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DEPARTMENT OF ENVIRONMENTAL SCIENCES AND ENGINEERING

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

REPORT ON THE FIFTEENTH SESSION

of the

INTERNATIONAL PROGRAM IN SANITARY ENGINEERING DESIGN

Prepared for

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

1974

A.I.D.
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Contents

	<u>Page</u>
Letter of Transmittal	iii
Background	1
Uniqueness of IPSED	1
Resumé of IPSED	3
Report on the Fifteenth Session	5
1. Authority	5
2. Description of Purpose	5
a. Academic Phase	5
b. Field Trips & Professional Meetings	5
c. Municipal Phase	6
d. Consulting Office (Internship) Phase	6
e. Corollary Activities (Professional & Social)	6
3. Qualifications and Support of Participants	6
4. Supporting Agencies	7
5. Facilities for Conduct of the Program	7
a. Campus Classroom	7
b. Extra Classroom	7
c. Office Facilities	7
d. Car Pool	7
e. Lodging and Transportation	7
f. Collaborating Municipalities	7
g. Collaborating Engineering Offices for Design Phase	8
Appendix A: Fifteenth Session Faculty & Staff	9
Appendix B: Fifteenth Session Participants	10
Appendix C: Consulting Firms	23
Appendix D: IPSED Curriculum	25
Appendix E: IPSED Class Schedule	26
Appendix F: IPSED Classroom Lectures	27
1. ENVR 170: WASTEWATER COLLECTION AND TREATMENT	27
2. ENVR 173: DESIGN OF HYDRAULIC STRUCTURES	28
3. ENVR 175: SANITARY ENGINEERING DESIGN IN DEVELOPING COUNTRIES	29
4. ENVR 181: GROUND WATER HYDROLOGY	30
5. ENVR 182: WATER RESOURCES PLANNING IN DEVELOPING COUNTRIES	31
Appendix G: Field Trip Itinerary for Fifteenth Session	32
Appendix H: Fifteenth Session Field Assignments, 1973-74	33
Appendix I: Certificate of Achievement	36

THE UNIVERSITY OF NORTH CAROLINA
AT
CHAPEL HILL

THE SCHOOL OF PUBLIC HEALTH
DEPARTMENT OF
ENVIRONMENTAL SCIENCES AND ENGINEERING
ZIP CODE 27514

INTERNATIONAL PROGRAM IN
SANITARY ENGINEERING DESIGN
PHONE: AREA CODE 919
966-1171, 966-1252, 966-2129

October 1, 1974

Mr. A. Dale Swisher, P.E.
Environmental Health
Office of Health
Technical Assistance Bureau
Department of State
Agency for International Development
Washington, D.C. 20523

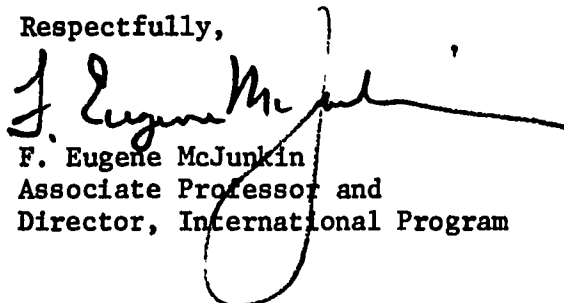
Dear Mr. Swisher:

In accordance with our Contract AID/csd-1888, we are pleased to submit our report on Task Order No. 11 covering all phases of the Fifteenth Session of the International Program in Sanitary Engineering Design.

The work herein reported was carried out under the provisions of this contract between the U.S. Department of State and the University of North Carolina at Chapel Hill.

We wish to thank you and your predecessors for your cooperation and support in all aspects of this important work.

Respectfully,



F. Eugene McJunkin
Associate Professor and
Director, International Program

FEM/tcw

Background

The International Program in Sanitary Engineering Design (IPSED) is conducted by the University of North Carolina at Chapel Hill under contract with the Agency for International Development of the United States Department of State. It has been in operation since 1962, and until 1967, one or two sessions were held each year, depending upon demand. Since 1967, only one session of the Program has been conducted yearly. Earlier reports on the previous fourteen sessions of IPSED are on file. It is intended to make each report complete in itself at the risk of some repetition to those who would read them all.

