupied with IPSED activities, both during the sessions and in between sessions, to take care of all the minutiae of work associated with both planning and execution of the work.

(a) University faculty and staff:

George Eric Barnes, Professor of Sanitary Engineering, B.S.C.E., 1923 (Massachusetts Institute of Technology); C.E. (Hon.), 1935 (Case Institute of Technology); M. A., 1953 (Western Reserve University).

James Clement Brown, Associate Professor of Sanitary Engineering, B. S., 1949 (Illinois Institute of Technology); M.S., 1961 (Case Institute of Technology).

Emil Theodore Chanlett, Professor of Sanitary Engineering, B.S., 1937 (College of the City of New York); M.S.P.H., 1939 (Columbia); M.S.S.E., 1941 (University of North Carolina).

Richard Francis Cole, Instructor in Sanitary Engineering, B.S.C.E., 1959 (Drexel Institute of Technology); M.S.S.E., 1961, (Massachusetts Institute of Technology).

James Christian Lamb III, Professor of Sanitary Engineering, B.S.C.E., 1947 (Virginia Military Institute); M.S., 1948, S. E., 1952, Sc.D., 1953 (Massachusetts Institute of Technology).

Donald Thomas Lauria, Engineering Associate and Instructor in Sanitary Engineering. B.C.E., 1956 (Manhattan College); M.S.S.E., 1965 (Syracuse University).

Gerrit van Rooyen Marais, Engineering Associate and Instructor in Sanitary Engineering, Diploma in Mechanical Engineering, 1945-1950 (Uitenhage Technical College); B.Sc., Civil Engineering, 1952-1955 (University of Cape Town); M.Sc., 1957-1965 (University of Witwatersrand); Diploma of Imperial College (DIC), (University of London).

Frederick Eugene McJunkin, Engineering Associate and Instructor in Sanitary Engineering, B.C.E., 1955 (North Carolina State College); M.S.S.E., 1961 (University of North Carolina).

Daniel Alexander Okun, Professor of Sanitary Engineering, Head, Department of Environmental Sciences and Engineering, B.S.C.E., 1937 (Cooper Union); M.S. 1938 (California Institute of Technology); Sc.D., 1948 (Harvard University).
Director of IPSED Program.

Charles Manuel Weiss, Professor of Environmental Biology, B.S., 1939 (Rutgers University); Ph.D., 1950 (Johns Hopkins University).

- (b) guest lecturers: below is a list of individuals who have been invited to make presentations before the IPSED groups, on topics in which they are well-known experts:

<u>Name</u>	<u>Date and Subject</u>
E. R. Baumann Professor of Civil Engineering, Iowa State University Ames, Iowa	December 1, 1965 General Design Considerations for Sewerage Facilities
George Bruno Chicago Pump Co. Chicago, Ill.	December 8, 1965 Sewage Treatment Plant Equipment
Jorge Guzman Pan American Health Organization Washington, D. C.	November 1, 1965 International Finance
Joseph Haratani Agency for International Development Washington, D. C.	February 16, 1965 Water Supply Needs in Developing Countries

<u>Name</u>	<u>Date and Subject</u>
Richard V. Ford Ford Meter Box Company E. Haddonfield, N. J.	November 10, 1965 Low Cost Distribution Systems
Kenneth V. Hill Greeley and Hansen Chicago, Ill.	November 3, 1965 Project Organization and Execution
Robert D. Mitchell Malcolm Pirnie Engineers New York, N. Y.	October 4, 1965 Design of Dams
Joe L. Mogg Edward E. Johnson, Inc., Minneapolis, Minn.	October 10-18, 1965 Development of Ground Water and Well Supplies
Luis Orihuela World Health Organization Washington, D. C.	April 28, 1965 World Health Problems
Wm. M. Piatt Piatt, Davis & Associates Durham, N. C.	October 25, 1965 Sanitary Engineering Equipment and, November 17, 1965 Water Treatment Plants
Charles S. Pineo Pan American Health Organization Washington, D. C.	September 27, 1965 Community Water Supply Activities of International Agencies
M. E. Rogers Camp, Dresser & McKee Boston, Mass.	November 29, 1965 Plant Controls and Measuring Equipment

SECTION II - REPORT ON FIFTH SESSION

7. Participants: The Fifth Session of the International Program in Sanitary Engineering Design was held during the period February-October, 1965. There were five participants, from three different countries, as follows:

Name: Benjamin Omotunde Adeyemi (Sponsored by AID)
Age: 32
Home: Ministry of Works and Transport, Eleiyele, Ibadan, Nigeria
Family: Married (one child)
Education: University of Aberdeen, Scotland, degree in Civil Engineering, 1958.
Present Employer: Ministry of Works and Transport, Water Supply Distribution, Government of Western Nigeria.
Title: Area Water Engineer (Ibadan area)
Brief Job Description: Responsible for management of all the water supply in the Ibadan area, including construction of new schemes in the area.
Date of Entry to U.S.: September 7, 1964
Duration of Program: 12 months
Training Officer: Mr. George M. Powell

Name: Carlos Guerrero (Sponsored by AID)
Age: 39
Home: Calle Heroes del Acre 1762, La Paz, Bolivia
Family: Married (three children)
Education: Military Engineering School, B.S. degree in Civil Engineering, 1957. National University of Mexico City, certificate in Sanitary Engineering, 1959.
Present Employer: Community Water Supply - USAID, Occupational Health Institute, La Paz, Bolivia.
Title: Sub-Chief of the Engineering Division
Brief Job Description: Responsible for design, construction and organization of administrative groups for community water systems and supervision of project engineers.
Date of Entry to U.S.: October 30, 1964
Duration of Program: 12 months
Training Officer: Mr. Arthur Angel

Name: Tran Phuoc Tho (Sponsored by AID/PHS)
Age: 31
Home: 130 Tu Duc, Saigon, Vietnam
Family: Married (one child)
Education: Public Works School, diploma in Civil Engineering, 1958. University of Michigan. Graduate work in Sanitary Engineering - two semesters and one summer (1961).
Present Employer: National Water Supply Agency, Bui Luu Lan, 55 Pasteur, Saigon, Vietnam
Title: Chief of Municipal Water Supply Division
Brief Job Description: Chief of Division, in charge of design, construction and operation of all water supply facilities outside Saigon, also teacher at Public Works School.
Date of Entry to U.S.: January 24, 1965
Duration of Program: 12 months
Training Officer: Mr. J. James Bozek

Name: Nguyen Danh Vang (Sponsored by AID/PHS)
Age: 30
Home: 143/20 Nge Tung Chau, Gia Dinh, Vietnam
Family: Single
Education: Public Works School, certificate as public works technician, 1957. University of Minnesota (Minneapolis), November 1959 - August 1960 then practical training in Puerto Rico (San Juan) August 1960 - November 1960.
Present Employer: National Water Supply Agency, 55 Pasteur Street, Saigon, Vietnam
Title: Chief of Sub-division of Operation
Brief Job Description: Responsible for operation and maintenance of water systems.
Date of Entry to U.S.: January 24, 1965
Duration of Program: 12 months
Training Officer: Mr. J. James Bozek

Name: Nguyen Dinh Vien (Sponsored by AID)
Age: 26
Home: 271 Le Doi Hank Street, Cholon, Saigon, Vietnam
Family: Single
Education: College of Public Works Engineering of Phutho, degree in Civil Engineering, 1962.
Present Employer: Directorate of Water Supply, Public Works Department, 55 Pasteur Street, Saigon, Vietnam
Title: Assistant Chief of Planning and Design Service
Brief Job Description: Responsible for design and computation of concrete works.
Date of Entry to U.S.: January 24, 1965
Duration of Program: 12 months
Training Officer: Mr. J. James Bozek

In addition to the
during the time they were.

attended a portion of the program as observers
under assignments. These were:

Name: M. Zeki Aygen (Sponsored by AID)
Age: 31
Home: Aydinlik Evler, Seher Apt. No. 35/6
Kayseri, Turkey
Family: Single
Education: Istanbul Technical College, Civil Engineering, 1957, Oklahoma State
University (Stillwater) Sanitary and Public Health Engineer, M.S. 1965.
Present Employer: State Waterworks (DSI) Region 12
Title: Chief
Brief Job Description: Design and general supervision of construction and
maintenance of water supply systems.
Observer: Not undertaking full program.

Name: Yuksel Isleyen (Sponsored by AID)
Age: 30
Home: Cukur M. Barutluk cd. 2, Bursa, Turkey
Family: Married (one child)
Education: Istanbul Technical College, Civil Engineering 1959
Majoring in Construction, Oklahoma State University (Stillwater)
MSSE 1965.
Present Employer: State Waterworks (DSI)
Title: Chief Engineer
Brief Job Description: Design and supervision of construction of water supply systems.
Observer: Not undertaking full program.

Name: O. Perakyla (Sponsored by PAHO)
Age: 39
Home: Ollinvainiontic 4, Helsinki, Finland
Family: Married (four children)
Education: Technical University of Helsinki, Civil Engineering 1949.
Present Employer: Department of Agriculture, Helsinki
Title: Office Engineer
Brief Job Description: Technical and financial review water supply and sewage
projects.
Observer: Not undertaking full program.



Benjamin O. Adeyemi



Carlos Guerrero



Tran Phuoc Tho



Nguyen Danh Vang

Note: No photograph of Vien available.

PARTICIPANTS IN THE FIFTH SESSION OF THE INTERNATIONAL PROGRAM
IN SANITARY ENGINEERING DESIGN

8. Academic Program: After the usual week of orientation in which the participants were made familiar with the University and its activities, and after they had been housed and fairly well settled, the academic program of the session began on February 15, terminating May 7. The detailed curriculum, listing the lecturers, topics, and dates, will be found in Appendix C.

In the Department of Environmental Sciences and Engineering of UNC, Saturday morning seminars are held for faculty and graduate engineers. The IPSED participants are also free to attend these seminars. A list of subjects and speakers for the various seminars concurrent with the academic program of the Fifth Session is given in Appendix D.

9. Field Trips and Meetings Attended: During the academic session, as customary, field trips were made by the group to various waterworks and sewage treatment plants in North Carolina, to the number of about two every three weeks. Also, as will be shown, they were in attendance at several regional and national meetings of technical societies. The field trips included:

(a) field trips:

- February 18 - Winston-Salem, N. C. water and sewage treatment plants
- March 1 - Chapel Hill, N. C. water treatment plant
- March 16 - Chapel Hill, N. C. sewage treatment plant
- March 19 - Fayetteville, N. C. water and sewage treatment plants
- March 23 - Durham, N. C. water treatment plant
- April 1 - Greensboro, N. C. water and sewage treatment plants
- April 21 - Charlotte, N. C. water and sewage treatment plant and to Cowan's Falls Dam
- April 29 - Durham, N. C. sewage treatment plant