The need for more water for more people in developing countries is recognized as basic. 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 sketch 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.

Uniqueness of IPSED

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.

Many of the developing countries have not yet provided 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.

The most troublesome factors encountered with prevailing programs for study in industrialized countries stem from the radical differences which may exist between 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 availability 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 degree 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 is usually confronted with the fact that much of this hard earned knowledge would be impractical for direct application under his own local circumstances. 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 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, leading to most undesirable consequences.

The newly graduated sanitary engineer entering practice within the United States generally must serve an internship of several 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 professionals 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 procedure.

In the United States, the tendency in water and wastes treatment plant design has been, over the years, to supplant simple processes and treatment devices, generally characterized by relatively low investment but high 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 technologically 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 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 worked successfully in this program.

A 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 are such that all but one of the over 130 participants have returned after completing the program, as intended, to do the work needed at home.

Resumé of IPSED

Participants in the Program are brought to the United States for work that takes about a calendar year; shortened programs are arranged in cases where time and funds are limited. This work is carried out in three successive and coordinated phases, which are as follows: (1) a semester of special courses at the University of North Carolina; (2) one month at a municipal waterworks, for operating experience; and (3) an internship of about six months with an engineering organization engaged in the design and supervision of construction of water and sewerage works. The first phase is carried out in classes which all participants attend as a group. The second and third phases are worked out individually for each participant, in such fashion as to insure maximum benefit to him in view of his probable responsibilities after his return to his country of origin. The second and third phases are supervised by the University so that all three phases are properly correlated.

The Fifteenth Session began August 21, 1973 with the arrival of the first participant; in all there were 14 men from 8 different countries representing Asia, Eastern Europe, and Latin America. (See bio-data sheets on participants.) After an eight-day orientation, classes began August 30, the last day of classes was December 7, and exams were over December 20. During the intervening four months, the participants completed the academic portion of the Program which consisted of five courses in the Department of Environmental Sciences and Engineering, various field trips, attendance at a national professional meeting, and additional special lectures by visiting consultants.

Orientation was an intensive period of acquainting the participants with the area and the campus, settling them in their rooms in the graduate dorm, shopping trips and registration. When the participants arrived they were met by someone from the IPSED office, usually the administrative manager and a graduate student from the department. Rooms had been reserved in the graduate dorm, Craige Hall, for single participants and those without their families. There were also tours of the town and the campus, as well as several welcoming parties given by the IPSED Faculty and the Department of Environmental Sciences and Engineering.

The curriculum in the academic phase of the Fifteenth Session of IPSED was similar to that of previous sessions. The academic phase included a one semester program of both refresher and new material in such courses as water works design, hydraulics, hydrology, wastewater works design, and planning. Class schedules are worked out jointly by each participant and the IPSED Director. Because of the varied background of the participants, substitution of other Departmental courses was occasionally made in course work to avoid repetition of former work or where there were deficiencies. Much of the material for the courses was duplicated and issued to participants for reference and permanent retention.

Following the fall semester academic phase of the program, most participants were assigned to water treatment plants for one month, usually in North Carolina.

For design assignments from one to six months efforts were made to match a participant's interests with a firm doing work of that nature and especially with those firms doing work in a participant home country. (See "Field Assignments" for Municipal and Design Assignment Roster). The IPSED Office helps with travel plans and locating housing for the Municipal phase. The host water plants and design offices are a great help with locating housing for the participants.

Each participant submits a report to the IPSED Director on completion of his personal program. Each participant is awarded a Certificate of Achievement (see Appendix I) on satisfactory completion of the program.

REPORT ON THE FIFTEENTH SESSION OF
THE INTERNATIONAL PROGRAM IN SANITARY ENGINEERING DESIGN

1. Authority: The work herein reported was carried out under the provisions of Task Order No. 11 of the Contract AID/csd-1888 between the U.S. Department of State and the University of North Carolina at Chapel Hill. The contract is an extension of and supersedes earlier Contracts AID/csd-718 and AID/csd-362.
2. The International Program in Sanitary Engineering Design: The International Program in Sanitary Engineering Design (IPSED) came into existence 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 engineering training program encompasses the following:

- (a) Academic Phase: A curriculum is set up for a one-semester course of both refresher and new material in such categories as have been previously mentioned (see page 25). Much of the material is written for the course and is issued to participants for reference. All instruction is in English. 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 water-works or sewage treatment plant, usually within North Carolina—a state which is well supplied with excellent municipal utilities of this character. Since the groups are limited in size (twenty participants or less), individual attention is given in the work.