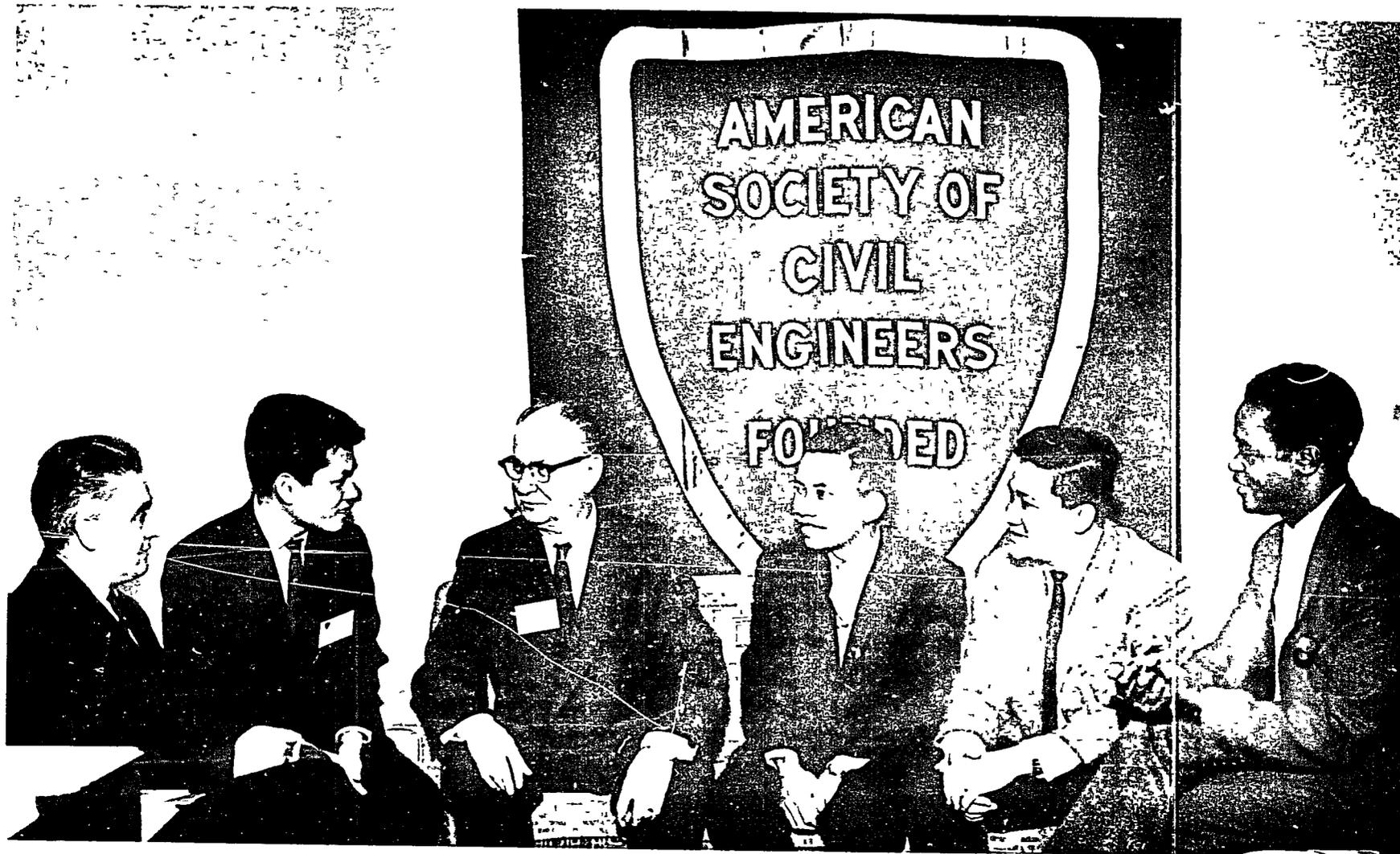
(b) meetings of technical or professional societies:

March 8-12 to Mobile, Alabama, in attendance at the National Water Resources Conference of the American Society of Civil Engineers. At the banquet, special note was made of attendance of these participants, and photographs of them were published in the local newspapers and the ASCE magazine, "Civil Engineering".

April 7-9 to St. Louis, Missouri, in attendance at the Missouri Section meeting of the American Water Works Association.

April 11-13 to Charlotte, North Carolina, attendance at the Meter Repair School.

April 14-16 attendance at the Fourteenth Southern Water Resources and Pollution Control Conference. This is held annually as a joint program of the University of North Carolina at Chapel Hill, the University of North Carolina at Raleigh, and Duke University. The place of meeting is rotated from year to year.



ATTENDANCE AT NATIONAL TECHNICAL SESSION

Participants at National Water Resources Meeting of the American Society of Civil Engineers, Mobile, Alabama, March 7-11, 1965. Left to right: Carlos Guerrero (Bolivia), Nguyen Vien (Vietnam), Professor George E. Barnes (UNC), Nguyen Vang (Vietnam), Tran Phuoc Tho (Vietnam), and Benjamin Adeyemi (Nigeria)

10. Municipal Assignments: As stated in paragraph 2 (c), after completion of the academic phase of the International Program, the participants are ordinarily assigned individually to some municipality, usually in North Carolina, for a period of one month, during which time they acquire operating experience in a waterworks plant, or sewage treatment plant, or both. Two of the present group began graduate study at the end of the academic phase, and this was taken as superseding the municipal and consulting assignments, being more important to the individuals concerned. Therefore, the assignments appear as follows:

Benjamin Adeyemi: not assigned to a municipality; the firm of Gilbert Associates of Reading, Pennsylvania, having work in the office for Adeyemi's home country, took him over under our general guidance.

Carlos Guerrero: assigned to Durham, North Carolina, waterworks

Tran Phuoc Tho: on completion of the academic phase of the program, Mr. Tho received permission from his government to pursue work toward a Master's degree at the University of North Carolina in Chapel Hill. He began this work in the summer of 1965 and completed it with distinction, in something over two semesters. In recognition of this we also issued him a certificate for having completed IPSED.

Nguyen Vang: on completion of the academic phase of the program, Mr. Vang, like Mr. Tho, received permission from his government to take work for the Master's degree. This he did with satisfactory showing at the University of Delaware, and we also issued him a certificate from IPSED.

Nguyen Vien: Mr. Vien was sent to the Ohio Department of Health in Columbus for field experience and to split his time between that office and the consulting office of Burgess & Niple in Columbus. He entered but did not complete a course in remedial English at the Ohio State University (a course which we recommended in view of his English deficiency), nor did he complete his assignment with the Department of Health or with Burgess & Niple. He left the country without credit for the program, although he had, of course, completed the academic phase.

11. Consulting Office (internship) Assignments: As has been indicated, the value of IPSED to the participant is as much derived from his assignment to an engineering office, for design and general experience, as from any single phase of the program. We have listed in paragraph 5 (h), over twenty engineering firms of first rank in the profession, that have been collaborating in this aspect of the work. In making the assignment to each individual participant, we therefore can choose the firm he will work with, with some discretion, taking into account the work at hand in each office, and how it may benefit the participant in view of his probable future. Oftentimes we are able to put him with a firm that is doing work for his own country, which may, in a particular instance, have special advantages. Assignments of the five participants in the Fifth Session were as follows:

<u>Participant</u>	<u>Internship Station</u>
Benjamin Adeyemi (Nigeria)	Reading, Pennsylvania Gilbert Associates
Carlos Guerrero (Bolivia)	Boston, Massachusetts Metcalf & Eddy
Tran Phuoc Tho (Vietnam)	Chapel Hill, North Carolina *Graduate study at the University of North Carolina
Nguyen Vang (Vietnam)	Newark, Delaware *Graduate study at the University of Delaware
Nguyen Vien (Vietnam)	Columbus, Ohio *Ohio Department of Health and Burgess & Niple

*see also preceding paragraph for history of this assignment

12. Reports and Commentaries: At the conclusion of his work in the program, each participant is required to submit a report on his total experience. These reports we find valuable for two reasons, i.e., (1) they assist us in evaluating the participant himself, and (2) they give indications of how the program may be strengthened and improved. Some quotes and commentaries, based partially on these reports, follow:

Benjamin Adeyemi (with Gilbert Associates, Reading, Pennsylvania)

"The Ibadan (Nigeria) proposed water supply scheme was just in the process of design; most of my time was spent on this project. . . including assisting in stability analysis for spillway of impounding dam. . . review and design of treatment works layout. . . hydraulics and economic studies of supply mains . . . distribution system sewage disposal schemes. . . field visits to projects in Pennsylvania." Relative to the academic phase - "wish time were longer on such topics as hydrology and sewage treatment. . . of particular interest in the course were the lectures on hydraulics, water chemistry, water rates and financing, and ground water hydrology. . . field trips to see various ideas developed by different engineers."

Carlos Guerrero (with Metcalf and Eddy, Boston, Mass.)

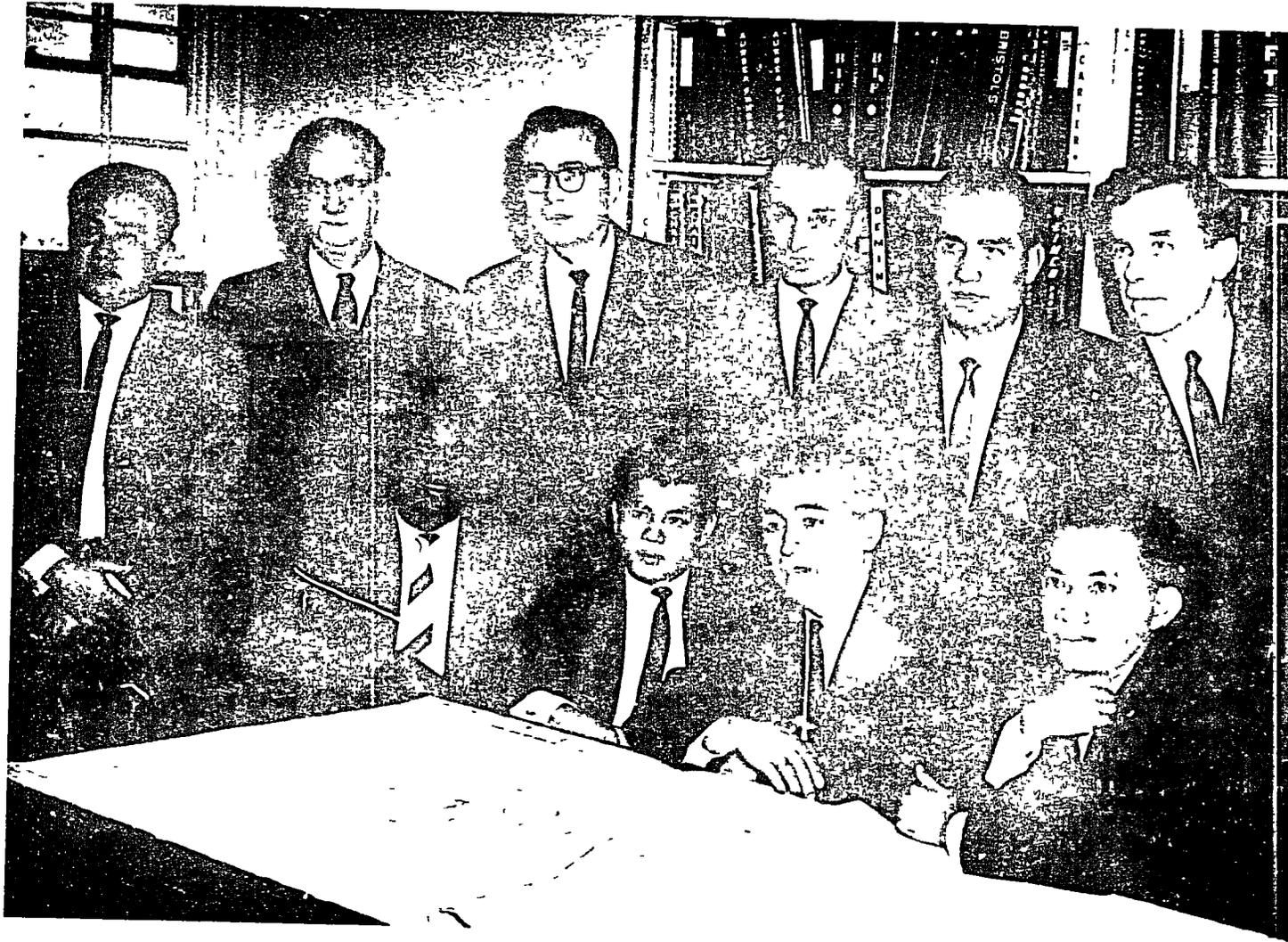
Of special interest was a certificate issued to Guerrero by the firm of Metcalf & Eddy. It states, in part, "Under the sponsorship of the United States Agency for International Development and its International Program in Sanitary Engineering Design at the University of North Carolina at Chapel Hill, he participated in the investigation for, and the design and construction inspection of groundwater supply wells, water distribution systems and treatment plants, structural evaluation of reinforced concrete storage tanks and sewage treatment plants."

During his visit he displayed a keen and diligent interest in the practice of engineering and we were impressed by his friendly manner and spirit of cooperation. . ."

Tran Tho and Nguyen Vang: for reasons already indicated these participants submitted no final report. However, Mr. Tho, as a partial requirement for the degree of Master of Science in Sanitary Engineering at U.N.C., wrote (with Professor George E. Barnes as Faculty Adviser) a master's paper on the subject of costs for work in Viet Nam, in comparison with similar work elsewhere. This was a good thorough job and cost analysis, with data collected not hitherto available.

Nguyen Vien: completed the academic phase of the program; did not complete the rest; no final report.

Finally, taking an overall view of these five participants, we would say that four of the five went through the program, or its equivalent, with flying colors. We believe that the failure of the fifth to finish was basically owing to the fact that his English was much too poor for purposes of communication and for keeping the pace demanded by the program.



PARTICIPANTS IN FIFTH SESSION

Left to right: seated Benjamin Adeyemi (Nigeria), Nguyen Vien (Vietnam), Carlos Guerrero (Bolivia) Vang (Vietnam), standing, Tran Phuoc Tho (Vietnam), Professor George E. Barnes (UNC), James C. Brown M. Zeki Aygen (Turkey), Yuksel Isleyen (Turkey), O Perakyla (Finland), and Dr Daniel A. Okun, De Head and Program Director (UNC).

SECTION III - REPORT ON SIXTH SESSION

13. Participants: The Sixth Session was held between September 1965 and August 1966. The participants arrive sometime during the week ahead of scheduled classes of the academic portion of the program. This week, or part of it, is devoted to orientation; to acquaint the participants with the University and its surroundings, to get them housed and settled, and to meet the faculty and school officials. In the Sixth Session there were eleven participants, from nine different countries. Also, attending part of the program (but on another mission) was Miss Irma Zea, sent under other contract by the University of San Carlos in Guatemala, for special training. With the exception of that of Miss Zea, the biographies of all participants are given below:

Name: Zafar Ahmad (Sponsored by AID/PHS)
Age: 30
Home: 17/1, Madan Paul Lane, Cacca-1, Dacca, Pakistan
Family: Single
Education: Jagannath College, Certificate in Science, 1954;
Engineering College, Dacca, B.Sc. Eng. degree, 1961.
Present Employer: Public Health Engineering, Government of East Pakistan, Dacca.
Title: Assistant Engineer
Brief Job Description: Plan and design of buildings; site supervision; inspection
of C.W.R. and elevated tank, etc.
Duration of Program: 18 months.
Training Officer: Mr. William S. Wilson

- - - - -

Name: Abdul Al Mahmoud (Sponsored by PAHO)
Age: 24
Home: North Gate, 10/9/1, Baghdad, Iraq
Family: Single
Education: Al Amarah Secondary School, B.S., 1958, Engineering College,
Baghdad University, B.Sc. in Civil Engineering, 1962.
Present Employer: Baghdad District Water Supply Administration.
Title: Civil Engineer
Brief Job Description: Supervision of all operations concerned with supply of
water to certain district of Baghdad Area.
Duration of Program: 1 year.
Training Officer: Mrs. Marvella Toney

- - - - -

Name: Alir Doria (Sponsored by OAS)
Age: 40
Home: Rua Bento Freitas, 440 Sao Paulo, Brazil
Family: Married
Education: London School of Hygiene and Tropical Medicine, London, England, degree in sanitary engineering, 1957; School of Engineering, University of Parana, Brazil, degree in civil engineering, 1950.
Present Employer: Diretoria de Viacao, Sec. Viacao de Est. S.P., Sao Paulo, Brazil.
Title: Civil Engineer and Sanitarian
Brief Job Description: Design and plans for industrial wastes and sewage and water treatment plants; experience in related problems of such.
Duration of Program: 3 months
Training Officer: Mrs. Mary Chamberlain

Name: Syed Husain (Sponsored by AID)
Age: 36
Home: 315-B Shepherd Road, Moghalpura, Lahore, Pakistan
Family: Single
Education: D. J. Sc. College, Kar., certificate in math and science, 1950; N.E.D. Eng. College, Karachi, Pakistan, degree in civil engineering, 1955.
Present Employer: Chief Engineer, West Pakistan, Public Health Engineering Department, Lahore.
Title: Assistant Sanitary Engineer
Brief Job Description: Prepare and execute rural and urban water supply schemes and sewerage and drainage schemes; prepare and execute Environmental Sanitation Schemes.
Duration of Program: 56 weeks.
Training Officer: Mr. Edward Gilman, Jr.

Name: Muhammad Khokhar (Sponsored by PAHO)
Age: 34
Home: Rangpura, Gujrat, West Pakistan
Family: Married
Education: Zamindar College, Gujrat, West Pakistan, F.Sc. diploma in 1950; Govt. College of Eng. & Tech. Maghalpura, Lahore (under Panjab University), B.Sc. degree in civil engineering, 1953.
Present Employer: Public Health Engineering Department, Government of West Pakistan.
Title: Assistant Director Survey
Brief Job Description: Preparation of survey plans and collection of survey data for water supply and sewerage schemes.
Duration of Program: 12 months
Training Officer: Dr. Daisy T. Berkes

Name: Francis Obodoechina (Sponsored by AID)
Age: 28
Home: Ministry of Works, Enugu, Eastern Nigeria
Family: Married
Education: University College, Ibadan, intermediate B.Sc. degree, 1957;
University of Aberdeen, B.Sc. degree in Civil Engineering, 1961.
Present Employer: Eastern Nigeria Government
Title: Executive Engineer (Water)
Brief Job Description: Complete design of rural water supply schemes; design of
extensions to existing urban water supply schemes; contract
documents.
Duration of Program: 52 weeks.
Training Officer: Mr. George H. Hill

Name: Armand Razafy (Sponsored by AID)
Age: 36
Home: Cite Desportes, Bloc C.43, rue Dr. Besson, Ankadivato,
Tananarive, Madagascar.
Family: Married
Education: Teachers' Training College, diploma, 1956; University of Paris,
B. S. in Geology, 1961; first year M.S. in Hydrogeology.
Present Employer: Direction of Mines, Ministry of National Economy.
Title: Geologist-Engineer
Brief Job Description: Hydrogeological studies of different regions of Madagascar
as well as appraisal of hydraulic resources in connection
with water supply.
Duration of Program: 12 months.
Training Officer: Mr. John R. Gilmore

Name: Ismail Razee (Sponsored by AID/PHS)
Age: 29
Home: 5, K. M. Das Lane, Dacca-3, Pakistan
Family: Single
Education: S. N. College, I.Sc. diploma, 1953; Rajshahi Government College,
I.Sc. diploma, 1954; Ahsanullah Engineering College, B.Sc. degree
in engineering, 1959.
Present Employer: Public Health Engineering Department
Title: Assistant Engineer
Brief Job Description: Supervision of water supply scheme for Rajshahi Municipality
and towns in district; supervision of sinking of tube wells in
Rajshahi District.
Duration of Program: 12 months
Training Officer: Mr. Theodore Wilson

Name: Marina Rosa e Silva (Sponsored by PAHO)
Age: 43
Home: Rua Almirante Alexandrino 976, Bloco E, Porta 3, Apt. 202, Rio de Janeiro, Brazil.
Family: Married
Education: School of Engineering of Pernambuco, degree in Civil Engineering, 1945; National School of Saude Publica, Guanabara, degree in Public Health Engineering, 1960.
Present Employer: Public Health School
Title: Chief, Environmental Sanitation Section
Brief Job Description: Co-ordinate teaching of subjects related to sanitary engineering; review of programs submitted by professors before approval by Board of School; substitute for Director.
Duration of Program: 12 months
Training Officer: Dr. Gerda Gray

Name: Ahmet Takaoglu (Sponsored by AID)
Age: 41
Home: Kennedy Cad. 16/8 Kavaklidere, Ankara, Turkey
Family: Married
Education: University of Istanbul (Technical), diploma in Civil Engineering, 1949.
Present Employer: Ilker Bank (under contract by General Directorate of State Hydraulic Works).
Title: Assistant Director, Water and Drainage System
Brief Job Description: Responsible for preparing drainage system projects and drinking water projects, including bidding, programming, controlling, acceptances and computations.
Duration of Program: 52 weeks
Training Officer: Miss Leila Mogannan

Name: Hugo Tejerina
Age: 26
Home: Av. Republica No. 25 (Calle 18), La Paz, Bolivia.
Family: Single
Education: San Andres University, B. S. in Civil Engineering, 1962.
Present Employer: Community Water Supply Division, USAID, La Paz, Bolivia.
Title: Civil Engineer
Brief Job Description: Design, construction and supervision of water supply systems and sanitary works.
Duration of Program: 52 weeks.
Training Officer: Mr. Arthur Angel



Zafar Ahmad



Abdul Al Mahmoud



Syed Husain



Muhammad Khokhar



Francis Obodoechina



Armand Razafy



Ismail Razee



Marina Rosa e Silva



Ahmet Takaoglu



Hugo Tejerina

Note: No photograph for Doria available.

PARTICIPANTS IN THE SIXTH SESSION OF THE INTERNATIONAL PROGRAM
IN SANITARY ENGINEERING DESIGN

14. Academic Program: All participants in IPSED arrive early enough to share in an orientation program designed to acquaint them with their surroundings and to get them properly housed and settled. This happens during the week preceding the classes of the academic phase of the program. For the sixth group, these classes started September 13 and terminated December 10, 1965. The full schedule for these classes, with topics and lecturers, is given in Appendix E.

The Department of Environmental Sciences and Engineering at UNC holds weekly seminars on Saturday mornings. The IPSED participants are free to attend. A list of subjects and speakers for these seminars running concurrently with the academic phase of IPSED is given in Appendix F.