Participants in IPSED can receive, at their option, up to eleven semester hours of postgraduate credit for successful completion of the courses. Application for enrollment for credit may be made after arrival at the University. Those students not enrolling for credit attend all lectures but may have a lighter work load, at the option of the teacher.

- (b) During the semester the participants went on several field trips. Locally, the participants went to the Chapel Hill, Raleigh, and Durham water works. For the past few years an extended field trip has been undertaken by the participants, two trips have been to the southeastern United States; last year's trip went north to New York City. This year the group attended the Annual Environmental Engineering meetings of the American Society of Civil Engineers (ASCE) in New York City, October 29 through November 1, 1973. On this same trip they toured the BIF plant in Providence, Rhode Island. (See Appendix G for the itinerary of this trip.)

On November 16 they attended the annual meeting of the N.C. ASCE in Durham, N.C. In September they visited the Wrightsville Beach Test Facility and the Wilmington Water Treatment Plant.

- (c) Municipal Phase: In the municipal phase; following the academic phase, the participants are assigned individually to various water-works for operating experience to learn the intricacies of operating and sometimes of management problems. Most of the municipalities selected are within the state of North Carolina. At times, for special reasons, participants have been sent as far afield as Los Angeles, California, and to St. Louis, Missouri. A list of collaborating municipalities is given under Appendix H.
 - (d) Consulting Office (Internship) Phase: In the consulting office phase, which follows the municipal phase, participants are assigned individually to engineering offices for an internship period varying in length but ordinarily about six months. These are selected with the participant's needs in mind and in relation to the work done in the particular office. In many instances, he will work on projects which the firm is handling for the participant's home country. A list of collaborating engineering firms is given Appendix C.
 - (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 to listen to important papers, to visit equipment exhibits, and to enlarge their professional acquaintance while seeing a professional society in "action". 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 participants. They have also attended some state and regional meetings of these societies closer to Chapel Hill and near their consulting assignments. 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. Special attention is given to married couples where participants are accompanied by their spouses. Shopping trips have been arranged and arrangements are made for participants to take part in University student activities and local cultural events. The University's international student office operates special visitation programs during University holidays. Several participants visited in homes and churches in small towns in North Carolina during the 1973 Christmas holidays.
3. Qualifications and Support of Participants: Participants were all graduate engineers with some practical experience and with competence in English. They were recommended by their sponsoring agencies and firms. Following acceptance by the parties to this contract, they come to this country for the period of their fellowship, usually twelve months, during which time they are paid living and travel expenses or a stipend. These stipends are financed by the supporting agencies WHO, AID, or by others who may offer scholarships and fellowships for the purpose (see Appendix H).

4. Supporting Agencies: The agencies which have given scholarship and financial aid to participants include the Agency for International Development to the U.S. State Department, the Pan American Health Organization, the World Health Organization itself, the Organization of American States, the Ford Foundation, and the United Nations. In addition, participants are sometimes supported, as were two students this session by the government of their home country, through the World Bank. Three of the students were supported by the National Science Foundation of the Republic of China. One student was supported by the Kosciuszko Foundation.
5. Facilities for Conduct of the Program: Facilities for the conduct of Program include:
 - (a) Campus Classroom: A classroom especially equipped for their convenience, with individual desks for each man, is set aside for the exclusive use of the participant groups. The room has visual aid equipment, including projectors for motion pictures and slides and a 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 Staff: In the main building of the School of Public Health, there is a reference room in which plans, specifications, reports, catalogues, reprints, and so forth are kept and made available for classroom use.