15. Field Trips and Meetings Attended: Included in the academic program for IPSED are field trips to municipal waterworks and sewage treatment plants in North Carolina. These are taken about once a week, and, according to distance travelled, may take an afternoon or a full day. During the Sixth Session, the following such visits were made:

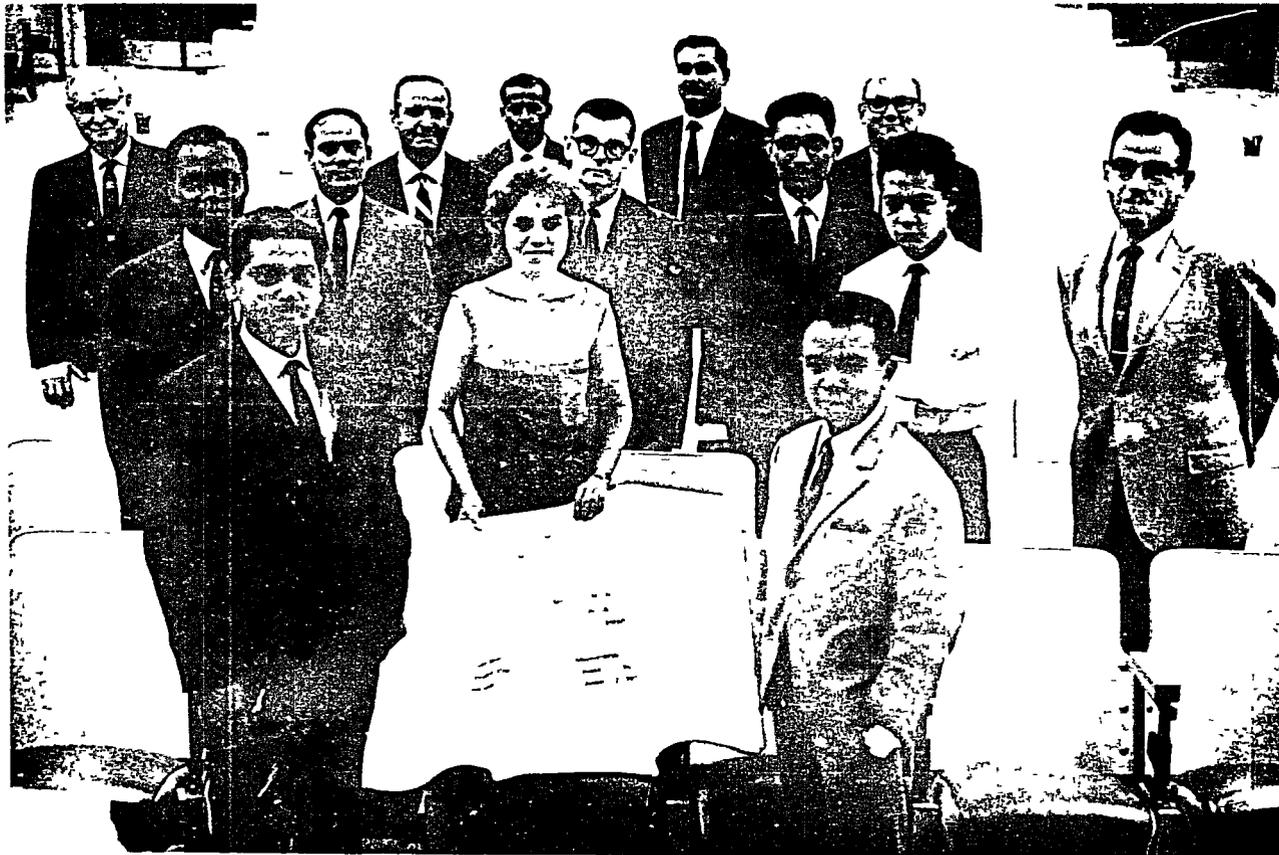
(a) field trips:

September 15	Chapel Hill, N. C., Waterworks
September 23	University Lake (instrumentation and field observations)
September 24	Durham, N. C., sewage treatment plant and experimental oxidation ponds, N. C.
October 1	Wrightsville Beach/ U. S. Desalination Station (this was a special meeting of the American Society of Mechanical Engineers to which the IPSED group was invited; inspection of all experimental work and evening banquet.)
October 7	Chapel Hill, N. C., dam and sewage treatment plant
October 28	Durham, N. C., dam and water treatment plant
November 16	Raleigh, N. C., industrial water and waste treatment plants
December 9	Greensboro, N. C., water and sewage treatment works

(b) Professional meetings attended by the group included:

October 11-15, 1965: Annual meeting of the Water Pollution Control Federation, held in Atlantic City. Also, at this meeting, the group attended a breakfast session of the Interamerican Association of Sanitary Engineering (AIDIS) on October 13.

November 9, 1965: Annual meeting of the North Carolina Section of the American Water Works Association and the Water Pollution Control Federation, held at Winston-Salem, N. C.



PARTICIPANTS IN SIXTH SESSION

- First Row** - (Left to right): Ismail Razei (Pakistan), Claudius Razafy (Malagasy)
Second Row - (Left to right): Francis Obodochina (Nigeria), Marina Rosa e Silva (Brazil),
 Hugo Tejerina (Bolivia), Dr Okun.
Third Row - (Left to right): Zafar Ahmad (Pakistan), Donald T. Lauria, Syed Husain (Pakistan).
Fourth Row - (Left to right): Professor Barnes, Ahmet Takaoglu (Turkey), Alir Doria (Brazil).
Fifth Row - (Left to right): Muhammad Khokhar (Pakistan), Abdul Al Mahmud (Iraq).

16. Municipal Assignments: Municipal assignments for approximately a one-month's period for operating experience on water works or sewage treatment plants, or both, were made as follows:

Ahmad, Zafar: for special reasons owing to his work in Pakistan, Ahmad was sent directly to the office of Camp, Dresser & McKee in Boston (see consulting assignments).

Salman Al Mahmoud: City of Raleigh, N. C.

Alir Doria: Doria, sponsored by the Organization of American States, was given but limited time in this country; at the end of the academic phase he was therefore sent directly to the consulting firm of Alexander Potter & Associates (see following paragraph).

Syed Husain: City of Durham, N. C.

Muhammad Khokhar: City of Fayetteville, N. C.

Francis Obodoechina: City of Dayton, Ohio, water department.

Claudius Razafy: sent directly to consulting office (see following).

Ismail Razez: returned to Pakistan owing to previous commitments.

Ahmet Takaoglu: a special arrangement with Buck, Seifert & Jost of Englewood Cliffs, N. J. in which he was given time for construction experience in San Juan, Puerto Rico.

Marina Rosa e Silva: City of Charlotte, N. C., water department.

Hugo Tejerina: City of Winston-Salem, N. C., water department.

17. Consulting Office (internship) Assignments: As in earlier sessions, the participants were individually assigned to selected consulting engineering offices for design experience and to familiarize themselves with general engineering procedures and management. The assignments were in general for a duration of about six months, some shorter, some longer, according to the man's length of stay by approval of the sponsoring agency.

Zafar Ahmad to Camp, Dresser & McKee of Boston, Mass.

Salman Al Mahmoud: originally assigned to O'Brien & Gere, Syracuse, N. Y. However, with the permission of his home government and with our approval and that of his sponsor, he entered the University of Michigan at Ann Arbor as a graduate student in sanitary engineering. He earned his Master's degree in March 1966. With some two months still to go on his authorized time in this country, we arranged for him to be assigned to the Metropolitan Water Supply District of Southern California

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

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



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

PARTICIPANTS IN CONSULTING ASSIGNMENTS

and with the Los Angeles County Water Supply Commission, where he acquired additional experience in water supply planning, operation, and management.

Alir Doria: sponsored by OAS, Doria's time in this country was severely limited. After finishing the academic phase of the program, he was sent to the office of Alexander Potter Associates, New York, N. Y.

Syed Husain: Assigned to the office of Alvord, Burdick, and Howson, Chicago, Ill.

Muhammad Khokhar: to the office of Greeley & Hansen, Chicago, Ill.

Francis Obodochina: to the office of Gilbert Associates, Reading, Pa.

Claudius Razafy: because his French was better than his English, Razafy was sent to Montreal, Canada, to the office of LaLonde, Girouard, and Letendre.

Ismail Razee: Razee had come to us after earning his Master's degree in sanitary engineering at the University of Wisconsin. He returned to Pakistan after completion of the academic phase of the program.

Ahmet Takaoglu: a special arrangement with Buck, Seifert and Jost of Englewood Cliffs, N. J., permitted Takaoglu to split his time between construction work for the firm in San Juan, Puerto Rico, and design experience at the home office in New Jersey.

Marina Rosa e Silva: to the office of Havens & Emerson, New York, N. Y.

Hugo Tejerina: to Whitman, Requardt & Associates, Baltimore, Md.

18. Reports and Commentaries: Final reports from the participants are most likely to be turned in when the participant is required to return to Chapel Hill, just prior to his return home via Washington. If the participant does not so return, there is often a delay and sometimes failure to deliver. Participants in the sixth session were given (early in the program) an outline, (as shown in Appendix H) with suggested report content. This outline may be followed insofar as it is appropriate to the participant's work.

It will be noted in the academic curriculum that a week or ten days' classwork is devoted to the subject of ground water and wells, conducted by the Johnson well people of Minneapolis, who are the same ones who conduct the more extended ground water school at the University of Minnesota. Where the participant's interest, or anticipated home duties, seem to warrant it, we have sent him to the Minnesota ground water school in addition to his other assignments. Owing to limitations on total time in this country, this usually means time out of the consulting phase. Thus in the sixth group, we sent four men to the Minnesota school for more extended training in this aspect of the work - - Husain, Khokhar, Razafy, and Takaoglu.

The final reports from Husain, Khokhar, Obodoechina, Rosa e Silva, and Takaoglu were received in due course. Most of the commentaries are, as may be expected, highly complimentary with reference to various aspects of the program. Such phrases as "enriching experience," "development of new concepts," and the like, are common. Certain shortcomings are pointed out which we use as guides, where possible, to improving the work. One general consensus seems to be that of the total time available (usually about ten months), a greater proportion should be devoted to the academic phase (which is so intensive) and a lesser proportion to the consulting or intern phase. Also, many would wish a greater amount of time to be spent on sewerage and sewage treatment, in addition to water supply. Complaints sometimes arise from the restricted allowances made on the part of some sponsors for per diem expenses. Some participants are very desirous of a diploma from the University instead of a certificate from IPSED (greater status at home, perhaps). This is not the intent of the program.

19. Closing Remarks: Finally, we might say that the reader who has carefully perused these pages is bound to see that in spite of the fact that we treat these foreign engineers in groups for certain purposes, they get, at the same time, a great deal of individual attention with respect to their professional and personal needs; much more so than the "program" would indicate on superficial examination. This is necessarily true in view of their varied background, varied competence in English, and varied prospects for their own future, all of which must be taken into account in their respective assignments. IPSED has an overall pattern to be sure, but within this pattern are many considerations which are carefully worked out for each individual participant.



Khokhar, Rosa e Silva and Takaoglu hold certificates in front of the School of Public Health.



Participants with Carol Westerberg, IPSED secretary.



Participants display certificates.

PARTICIPANTS RECEIVE CERTIFICATES

APPENDICES

APPENDIX A - REFERENCE TO EARLIER REPORTS

Earlier reports pertaining to preceding sessions of the International Program in Sanitary Engineering Design include the following:

<u>Session</u>	<u>Date of Session</u>	<u>Date of Report</u>
1	January, 1963 - November, 1963	March 31, 1964
2	September, 1963 - July, 1964	February 22, 1965
3	February, 1964 - December, 1964	} Sessions 3 & 4 jointly reported
4	September, 1964 - July, 1965	

APPENDIX B – SUMMARY LIST OF PARTICIPANTS AND COUNTRIES OF ORIGIN

In the six sessions of the International Program in Sanitary Engineering Design, there have been 42 participants from 19 different countries, as follows:

<u>Group No.</u>	<u>Name of Participant</u>	<u>Country</u>
1	Eduardo Garcia Zekal Gurgul Francisco de Mendonca Semih Turker Sacit Unal	Colombia Turkey Brazil Turkey Turkey
2	Horace L. Beckford Salman M. El-Rawi Walter B. Fabian Jeff E. Flanagan Vincent E. Hemming Ernmanuel A. Ojo Pedro A. Parada Ali H. Shubber	Jamaica Iraq Costa Rica USAID Burma Jamaica Nigeria Bolivia Iraq
3	Andres Bacigalupi Kofi Mensah Addison Felipe Ruiz Luckaman Al-Abaddy	Argentina Ghana Chile Iraq
4	Kofi Mensah Addison (started with 3, ended with 4) Emilio de la Fuente Philip Peng-fei Kuo Nilo Leite Nassar Augusto A. Navarro Muwaffaq B. A.Sulaiman Najeeb Foteh Tleel	Ghana Peru Taiwan Brazil Peru Iraq Jordan
5	Benjamin O. Adeyemi Carlos Guerrero Nguyen Danh Vang Tran Phuoc Tho Nguyen Dinh Vien M. Zeki Aygen Yuksel Isleyen O. Perakyla	Nigeria Bolivia Vietnam Vietnam Vietnam Turkey Turkey Finland

Appendix B - continued

<u>Group No.</u>	<u>Name of Participant</u>	<u>Country</u>
6	Zafar Ahmad	Pakistan
	Salman Al Mahmoud	Iraq
	Alir Doria	Brazil
	Syed Husain	Pakistan
	Muhammad Khokhar	Pakistan
	Francis Obodoechina	Nigeria
	Claudius Razafy	Madagascar
	Ismail Razee	Pakistan
	Ahmet Takaoglu	Turkey
	Marina Rosa e Silva	Brazil
	Hugo Tejerina	Bolivia

APPENDIX C - CURRICULUM FOR ACADEMIC PHASE OF FIFTH SESSION

INTERNATIONAL PROGRAM IN SANITARY ENGINEERING DESIGN

SPRING - 1965

1st WEEK - February 15 - 19

WATER NEEDS AND PRELIMINARY STUDIES

A.M. Lectures:

2/15 - Mon.	D. A. Okun J. C. Brown	Preliminary Studies and Reports Conversion Units
2/16 - Tues.	J. C. Brown J. Haratani (P.M.)	Population and Water Use Forecasting World Water Supply Needs
2/17 - Wed.	R. Marland	Water and Health Water Quality Standards
2/18 - Thurs.	FIELD TRIP	Winston-Salem, North Carolina
2/19 - Fri.	J. C. Brown	Outlines of Water Supply and Waste Disposal Systems Period of Design Basis of Design

P.M. Individual Work:

2/15	Report and Plan Study
2/16 - 2/17	Population and Water Use Problem
2/18	FIELD TRIP
2/19	Basis of Design Problems

2nd WEEK - February 22 - 26

HYDRAULICS

A.M. Lectures:

2/22 - Mon.	G. E. Barnes	Elements of Hydraulics, Energy and Pressure Gradients
2/23 - Tues.	G. E. Barnes	Analysis of Energy and Pressure Gradients
2/24 - Wed.	G. E. Barnes	Flow in Networks

Appendix C - continued

2/25 - Thurs.	G. E. Barnes	Flow in Networks (cont.)
2/26 - Fri.	G. E. Barnes R. Cole (P.M.)	Elements of Open Channel Flow Distribution System Analysis by Method of Sections

P.M. Individual Work:

2/22		Problem Work in Hydraulics
2/23 - 2/26		Problem Work in Hydraulics and Films

3rd WEEK - March 1 - 5

PUMPS AND PUMPING SYSTEMS

A.M. Lectures

3/1 - Mon.	G. E. Barnes	Open Channel Flow
3/2 - Tues.		Individual Work
3/3 - Wed.	G. E. Barnes	Centrifugal Pumps
3/4 - Thurs.	G. E. Barnes	Pump Characteristics
3/5 - Fri.	G. E. Barnes J. C. Brown	Water and Sewage Pumping Stations Pumping Systems

P.M. Individual Work:

3/1		Hydraulic Problems - Open Channel Flow FIELD TRIP - Chapel Hill Water Treatment Plant
3/2		Hydraulic Problems - Films Centrifugal Pumps
3/3		Slide Lecture - Types of Pumps Demonstration - Pumps (J. C. Brown)
3/4 - 3/5		Pumping Stations

Appendix C - continued

4th WEEK - March 8 - 12

3/8 - 3/12

American Society of Civil Engineers
Water Resources Engineering Conference
Mobile, Alabama, and Miscellaneous
field trips in Mobile and surrounding
areas. Accompanied by G. E. Barnes

5th WEEK - March 15 - 19 UNIT OPERATIONS OF WATER AND WASTE TREATMENT

A.M. Lectures:

3/15 - Mon.	J. C. Brown	System Head Curves
3/16 - Tues.	J. C. Brown	Mixing and Flocculation
3/17 - Wed.	J. C. Brown	Sedimentation
3/18 - Thurs.	J. C. Brown	Filtration
3/19 - Fri.	FIELD TRIP	Fayetteville Water and Sewage Treatment Plant

P.M. Individual Work:

3/16	FIELD TRIP	Films and Demonstrations on Pump Problems - Chapel Hill Sewage Treatment Plant
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6th WEEK - March 22 - 26

WATER CHEMISTRY

A.M. Lectures:

3/22 - Mon.	J. C. Lamb	General Chemistry
3/23 - Tues.	FIELD TRIP	Durham Water and Sewage Treatment Plant
3/24 - Wed.	J. C. Lamb	CO ₂ , pH, Alkalinity, Corrosion Control
3/25 - Thurs.	J. C. Lamb	Water Softening and Coagulation
3/26 - Fri.	J. C. Lamb	Water Softening and Coagulation

Appendix C, continued

P.M. Individual Work:

Start Water Plant Design Problems
Turbidity Tests
Problem in Softening
Coagulation Jar Tests

7th WEEK - March 29 - April 2

1) UNIT OPERATIONS OF WATER AND WASTE
TREATMENT
2) TREATMENT PLANT LAYOUT

A.M. Lectures:

3/29 - Mon.	G. E. Barnes	Oxidation Ponds
3/30 - Tues.	G. E. Barnes	Trickling Filters, Imhoff Tanks Theory and Practice of Disinfection
3/31 - Wed.	J. C. Brown	Chlorination and Disinfection
4/1 - Thurs.	FIELD TRIP	Greensboro, North Carolina Water and Sewage Treatment Plant
4/2 - Fri.	D. A. Okun	Principles and Practice of Water and Waste Treatment Plant Layout

P.M. Individual Work:

Water Treatment Plant Design Problems

8th WEEK - April 5 - 9

DISTRIBUTION SYSTEMS

A.M. Lectures:

4/5 - Mon.	J. C. Brown	Sewerage Determination of "C" Coefficient
4/6 - Tues.		no class
4/7 - Wed.	FIELD TRIP	Missouri Section Meeting - AWWA
4/8 - Thurs.	FIELD TRIP	St. Louis Water Treatment Plants
4/9 - Fri.	FIELD TRIP	St. Louis Water Treatment Plants

P.M. Individual Work

Water Treatment Plant Design Problems

Appendix C, continued

9th WEEK - April 12 - 16

PIPES AND APPURTENANCES

A.M. Lectures:

4/12 - Mon.	Attended Repair School Sponsored by North Carolina and AWWA
4/13 - Tues.	Attended Repair School Sponsored by North Carolina and AWWA
4/14 - Wed.	14th Southern Water Resources and Pollution Control Conference School of Public Health, UNC
4/15 - Thurs.	14th Southern Water Resources and Pollution Control Conference
4/16 - Fri.	14th Southern Water Resources and Pollution Control Conference

P.M. Individual Work:

Water Treatment Plant Design Problems

10th WEEK - April 19 - 23

1) SERVICE CONNECTIONS
2) ORGANIZATION OF A DESIGN OFFICE
3) PROJECT FINANCING

A.M. Lectures:

4/19 - Mon.		HOLIDAY
4/20 - Tues.		Films - Chlorinator
4/21 - Wed.	FIELD TRIP	Charlotte, N. C. - Grinnell Co. (J. E. Fuller) C. I. Pipe and Appurtenances Visit to Catawba River Dam
4/22 - Thurs.	FIELD TRIP	
4/23 - Fri.	FIELD TRIP	

P.M. Individual Work:

Water Treatment Plant Design Problems

Appendix C, continued

11th WEEK - April 26 - 30

1) FINANCING AND WATER RATES
2) GROUND WATER

A.M. Lectures:

4/26 - Mon.	J. C. Brown	Project Financing and Feasibility Analysis
4/27 - Tues.	J. C. Brown	Economics
4/28 - Wed.	L. Orihuela	International Finance
4/29 - Thurs.	J. C. Brown	Settling Tanks
4/30 - Fri.	J. Sherwni	Ground Water

P.M. Individual Work:

		Problems in Feasibility Analysis Problems in Water Rate Calculation Problems in Ground Water
4/29 - Thurs.	FIELD TRIP	North Fork Sewage Treatment Plant, Durham, N. C.

12th WEEK - May 3 - 7

1) GROUND WATER
2) COMPLETION OF DESIGN PROBLEM

A.M. Lectures:

5/3 - Mon.	J. Sherwani	Ground Water
5/4 - Tues.	Dr. Okun	Ground Water
5/5 - 5/7	G. E. Barnes	Completion of Water Treatment Plant Design Problem

P.M. Individual Work:

	Problems in Ground Water Completion of Water Treatment Plant Design Problem
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APPENDIX D - SEMINARS FOR FIFTH SESSION

Seminars held weekly on Saturday mornings by the Department of Environmental Sciences and Engineering for the benefit of faculty and graduate students, and also attended by IPSED participants for topics of interest, were presented concurrently with the academic phase of IPSED as follows:

Man's Environment in the Twenty-First Century

- | | |
|-------------|--|
| February 13 | "Food Packaging and Protection." Morris A. Shiffman, Associate Professor of Environmental Sanitation, Department of Environmental Sciences and Engineering, U.N.C. |
| February 20 | "The Use of Land." Barclay G. Jones, Associate Professor of City and Regional Planning, Cornell University. |
| February 27 | "Housing." Carl Feiss, Planning and Urban Renewal Consultant, Washington, D. C. |
| March 6 | "Transportation." William L. Mertz, Technical Director, Tri-State Transportation Commission, New York. |
| March 13 | "Energy." Milton Heath, Jr., Assistant Director, Institute of Government, and Roland A. Kampmeier, Consulting Engineer, Chattanooga, Tennessee. |
| March 20 | "Population." Rupert B. Vance, Kenan Professor of Sociology, Department of Sociology and Anthropology. |
| March 27 | "Psychological Patterns." John P. Filley, Associate Professor of Mental Health, School of Public Health, University of North Carolina. |
| April 3 | "Sociological Factors." Robert N. Wilson, Professor of Epidemiology, School of Public Health, University of North Carolina. |
| April 10 | "Communication and Data Exchange." George E. Nicholson, Jr., Professor of Statistics, Department of Statistics, University of North Carolina. |
| May 1 | "The Development of the Phosphate Resources of Eastern North Carolina and Its Impact on this Area." Dr. Leo J. Miller, Division Manager, Phosphate Division, Texas Gulf Sulphur Company. |

APPENDIX E - CURRICULUM FOR ACADEMIC PHASE OF SIXTH SESSION
INTERNATIONAL PROGRAM IN SANITARY ENGINEERING DESIGN
FALL - 1965

1st WEEK - September 8 - 10

ORIENTATION

9/8	Wednesday	AM, PM	M. W. Dearman	Orientation
9/9	Thursday	AM, PM	M. W. Dearman	Orientation
9/10	Friday	AM, PM	M. W. Dearman	Orientation

2nd WEEK - September 13 - 17

INTRODUCTION

9/13	Monday	AM	D. A. Okun	Greetings; Aims of Program
		PM	G. E. Barnes D. T. Lauria	Program Review
9/14	Tuesday	AM	D. T. Lauria	Introduction to IPSED Facilities
		PM	G. E. Barnes D. T. Lauria	Participant Assessment
9/15	Wednesday	AM	G. E. Barnes D. T. Lauria	Participant Assessment Textile Wastes
		PM		FIELD TRIP: Chapel Hill Water Treatment Plant
9/16	Thursday	AM	G. E. Barnes	Population and Water Use Forecasting
		PM		School of Public Health Convocation
9/17	Friday	AM	J. K. Sherwani	Statistical Analysis of Hydrological Data
		PM	D. T. Lauria	Bulk and Paper Wastes