Headquarters for the Program is a two-story dwelling (308 Pittsboro Street) near the School of Public Health. This has been equipped for Program purposes. The rooms house the IPSED Director, the Administrative manager, and secretary. Moreover, files, records, reports, etc. and materials relating to the Program and to the Department are kept therein.
 - (d) Car Pool: Field trips for inspection of municipal treatment plants used cars from the University car pool. Chartered buses took the participants on the Wilmington-Wrightsville Beach field trip.
 - (e) Lodging and Transportation: Participants are housed in Craige Dormitory, one of the newer dormitories on campus. Married couples are assisted in locating appropriate housing, whether it be a house or an apartment. Participants are issued bicycles, if they wish one, for use around campus and in town.
 - (f) 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 the following cities:

North Carolina: Chapel Hill, Charlotte, Durham, Fayetteville, Greensboro, Raleigh, and Winston-Salem.

Out-of-State: Hackensack, New Jersey; Philadelphia, Pennsylvania; Newport News, Virginia; Oakland and San Diego, California.

- (g) Collaborating Engineering Offices for Design Phase: For taking participants during the design or engineering internship phase of the Program, we are indebted to the following organizations, many of which have collaborated in this phase of the Program on more than one occasion: (see Appendix C).

Appendix A

Fifteenth Session Faculty

George Eric Barnes Professor of Sanitary Engineering, B.S.C.E., 1923 (Massachusetts Institute of Technology); C.E. (Honorary), 1935 (Case Institute of Technology); P.E.; Emeritus

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

Donald Thomas Lauria Associate Professor in Environmental Engineering and Engineering Associate, B.C.E., 1956 (Manhattan College); M.S.S.E., 1965 (Syracuse University); Ph.D., 1970 (University of North Carolina); P.E.

F. Eugene McJunkin Director of the International Program in Sanitary Engineering Design and Associate Professor of Environmental Engineering, B.C.E., 1955 (North Carolina State University); M.S.S.E., 1961 (University of North Carolina); P.E.

Jabbar K. Sherwani Associate Professor of Systems Analysis and Hydrology, B.S. (C.E.), 1945 (Punjab University); M.C.E., 1947 (Polytechnic Institute of Brooklyn); Ph.D., 1951 (Utah); M.P.A., 1958 (Harvard)

Charles Manuel Weiss Acting Head of the Department of Environmental Sciences and Engineering and Professor of Environmental Biology, B.S. 1939 (Rutgers University); Ph.D., 1950 (Johns Hopkins University)

Fifteenth Session Staff

Charlotte E. Hermann Administrative Manager

Brenda Stoner Secretary

T. C. Stoner Project Assistant

Appendix B

MOHAMMAD ALAUDDIN

FAMILY STATUS: Married

EDUCATION: Bachelor of Science in Civil Engineering:
Bangladesh University of Engineering and
Technology, 1963
Master of Science in Sanitary Engineering:
Northwestern University, Evanston, Illinois,
1968

EMPLOYER: Government of Peoples Republic of Bangladesh
Public Health Engineering
Dacca, Bangladesh

TITLE: Executive Engineer

BRIEF JOB DESCRIPTION: Execution of rural sanitation programs and
water supply programs

SPONSOR: AID

DURATION OF FELLOWSHIP: Twelve months

TRAINING OFFICER: Mr. Frank P. Schwencke

IGOR HALVERN BARBOVITCH

FAMILY STATUS: Single

EDUCATION: Bachelor of Science in Civil Engineering:
School of Engineering at São Carlos City,
University of São Paulo, Brazil.
(Certificate in Engineering)

EMPLOYER: Cis. de Sanebmento da Baixada Santisto
Av. São Francisco, 128
Santos, S.P.
Brazil

TITLE: Civil Engineer

BRIEF JOB DESCRIPTION: Responsible for water and sewerage facilities
built along the São Paulo state coastline

SPONSOR: AID

DURATION OF FELLOWSHIP: Four months

TRAINING OFFICER: Mr. Arthur Angel

JOSE ALBERTO BIENDICHO

FAMILY STATUS: Married

EDUCATION: Bachelor of Science in Civil Engineering:
School of Engineering, University of Panama,
Panama

EMPLOYER: IDAAN (Instituto de Acueductos y Alcantarillados
Nacionales)
P.O. Box 5234
Panama 5, Republic of Panama

TITLE: Project Engineer

BRIEF JOB DESCRIPTION: Inspector of new sewerage constructions

SPONSOR: AID

DURATION OF FELLOWSHIP: Twelve months

TRAINING OFFICER: Ms. Elizabeth Darden

RONG-TSANG CHEN

FAMILY STATUS: Married, two children

EDUCATION: Bachelor of Science in Engineering: National
Taiwan University, Taipei, Taiwan,
Republic of China