Appendix E, continued

3rd WEEK - September 20 - 24

				<u>BASIC SANITARY SCIENCES</u>
9/20	Monday	AM	D. A. Okun	World Water Supply Problems
		PM	J. K. Sherwani	Statistical Analysis of Hydrological Data
9/21	Tuesday	AM	D. T. Lauria	Sanitary Chemistry - Water
		PM	D. T. Lauria	Sanitary Chemistry - Laboratory
9/22	Wednesday	AM	D. T. Lauria	Sanitary Chemistry - Water
		PM		Sanitary Chemistry - Laboratory
9/23	Thursday	AM	C. M. Weiss	Aquatic Biology
		PM		FIELD TRIP: University Lake, Morgan Creek
9/24	Friday	AM	D. T. Lauria	Stream Sanitation
		PM	D. T. Lauria	Waste Assimilation FIELD TRIP: Durham Oxidation Pond

4th WEEK - September 27 - October 1

				<u>BASIC ENGINEERING CONSIDERATIONS</u>
9/27	Monday	AM	G. E. Barnes	Hydraulics
		PM	C. S. Pineo	Community Water Supply Activities of International Agencies
9/28	Tuesday	AM	G. E. Barnes	Hydraulics
		PM	G. E. Barnes	Hydraulic Problems
9/29	Wednesday	AM	G. E. Barnes	Open Channel Flow
		PM	G. E. Barnes	Hydraulic Problems
9/30	Thursday	AM	G. E. Barnes	Pumps

Appendix E, continued

		PM	G. E. Barnes	Pump Problems
10/1	Friday	AM, PM		FIELD TRIP: Wrightsville Beach, N.C. (Desaliniza- tion Plant)

5th WEEK - October 4 - 8

BASIC ENGINEERING
CONSIDERATIONS

10/4	Monday	AM	G. E. Barnes	Pumps
		PM	R. D. Mitchell	Dams
10/5	Tuesday	AM	G. E. Barnes	Pumps
		PM	G. E. Barnes	Pump Problems
10/6	Wednesday	AM	D. T. Lauria	Water Treatment Processes
		PM	D. T. Lauria	Water Treatment Processes
10/7	Thursday	AM	D. T. Lauria	Water Treatment Processes
		PM	D. T. Lauria	Water Treatment Processes
10/8	Friday	AM	D. T. Lauria	Stream Sanitation
		PM		FIELD TRIP: Chapel Hill Dam and Sewage Treatment Plant

6th WEEK - October 11 - 15 WPCF CONVENTION

10/11 to Monday -				
10/15	Friday		Atlantic City, New Jersey	

7th WEEK - October 18 - 22

BASIC ENGINEERING
CONSIDERATIONS

10/18	Monday	AM, PM	J. L. Mogg	Ground Water
10/19	Tuesday	AM, PM	J. L. Mogg	Ground Water

Appendix E, continued

10/20	Wednesday	AM, PM	J. L. Mogg	Ground Water
10/21	Thursday	AM, PM	J. L. Mogg	Ground Water
10/22	Friday	AM, PM	J. L. Mogg	Ground Water

8th WEEK - October 25 - 29

PRELIMINARY ENGINEERING
PLANNING

10/25	Monday	AM	D. T. Lauria	Sanitary Engineering Equipment
		PM	W. M. Piatt	Filter Plant Controls
10/26	Tuesday	AM	D. T. Lauria	Data Sources, Collection Methods, Analysis
		PM	D. T. Lauria	Class Problem - Population and Water Use
10/27	Wednesday	AM	G. E. Barnes	Preliminary Plan Preparation
		PM	D. T. Lauria	Class Problem - Plan Preparation
10/28	Thursday	AM	D. T. Lauria	Class Problem - Layout and Basic Decisions
		PM		FIELD TRIP: Durham Dam and Water Treatment Plant
10/29	Friday	AM	D. T. Lauria	Examination
		PM	D. T. Lauria	Class Problem - Cost Estimate

9th WEEK - November 1 - 5

GENERAL DESIGN PRACTICE

11/1	Monday	AM	D. T. Lauria	Class Problem - Project Financing and Rates
		PM	J. Guzman	International Finance
11/2	Tuesday	AM	G. E. Barnes	Class Problem - Report Outline
		PM	D. T. Lauria	Class Problem - Layout

Appendix E, continued

11/3	Wednesday	AM	D. T. Lauria	Engineering Office - Organization and Activities
		PM	K. V. Hill	Project Organization and Execution
11/4	Thursday	AM	D. T. Lauria	Function, Organization and Preparation of Plans
		PM	D. T. Lauria	Cost Estimates and Project Financing
11/5	Friday	AM	D. T. Lauria	Function, Organization and Preparation of Specifications
		PM		Individual work - class problem

10th WEEK - November 8 - 12

DESIGN: WATER SUPPLY,
TRANSMISSION AND
DISTRIBUTION SYSTEMS

11/8	Monday	AM	G. E. Barnes	How to write a report
		PM		Individual work - class problem
11/9	Tuesday	AM, PM		N. C. AWWA Meeting - Winston-Salem, N. C.
11/10	Wednesday	AM	D. T. Lauria	Function of Preliminary Planning
		PM	R. V. Ford	Low Cost Distribution Systems
11/11	Thursday	AM	G. E. Barnes	Distribution System Design
		PM	D. T. Lauria	Preparation of Cost Estimates
11/12	Friday	AM	G. E. Barnes	Distribution System Design
		PM	D. T. Lauria	Preparation of Cost Estimates

11th WEEK - November 15 - 19

DESIGN: WATER SYSTEMS

11/15	Monday	AM	G. E. Barnes	Interest Rate Tables
		PM	D. T. Lauria	Pumping System Design
11/16	Tuesday	AM	D. T. Lauria	Pumping System Design
		PM		FIELD TRIP: Raleigh, N. C.
11/17	Wednesday	AM	D. T. Lauria	Individual work - pumping systems
		PM	W. M. Piatt	Filter Design
11/18	Thursday	AM	D. T. Lauria	Sewage Pumping Station Design
		PM		FIELD TRIP: Burlington, N. C.
11/19	Friday	AM	D. T. Lauria	Pumping Station Layout
		PM	D. T. Lauria	Pumping Station Layout

12th WEEK - November 22 - 26

DESIGN: WATER TREATMENT PLANTS

11/22	Monday	AM	D. T. Lauria	Pump Station Layout
		PM		Individual work - Pumping Station Layout
11/23	Tuesday	AM	D. T. Lauria	Design of Flocculation Tanks and Filter Plant Control
		PM	D. T. Lauria	Design of Flocculation Tanks and Filter Plant Control
11/24	Wednesday	AM	D. T. Lauria	Electrical Design for Pumping Stations
		PM	D. T. Lauria	Electrical Design for Pumping Stations
11/25	Thursday	AM		Thanksgiving Holiday
		PM		" "

Appendix E, continued

11/26	Friday	AM		Thanksgiving Holiday
		PM		" "

13th WEEK - November 29 - December 3

DESIGN: WATER TREATMENT PLANTS AND SEWER SYSTEMS

11/29	Monday	AM	D. T. Lauria	Sewage Treatment Design
		PM	M. E. Rodgers	Plant Control and Measurement Equipment
11/30	Tuesday	AM	D. T. Lauria	Sewage Treatment Design
		PM	D. T. Lauria	Filter Design
12/1	Wednesday	AM, PM	R. E. Baumann	General Design Considerations: Sewerage Facilities
12/2	Thursday	AM	D. T. Lauria	Sewage Treatment Processes
		PM	D. T. Lauria	Sewage Treatment Processes
12/3	Friday	AM	D. T. Lauria	Sewer Appurtenances
		PM	D. T. Lauria	Individual work - class problem

14th WEEK - December 6 - 10

DESIGN: SEWAGE TREATMENT PLANTS

12/6	Monday	AM	D. T. Lauria	General Design Considerations: Sewage Treatment Plants
		PM	D. T. Lauria	Design Problem
12/7	Tuesday	AM	D. T. Lauria	Sewage Settling Tank Design
		PM	D. T. Lauria	Sewage Settling Tank Design
12/8	Wednesday	AM	D. T. Lauria	Screens, Grit Chambers, Settling Tanks, Chlorine Tanks, Drying Beds
		PM	G. Bruno	Pumps

Appendix E, continued

12/9	Thursday	AM, PM		FIELD TRIP: Greensboro
12/10	Friday	AM	D. T. Lauria	Use of Partial Elements - Curves for Sewers
		PM	D. T. Lauria	Design Problem

APPENDIX F - SEMINARS FOR SIXTH SESSION

Seminars held weekly on Saturday mornings by the Department of Environmental Sciences and Engineering for the benefit of faculty and graduate students, and also attended by IPSED participants for topics of special interest, were presented concurrently with the academic phase of IPSED as follows:

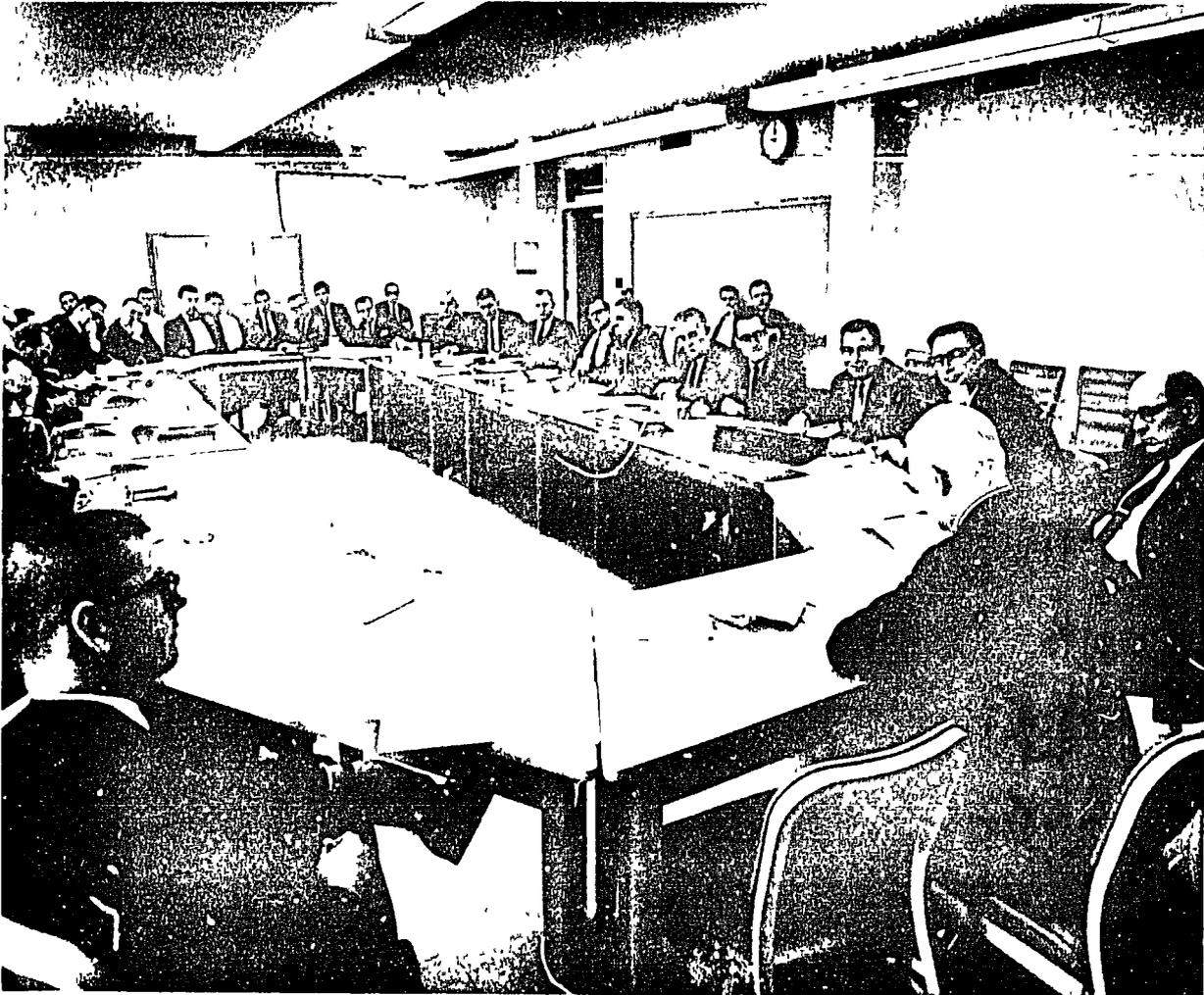
1965

- Sept. 18 "The Institutional Environment." Dr. Edward L. Fincher, Associate Professor of Aerobiology, Departments of Environmental Sciences and Engineering and Bacteriology.
- Sept. 25 "Phosphatases in Marine Algae." Dr. Edward J. Kuenzler, Associate Professor of Environmental Biology, Department of Environmental Sciences and Engineering.
- Oct. 2 "Water Resources and Water Management." Dr. Maynard M. Hufschmidt, Professor, Departments of City and Regional Planning and Environmental Sciences and Engineering.
- Oct. 9 "The Distribution of Fluoride in Estuarine Waters as Determined by a New Analytical Method for Fluoride Ion." Mr. Larry O. Hill, Research Trainee, Department of Environmental Sciences and Engineering.
- Oct. 16 "Late Somatic Effects of Irradiation." Dr. C. D. Van Cleave, Professor of Anatomy, School of Medicine, University of North Carolina.
- Oct. 23 "Planning for the Research Triangle Region - The Special Problems of Water Supply and Waste Disposal." Pearson W. Stewart, Executive Director, Research Triangle Regional Planning Commission, Research Triangle, North Carolina.
- Oct. 30 "Air Pollution in Relation to Local Wind Systems." Dr. E. Wendell Hewson, Professor of Meteorology, Department of Meteorology, University of Michigan.
- Nov. 6 "Water Management and Waste Control in General Electric." K. S. Watson, Manager, Water Management Laboratory, General Electric Co., Louisville, Kentucky.
- Nov. 13 "Techniques for Evaluating the Accumulation of Organic Compounds in the Environment." Dr. Don Hayne, Department of Experimental Statistics, N. C. State University.

Appendix F, continued

- Nov. 20 "Developing a Rationale for Water Filtration." Dr. Charles O'Melia, Lecturer in Sanitary Engineering, Harvard University.
- Dec. 4 "Diurnal Patterns in Ozone Concentrations in the North Carolina Mountains." Dr. Lyman A. Ripperton, Associate Professor of Air Hygiene, Department of Environmental Sciences and Engineering.
- Dec. 11 "Flocculation of Heterodispersed Systems." Dr. Warren J. Kaufman, Professor of Sanitary Engineering, University of California, Berkeley.

APPENDIX G
SPECIAL SEMINAR OF CONSULTANTS COLLABORATING IN THE PROGRAM



April 5, 1966

At the invitation of the Department of Environmental Sciences and Engineering, engineers from fourteen firms serving as consultants to the International Program in Sanitary Engineering Design, and representatives of the Community Water Supply Branch of the Agency for International Development and the Pan American Health Organization, in Washington, gathered in Chapel Hill on April 5 to exchange experiences and information on work procedures and problems encountered in their engineering projects and activities abroad in developing countries.

Topics under discussion were: General Considerations in Working Abroad, introduced by Mr. Kenneth V. Hill of Greeley and Hansen, Chicago, Preparation of Preliminary and Feasibility Studies, introduced by Mr. Joseph Lawler of Camp, Dresser & McKee, Boston; Preparation of Plans and Contract Documents, introduced by Mr. John Podger of Metcalf and Eddy, Boston, and Engineering Training, introduced by Dr. Daniel A. Okun of the Department of Environmental Sciences and Engineering, UNC at Chapel Hill.

The purpose of the symposium was to provide guide lines for engineering practice in developing countries for future training of IPSED participants, where training might be cued to meet situations of concern to the consulting engineering firms in their overseas experiences.

Appendix G, continued

Those in attendance at the symposium were:

CONSULTING ENGINEERS:

C. Herbert--Lalonde, Girouard & Letendre
K. V. Hill--Greeley and Hansen
C. F. Jost--Buck, Seifert & Jost
E. J. Kazmierczak--Engineering-Science
D. Laflamme--Lalonde, Girouard & Letendre
J. C. Lawler--Camp, Dresser & McKee
R. E. Lawrence--Black & Veatch
V. C. Lischer--Horner & Shifrin
R. P. Logan--Dorr-Oliver, Inc.
R. C. Marini--Camp, Dresser & McKee
John Podger--Metcalf & Eddy
R. C. Regnier--Whitman, Requardt & Assoc.
J. A. Romano--Gannett, Fleming, Corddry & Carpenter
R. W. Simpson--Gilbert Associates
C. R. Walter--Hazen & Sawyer
S. W. Williams, Jr.,--O'Brien & Gere
R. E. Leffel--Camp, Dresser & McKee

GOVERNMENT REPRESENTATIVES:

J. D. Caldwell--AID
Joseph Haratani--AID
C. S. Pineo--PAHO
K. F. Vernon--AID

(I.P.S.E.D.) PARTICIPANT:

Francis Obodoechina

DEPARTMENT STAFF:

H. G. Baity
G. E. Barnes
J. C. Brown
J. C. Lamb
D. T. Lauria
G. v. R. Marais
D. A. Okun
J. K. Sherwani

APPENDIX H - INSTRUCTIONS TO PARTICIPANTS
ON PREPARATION OF FINAL REPORT

Each participant in the International Program of Sanitary Engineering Design is required to submit a written final report on his total experience during the assignment. This is to be submitted in Chapel Hill following his assignment to the terminal phase of the program (usually with a consulting firm), and immediately before his return to his own country.

The following outline will assist in the preparation of this report. It will indicate the scope of reporting ordinarily to be expected, but need not be followed exactly, in every instance. It should serve rather as a general guide.

Keep a daily log or abbreviated diary of your activities on the program. This will be of help in writing the final report. The diary will constitute a refresher (particularly with respect to full names of persons, places, dates, etc., and will save time in this sense). It will also be a fine memo book for the future.

The purpose of the report is to help us in evaluating your experience, and to plan more effectively for future programs. The report itself will also serve the participant as excellent reference material for the future.

On the next page is a suggested form for the report which you may find useful in its preparation. Content is outlined below.

REPORT

Identify the writer by full name, permanent address, and office held in your own country. Also give the name of the organization which supplied you with the funds for participation and your adviser.

Substance of the Report:

- I. **Academic Phase of the Program (dates of attendance):**
 - a. discuss topics in which academic work was conducted, such as the world program in water supply, hydraulics, hydrology, development of ground water supply, development of surface supply, conduct of and reporting on preliminary studies, sanitary chemistry, sanitary biology, materials of construction, waterworks equipment, waterworks control equipment, design problems, organization, management, and financing. In this consider adequacy of coverage, suggestions for improvement in any aspect of the work, value of homework or problem sessions, importance of notes and reference material furnished you. Include work on sewerage, if any.

PREPARATION OF FINAL REPORT, continued

- b. field trips: number and character, what is gained from them; what information of value obtained.
 - c. attendance at national and local waterworks' meetings: papers of major importance to you; value of exhibits; enlarged acquaintance of the profession.
 - d. general commentaries on this phase of the program and suggestions for improvement.
2. Municipal Phase of the Program: Municipality to which you were assigned, and with whom associated on the job; dates of attendance; type and capacity of waterworks (and of sewage treatment plants if included); by whom designed, method of treatment, operating features of collection system, treatment plant, and distribution system; organization of personnel and delegation of responsibilities; financing and rate structure, metering and collection of bills for service; provision for planning and future design. Submit copies of municipal reports or other material that might give some of this information, to supplement your own, or offered in substitution of too much descriptive writing on your part, but not to eliminate basic reporting.
3. Design Office Phase of the Program: dates of attendance; name of firm and location.
 - a. organization chart, showing chain of responsibilities and their nature for partners or principals, and employees.
 - b. projects handled by the organization illustrative of its scope of operations in preliminary project studies, special investigations, design (structural, architectural, mechanical, electrical, hydraulic, and process), and supervision of construction.
 - c. library and reference material, how organized and effectiveness.
 - d. laboratory facilities, for what purposes used and how effective.
 - e. your own specific duties and assignments, name of your immediate superior. Opportunity for varied or narrow experience, whether or not experience applicable to work in view, in your own country.
 - f. submit sample reports, plans and specifications related to your own assignment, and make suitable reference to them in your report.
 - g. general commentaries on this phase of the program and suggestions for improvement.

PREPARATION OF FINAL REPORT, continued

FORM OF REPORT

Put report in binder, with abbreviated title, date, and name of author on the outside of the binder. Make an inside cover sheet, with full title, date, name of author, and his permanent address in the form of a title sheet.

SUMMARY: after writing the report, make a brief summary of its contents for the quick review of the reader. Bind this summary immediately behind the title sheet.

REPORT

Purpose

Scope

Academic Phase of Program)

Municipal Phase of Program)

Design Office Phase of Program)

Conclusions and Recommendations

see preceding paragraphs

Sign the report on the lower part of the title sheet. It is further suggested that paragraphs be given numbers and appropriate captions, for ready reference.

APPENDIX J - AN INTERNATIONAL PROGRAM IN SANITARY ENGINEERING DESIGN

The following paper was written for presentation at the International Conference on Water for Peace, to be held in Washington, D. C., May 23-31, 1967.



International Conference on **WATER for PEACE**

May 23-31, 1967

Washington, D.C.

Topic IX C of the Agenda
Author's Name: James C. Lamb III
Co-Author's Name: Donald T. Lauria

Original Language: English
Author's Country: United States of America
Author's Affiliation: Department of Environmental Sciences and Engineering,* School of Public Health, University of North Carolina, Chapel Hill, North Carolina 27514

AN INTERNATIONAL PROGRAM IN SANITARY ENGINEERING DESIGN

Several speakers at this conference are discussing in detail the serious and growing water problems in many areas of the world, their health and economic implications, national and international needs in water resources development, and numerous past, current, and proposed approaches for solution of the problems. Accordingly, the authors of this paper do not intend to add their review of general and broad aspects of the international water situation. Instead, the purpose of this paper is to describe the background and current status of a unique and well-established program at the University of North Carolina, which is directed towards meeting a universal educational need in the water resources field.

Successful evaluation and solution of all water resources problems to be discussed at this conference will depend to a critical extent upon availability of qualified personnel throughout the many countries of the world. These must include persons of many different backgrounds, having technological qualification ranging from routine operators and technicians to the highest level of engineering planners.

One group clearly required for successful attack on water supply deficiencies is a category of design engineers capable of intelligent planning and effective leadership in shaping technological approaches appropriate for solution of specific problems. These are the individuals who must assume responsibility for making the preliminary engineering studies and reports, collecting and interpreting information necessary for project financing, guiding the preparation of plans and specifications, supervising construction of water supply and wastes disposal facilities, and providing for development of procedures and personnel to insure effective maintenance and operation of the completed facilities. Usually, they also occupy key roles in the training and development of other engineering planners and designers who work under their supervision. Preparation of this group of essential individuals is the focus of efforts in the International Program in Sanitary Engineering Design (IPSED).

Nature of the Problem

Most of the developing countries are not yet in a position to initiate and maintain educational programs tailored for preparation of this small but important group of sanitary engineering design leaders. Traditionally, the relatively few persons in each country who are selected for these roles have been sent abroad for further study, many of them attending schools in the United States or Europe, for example. Frequently, this educational approach has provided excellent results and could be classed as eminently successful. On the other hand, certain chronic problems have been observed to recur, sometimes seriously diminishing its potential effectiveness.