EMPLOYER: Taiwan Public Works Bureau 4
Kai-Feng Street, Section 1
Taipei, Taiwan
Republic of China

TITLE: Assistant Engineer

BRIEF JOB DESCRIPTION: Design and planning of water supply systems

SPONSOR: NSC, Taiwan

DURATION OF FELLOWSHIP: Twelve months

TRAINING OFFICER: Mr. H. C. Pan

MR. JUNG JOON CHOI

FAMILY STATUS: Married, four children

EDUCATION: Bachelor of Science in Engineering: College of Engineering, Han Yang University, Seoul, Korea

EMPLOYER: Bureau of Water Works
Metropolitan Government of Seoul
Seoul, Korea

TITLE: Senior Mechanical Engineer

BRIEF JOB DESCRIPTION: Designs mechanical equipment and facilities for the production and supply of city water and supervises the construction and installation work as deemed necessary

SPONSOR: UNDP

DURATION OF FELLOWSHIP: Twelve months

TRAINING OFFICER: Mr. Jerome Margolius

JAHANGIR AHMAD CHOWDHURY

FAMILY STATUS: Married

EDUCATION: Bachelor of Science in Civil Engineering:
Bangladesh University of Engineering and
Technology, Dacca, Bangladesh

EMPLOYER: Chittagong Water Supply and
Sewerage Authority
Chittagong, Bangladesh

TITLE: Executive Engineer in Planning

BRIEF JOB DESCRIPTION: Maintenance of water supply system of the
City of Chittagong

SPONSOR: WORLD BANK

DURATION OF FELLOWSHIP: Twelve months

TRAINING OFFICER: Mr. Van Wagenen

RAFAL MILASZEWSKI

FAMILY STATUS: Married

EDUCATION: Master of Science in Sanitary Engineering:
Warsaw Technical University, 1966; Central
School of Planning and Statistics in Warsaw,
Poland

EMPLOYER: Central School of Planning and Statistics;
Warsaw Technical University, Warsaw, Poland

TITLE: Assistant Professor

BRIEF JOB DESCRIPTION: Teaching and research work in the field of
regional planning

SPONSOR: KOSCIUSZKO FOUNDATION

DURATION OF FELLOWSHIP: Twelve months

TRAINING OFFICER: Ms. Mary Van Starrex

PAUL ADHI NATAPRADJA

FAMILY STATUS: Married, one child

EDUCATION: Bachelor of Science in Civil Engineering
and Master of Science in Sanitary Engineering:
Bandung Institute of Technology, Bandung,
Indonesia

EMPLOYER: Department of Sanitary Engineering
Ministry of Public Works
Jl. Pattimura 20, Kebayoran
Baru, Jakarta, Indonesia

TITLE: Staff Engineer

BRIEF JOB DESCRIPTION: Planning and design for Yogyakarta Water Supply
Scheme; Project Manager for West Java/Jakarta
Sewerage System Project, for Jakarta Garbage and
Sewage Disposal Project, and for Storm-Sewage
Disposal in Pinang, Sumatra; Staff Engineer for
International Assistance Projects

SPONSOR: AID

DURATION OF FELLOWSHIP: Twelve months

TRAINING OFFICER: Mr. Frank P. Schwencke

TARAPADA PALIT

FAMILY STATUS: Married, one child

EDUCATION: Bachelor of Science in Civil Engineering:
Bangladesh University of Engineering and
Technology, Dacca, Bangladesh

EMPLOYER: Chittagong Water Supply and
Sewerage Authority
Chittagong, Bangladesh

TITLE: Executive Engineer

BRIEF JOB DESCRIPTION: Engaged in implementing the project works of
the revised scheme of Chittagong Water Supply
and Sewerage Authority

SPONSOR: WORLD BANK and CHITTAGONG WATER SUPPLY AND
SEWERAGE AUTHORITY

DURATION OF FELLOWSHIP: Twelve months

TRAINING OFFICER: Mr. R. W. Van Wagenen

QAZI GHULAM RASOOL

FAMILY STATUS: Married, four children

EDUCATION: Bachelor of Science in Engineering: College of Engineering and Technology, Aligarh Muslim University, Aligarh (U.P.) India; Master of Engineering (in Public Health): University of Calcutta, Calcutta, India

EMPLOYER: Jammu and Kashmir Government
Public Works Department
Srinagar, Kashmir
India

TITLE: Chief Engineer

BRIEF JOB DESCRIPTION: Drainage projects, sewerage works--execution, management, and control of water supplies; control of pollution to water bodies

SPONSOR: WHO

DURATION OF FELLOWSHIP: Six months

TRAINING OFFICER: Ms. Nancy J. Berinstein

ABU BAKR SIDDIQUE

FAMILY STATUS: Married

EDUCATION: Bachelor of Science in Civil Engineering:
Bangladesh University of Engineering and
Technology, Dacca
Master of Science in Civil Engineering:
Northeastern University, Boston, Mass.

EMPLOYER: Directorate of Public Health Engineering
Government of Bangladesh
Eden Buildings
Dacca, Bangladesh

TITLE: Executive Engineer

BRIEF JOB DESCRIPTION: Execution, supervision, and management of water
supply and sanitation works of government in
the rural and urban areas of the districts of
Bakergans and Patuakhali of Bangladesh

SPONSOR: AID

DURATION OF FELLOWSHIP: Twelve months

TRAINING OFFICER: Mr. Frank P. Schwencke

CHEN-YEE SU

FAMILY STATUS: Married, two children

EDUCATION: Bachelor of Science in Civil Engineering:
National Cheng-Kung University, Tainan, Taiwan,
Republic of China

EMPLOYER: Taiwan Public Works Bureau
17, Ming-Shing Street
Kao Shiung, Taiwan
Republic of China

TITLE: Assistant Engineer

BRIEF JOB DESCRIPTION: Planning and design of storm and sanitary
sewerage

SPONSOR: NSC, Taiwan

DURATION OF FELLOWSHIP: Six months

TRAINING OFFICER: Mr. H. C. Pan

JAW-SEN TSAY

FAMILY STATUS: Married, two children

EDUCATION: Bachelor of Science in Engineering: National
Cheng Kung University, Tainan, Taiwan,
Republic of China

EMPLOYER: Taiwan Public Works Bureau 4
Kai-Feng Street, Section 1
Taipei, Taiwan
Republic of China

TITLE: Assistant Engineer

BRIEF JOB DESCRIPTION: Planning and design of storm and sanitary
sewerage systems

SPONSOR: NSC, Taiwan

DURATION OF FELLOWSHIP: Twelve months

TRAINING OFFICER: Mr. H. C. Pan

Appendix C

Consulting Firms

ALBRIGHT AND FRIEL
Philadelphia, Pennsylvania
ALEXANDER POTTER ASSOCIATES
New York, New York
ALLEY, WILLIAMS, CARMEN &
KING, INC.
Burlington, North Carolina
ALVORD, BURDICK & HOWSON
Chicago, Illinois
BECHTEL CORPORATION
San Francisco, California
BLACK & VEATCH
Kansas City, Missouri
BLACK, CROW AND EIDSNESS
Gainesville, Florida
BROWN & CALDWELL
San Francisco, California
BUCK, SEIFERT & JOST
Englewood Cliffs, New Jersey
BURGESS & NIPLE
Columbus, Ohio
CAMP, DRESSER & MCKEE
Boston, Massachusetts
CARL F. BUETTNER & ASSOCIATES
St. Louis, Missouri
CHARLES T. MAIN, Inc.
Charlotte, North Carolina
CHESTER ENGINEERS
Pittsburgh, Pennsylvania
CORNELL, HOWLAND, HAYES &
MERRFIELD
Corvallis, Oregon
DEPARTMENT OF NATURAL &
AIR RESOURCES
Raleigh, North Carolina
DEPT. OF PUBLIC UTILITIES
Newport News, Virginia
DORR-OLIVER, INC.
Stamford, Connecticut
EAST BAY METROPOLITAN
Oakland, California
ENGINEERING-SCIENCE, INC.
Arcadia, California
FORD, BACON & DAVIS
New York, New York
GANNETT, FLEMING, CORDDRY &
CARPENTER, INC.
Harrisburg, Pennsylvania
GILBERT ASSOCIATES
Reading, Pennsylvania
GREELEY & HANSEN
Chicago, Illinois