Perhaps the most obvious problem is the radical differences which may exist between sociological and technological situations in the student's home country and those in the country where advanced education is undertaken. In the United States, for example, most academic programs leading to M.S. or Ph.D. sanitary engineering degrees are necessarily oriented to conditions prevailing in this country, because most of the students originate and will practice here throughout their careers. Accordingly, much of the technology which is taught, especially in the design area, is appropriate primarily for application in this country. A foreign student completing such a

program and returning to his homeland usually is confronted with the fact that much of his hard-earned knowledge would be impractical for direct application under local circumstances prevailing there. In some instances, the individual views this as a challenge and uses his formal education as a basic foundation upon which to build new technological viewpoints for developing solutions more appropriate under local conditions. Obviously, however, much of the effort and expense of obtaining his education is less effective than it might have been had the program been tailored more closely to his own specific needs.

In other instances, the reaction is much less favorable and leads to increased frustration at the incompatibility between his educational background and needs of his country. Frequently, the end result may be selection of design alternatives with which the engineer has become familiar during his education, and for which technical information already is conveniently available to him. Although desirable under other circumstances, these approaches sometimes may be completely inappropriate to the specific problem and local circumstances. Brown and Okun [1] have described several specific examples in which water supply facilities in other countries have been based too much on United States or European practices, with little or no attention to utilization of local materials, personnel, and techniques. Obviously, this may result in serious design errors, waste of limited financial resources and, occasionally, installation of facilities which cannot be operated efficiently.

All too frequently, another serious result may be emigration of the individual back to the country in which he studied, or to some other country where he may have a greater feeling of technological compatibility. Currently this very serious problem is being referred to as the "Brain Drain". Of course, it tends to defeat completely the purpose of an international educational program, leaving the developing country in a condition even worse than that ~~that~~ would have existed had the promising candidate been denied his foreign education. These problems in educating engineers abroad for work ultimately in their home countries have been recognized in general for a long time. It is evident that existing academic programs are providing valuable background for many individuals, especially those involved in teaching and research in countries having such activities. Further, it may be concluded that design engineers who undergo such education in this country and subsequently return to, and remain in, their homelands eventually are significantly better prepared to make major contributions in planning and development of water resources in those countries. Nevertheless, it appears obvious that the usual academic degree programs provide considerably less than optimum preparation for design engineers from developing countries. Accordingly, a few years ago, sanitary engineering leaders in United States government and education, who were actively responsible for international training, reached the conclusion that needs of many foreign students could be met better by instituting a special type of training program, tailored specifically to their requirements.

Goals of the Program

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

The overall goal was to develop a unique program, specifically aimed at training practicing engineers in the conception, design, construction supervision, and operation of water supply and wastewater disposal projects appropriate to widely varying local needs. It was planned to be a complete program in its own right, not part of an existing academic curriculum, and especially tailored to the needs of engineers who are, or probably will be, leaders in the design of water facilities in developing countries. The basic philosophy and approach throughout has been to provide technical background and encouragement to participating engineers to use techniques specifically appropriate to local conditions, without relying upon United States or European practices except as sources of engineering information and basic concepts. As indicated by Brown and Okun [1], "The program is planned to give engineers the confidence to make design decisions allowing the best use of the nation's resources."

Nature of the Program

The types of problems under attack and specific project goals have required an approach which is unique in several respects. In the first place, it was felt that maximum impact would be realized if participants were restricted to individuals already experienced in sanitary engineering and working in developing countries. The person envisioned as an "ideal" participant now is, or probably soon will be, in a highly responsible leadership position in one of his country's public

Lamb, James C., III

or private sanitary engineering organizations. A prerequisite for admission is that he must already have an engineering degree, plus specialized experience or advanced education in sanitary engineering. His academic and professional credentials must be approved by the IPSED faculty before admission.

Engineers who participate are selected by agencies in their own countries and are sponsored under fellowships awarded by the United States Agency for International Development, the World Health Organization, the Pan American Health Organization, the United States Public Health Service, or other international groups. Usually, the participant agrees that upon completion of the program he will return to his country of origin for a period of time specified by the sponsoring agency. In addition, his employer must assure that he will be assigned, upon return, to a position at least equal to that held prior to his training, in which the newly acquired knowledge can be applied.

Because the overall goal is to provide a type of training not offered in any conventional academic setting, this project has been organized apart from regular functions of the Department of Environmental Sciences and Engineering. Special faculty members have been brought to the University to organize, administer, and conduct the training, all of whom have experience as practicing design engineers. Other faculty members in the Department participate in the program, primarily by lecturing on selected technical subjects. None of the participants attend regular academic classes in the Department because the IPSED schedule requires full-time participation throughout each day.

The total duration of training for most participants is approximately one year, and includes three integrated phases--the academic, the municipal, and the design. The academic phase lasts for approximately three months, during which the participants reside in Chapel Hill and attend special classes five days per week. The mornings are devoted to work on an integrated planning and design problem, which continues throughout the entire three months of study. Maps and data of the kind needed for planning water and sewerage systems are supplied to the students. Lectures are presented describing how to analyze the data to determine design requirements, and the students prepare preliminary plans, including scaled layouts, of proposed facilities. Estimates of costs are prepared and financing details, as well as rate structures, are investigated.

The preliminary planning work occupies the mornings of approximately one-third of the total academic training period. Upon its completion, each student prepares final plans, including major design features of his proposed facilities. Appropriate equipment is selected, piping and unit layouts are completed, and the control and electrical designs are discussed. The design work ends with a careful consideration of project specifications.

Afternoons of the academic phase are devoted primarily to study and discussion of design and planning problems and related topics, under close supervision of the IPSED staff. A number of field trips are made to projects of interest in the vicinity of Chapel Hill. Internationally known experts on various aspects of planning and design visit the group as guest lecturers.

Emphasis in all instruction is on planning and design of sanitary engineering facilities. In addition to the planning and design problem, already described, specific topics of instruction include: world-wide water problems, statistics, sanitary chemistry, biology and limnology, hydrology, hydraulics, pumps and pumping, water and wastewater treatment processes, stream sanitation, mechanical and electrical plant equipment. However, many of these subjects are not covered in the breadth and detail of usual academic programs. The emphasis is placed only on those applied aspects of each topic considered to be essential knowledge for design of sanitary engineering facilities.

The informal methods of teaching encourage class participation and favor interchange of information and experiences among the participants on engineering problems in their homelands. Throughout, the IPSED faculty, which has broad international experience, works intimately with the participants, stimulating discussion and extending the range of examples and case histories.

Upon completion of the academic phase, each participant is individually assigned for approximately one month of residence in a selected municipality for observation and experience in the day-to-day operation of water and wastewater facilities. The municipal officials who cooperate with the IPSED staff direct activities of the participant to insure that he gains experience and insight into plant operating routines, process control, record keeping and reporting, management, financing, and planning for the future. Since emphasis in the program is on design, participants are encouraged to use the municipal phase of training as an opportunity to become familiar with desirable features of existing plants so that these might be incorporated in their own designs. The participants also learn about undesirable features which should be avoided.

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For the remainder of his tenure in the United States each participant is assigned to the office of a well qualified consulting engineer specializing in water and wastewater projects. The cooperating consultant attempts to supply to the participant experience which will provide maximum insight into the operation of a design office and the elements involved in planning, designing, and constructing water supply and wastewater disposal facilities of various types. Insofar as his capacity permits, the participant shares in the work of the firm, including the planning, reporting, specification writing, design of structures, preparation of plans for projects currently in the office, and supervision of construction. Frequently, it is possible to place him with a consultant who is actually planning or designing facilities in the homeland of the participant.

Additional aspects of the program of each participant include travel to one or more national meetings of organizations concerned with water supply and wastewater disposal, regional meetings of such organizations, visits to a substantial number of industrial and municipal facilities and, occasionally, attendance at selected short courses which may be of special significance for him in his future work at home.

After the design phase, the participant returns to Chapel Hill to submit a complete report on his experience and his evaluation of different phases of the program. Upon successful completion, he receives a special certificate showing that he has completed all work expected of him in a satisfactory manner. As presently constituted, he does not receive academic credit for the program, nor a degree from the University. It is possible that in the future some portions of the academic phase may be offered for graduate credit to those participants who so desire. This would not involve any change in the purpose or scope of the program, but would be formal recognition by the University of those activities deemed to be appropriate in an academic sense.

One participant, upon successful completion of his program, has remained at the University for an additional year to obtain a Master of Science in Sanitary Engineering in the usual academic program. This was accomplished with the approval and support of his home agency and his sponsoring agency. Two others have completed similar degree programs at other universities, and subsequently, all have returned to their homelands.

It is highly significant to note that the program structure and method of selection of participants result in return of all of them to the country of origin and application of knowledge gained to local problems. To date, over fifty engineers, from more than twenty different countries in Africa, Asia, Latin America, and the Middle East, have participated in the program and all have returned to their home countries to occupy positions of responsibility. There has been no instance of a participant in this program returning to the United States to establish permanent residence.

Overseas Activities

As an extension of the International Program in Sanitary Engineering Design, portions of the academic phase also are being offered at the Universidad Nacional de Ingenieria in Lima, Peru. This instruction is being given in Spanish, which eliminates a language barrier for many individuals. Also, its presence in Lima makes it much more readily available to Latin Americans than the Chapel Hill program. It is being conducted under the joint, full-time supervision of an IPSED faculty member, from Chapel Hill, and a professor at the University in Lima. The latter was one of the early program participants in Chapel Hill. It is anticipated that, after the first two years, the Lima project will continue under supervision of the Peruvian faculty, with support from Peruvian government agencies and the United States Government.

A most important element of the Lima operation has been the emphasis placed on applied research, conducted by students and faculty, pertinent to specific problems in that country. This very active research has been supported by Peruvian water supply agencies, and details of the program were described in two recent papers. [2,3]

International Publications

Another important aspect of the IPSED program has been the initiation of a new and continuing publication, Water Supply and Sanitation in Developing Countries. The purpose of the publication is to facilitate and encourage exchange of practical information among engineers in developing countries. Existing international communication of this type of knowledge has been grossly inadequate because of limited circulation of publications among practicing engineers in developing countries and because no publication has encouraged exchange of the specific types of information most needed by those persons.

Recognizing this need for better communication, the IPSED project has initiated a series of publications which are concerned particularly with activities of design and field engineers - to

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assist them by collecting and distributing information on common problems, new developments, designs, operating experiences and procedures that experience has shown to be successful under conditions prevailing in developing countries. The series is being issued in loose-leaf form, using lithographic reproduction. Each subject item is developed from information received from contributors, or otherwise available from international agencies, and published as a separate paper. They are being compiled from personal communications, reports, papers, literature surveys, etc. The principal source, however, ultimately should be from the engineers and administrators presently concerned with water supply and sanitation in developing countries.

Because of severe demands on the time of such individuals, and occasional language difficulties, the IPSED staff is assuming the responsibility for compiling and editing information which may be submitted in informal style. Full recognition is given to each contributor to the series, making it possible for readers to contact contributors personally to obtain additional information, if desired.

An additional function of the publication will be to identify design problems in water supply and sanitation that are most common in the developing countries. It is anticipated that publication of problems having general interest could attract information on solutions which may be available elsewhere, or may provide the stimulus for applied research to find a solution.

The first eleven publications in the series have been completed and mailed free of charge to an extensive international list of individuals. Additional copies have been sent to each AID local mission for distribution to key personnel in the several countries. Other publications in the series now are being solicited on a global basis and will be distributed periodically.

It is felt that this series of publications could become a very valuable means of communication on problems and solutions of problems pertinent to developing countries. Ultimately, success of the endeavor will depend upon active support of interested personnel in the field. To date, reaction to the publication by persons in many countries has been most favorable, and the prospects for its success appear to be very promising.

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