HARWOOD BEEBE CO.
Spartanburg, South Carolina
HASKINS, SHARP & ORDELHEIDE
Kansas City, Missouri
HAVENS & EMERSON
New York, New York
HAZEN & SAWYER
New York, New York
HENRY B. STEIG & ASSOCIATES
Indianapolis, Indiana
HORNER & SHIFRIN
St. Louis, Missouri
HOWARD K. BELL
Lexington, Kentucky
HUBBELL, ROTH & CLARK
Birmingham, Michigan
JAMES F. MacLAREN, LTD.
Toronto, Canada
JAMES M. MONTGOMERY
Pasadena, California
J.N. PEASE & COMPANY
Charlotte, North Carolina
JOHN J. BAFFA ASSOCIATES
New York, New York
JONES, HENRY & WILLIAMS
Toledo, Ohio
KENNEDY ENGINEERS
San Francisco, California
KRAMER, CHIN & MAYO, INC.
Seattle, Washington
LALONDE, GIROURARD & LENTENDRE
Montreal, Canada
MALCOLM PIRNIE
White Plains, New York
METCALF & EDDY
Boston, Massachusetts
NATIONAL SANITATION FOUNDATION
Ann Arbor, Michigan
NELSON, HALEY, PATTERSON
& QUIRK, INC.
Greeley, Colorado
NUSSHAUMER, CLARKE & VELZY, INC.
New York, New York
O'BRIEN & GERE
Syracuse, New York
OFFICE OF CITY ENGINEERS
Wyoming, Michigan
PIATT & ASSOCIATES
Durham, North Carolina
PITOMETER ASSOCIATES
Pittsburgh, Pennsylvania

Consulting Firms

continued

ROY F. WESTON, INC.
Newton Square, Pennsylvania
SMITH & GILLESPIE
Jacksonville, Florida
STANLEY ENGINEERING COMPANY
Muscatine, Iowa
STANLEY, GRIMBLE, ROBIN, LTD.
Edmonton, Alberta
STEARNS AND WHEELER
Cazenovia, New York
WHITMAN & HOWARD
Boston, Massachusetts
WHITMAN, REQUARDT & ASSOCIATES
Baltimore, Maryland
WIEDMAN & SINGLETON
Atlanta, Georgia
WILLIAM C. OLSEN ASSOCIATES
Raleigh, North Carolina
WILSON AND COMPANY
Salina, Kansas

Appendix D

IPSED Curriculum

1973-74

- ENVR 170 Wastewater Collection and Treatment: The design of wastewater collection and disposal facilities for small communities. Stressed design criteria, equipment, and systems for use in developing countries. [one or more credit hours]
(See Appendix for Class Schedule)
- ENVR 173 Design of Hydraulic Structures. Hydraulic design for water-works and sewerage projects; open channels; blackwater curves; siphons; transition sections; dams and outlet works; stilling basins; networks; centrifugal pumps; transients in unsteady flow. [three credit hours]
- ENVR 175 Sanitary Engineering Design in Developing Countries. Design of public water and sewerage facilities including intakes, pumping stations, treatment plants, distribution systems and sewerage collections works. Design criteria, equipment, and systems for use in developing countries are stressed. Process, mechanical, electrical, and control aspects of design are included.
[three credit hours]
- ENVR 181 Groundwater Hydrology. Groundwater occurrence and exploration; design, hydraulics, drilling construction, and testing of water wells; operation and maintenance of ground water supply systems. [two credit hours]
- ENVR 182 Water Resources Planning in Developing Countries. Preliminary planning of public water supply and sewerage facilities. Planning objectives and design criteria for developing countries are considered. Course topics include collection and analyses of data, decisions on water quantity, quality, needs for sewerage treatment, location and size of facilities and financing. Preliminary plans, cost estimates and planning reports are prepared by students. [three credit hours]

In addition, there were visiting consultants who lectured and/or conducted short courses on special topics, including the following listing:

Theodore M. Schad, Executive Director, National Water Commission,
Washington, D.C.: "Water Policies for the Future"

S. L. Chang, M.D., Chief of Etiology, NERC, EPA, Cincinnati, Ohio:
"Viruses in Water"

Richard F. Cole, Environmental Engineer, U.S. Atomic Energy Commission
(a former IPSED Director), Washington, D.C., "Design of Water Treatment
Plants (2 days)"

Appendix E

IPSED Class Schedule

1973-74

FIFTEENTH SESSION

- ENVR 170 WASTEWATER COLLECTION AND TREATMENT.
 Professor James C. Brown
 Time: 8:00 A.M. - Tuesday and Thursday
- ENVR 173 DESIGN OF HYDRAULIC STRUCTURES. Sixteen Lectures.
 Professor George E. Barnes
 Time: 10:00 A.M. - Monday, Wednesday, and Friday
- ENVR 175 SANITARY ENGINEERING DESIGN IN DEVELOPING COUNTRIES.
 Professor F. Eugene McJunkin
 Time: 10:00 A.M. - Tuesday and Thursday
- ENVR 181 GROUNDWATER HYDROLOGY
 Professor Jabbar K. Sherwani
 Time: 9:00 A.M. - Tuesday and Thursday
- ENVR 182 WATER RESOURCES PLANNING IN DEVELOPING COUNTRIES
 Professor F. Eugene McJunkin
 Time: 8:00 A.M. - Monday, Wednesday, and Friday
- WEEKLY MANAGEMENT SEMINAR
 Time: 2:00 - 4:00 P.M. Wednesday

Appendix F

ENVR 170: WASTEWATER COLLECTION AND TREATMENT

Subject

Characteristics of Sewage
Small Treatment Systems
Class Presentation
Water Quality
New York City Trip
Degree of Treatment
Process of Selection
Pretreatment
Primary Treatment
Secondary Treatment, Trickling
Filters
Secondary Treatment, Trickling
Filters
WPCF Meeting
Secondary Treatment, Activated
Sludge
Secondary Treatment, Activated
Sludge
Secondary Treatment, Lagoons Reserve Material
Secondary Treatment, Lagoons cont.
Land Disposal and Re-use Reserve Material
Land Disposal and Re-use cont.
Sludge Digestion
Sludge Disposal
Industrial Waste Control Reserve Material
Disinfection
Advanced Treatment Reserve Material
Flow Meters and Misc. Instrumentation
Misc. Planning & Design Consideration
Plant Operation
Financing
Open Session

Reading Material: (1) Fair and Geyer, Water Supply and Wastewater Disposal

(2) Okun, Wastewater Collection and Disposal

(3) ASCE, MOP 36

Field Trips: UNC Wastewater Research Center
Parkwood Plant
Research Triangle Institute Stabilization Pond
Durham (New Hope)
Durham (Northside)
Greensboro

ENVR 173: DESIGN OF HYDRAULIC STRUCTURES

Subjects

Hydraulics Review, General Principles (2 sessions)
Hydraulics and Energy Gradients
Dimensional Analysis and Dynamic Similarity
Origin and Basis of Formulas for Friction Losses
Minor Losses: "K" factors and Equivalent Pipe
Application of Loss Factors in Piping Systems
(with gravity and pumping heads)
Distribution Systems Analysis, Hardy Cross Method
Distribution Systems Analysis, Method of Sections
Principles of Open Channel Flow
(friction and other losses)
Backwater Curves
Hydraulic Jump and Applications
Test
Design of Transition Sections
Design of Grit Chamber Velocity Control Sections
Reservoir Capacity vs. Demand
Design of Stilling Basin
Design of Overflow Spillway and Apron
Flood Routing
Centrifugal Pump: Theory of Operation
Centrifugal Pump: Losses and Actual Operation
Centrifugal Pump: Types Suited to Various Applications
Centrifugal Pump: Specific Speed
Centrifugal Pump: Specifications and Installation Requirements
Centrifugal Pump: Pump Characteristic Curves
Centrifugal Pump: Drawing Curves from Test Data
Centrifugal Pump: Systems Head Curves and Applications
Test
Pump Starting and Stopping, Wet Wall Design for Unsteady
Flow Conditions
Water Hammer
Measuring Devices, Applications and Limitations Weirs,
Proportional Weirs, Orifices, Venturis, Parshall Flume and
Others
Hydraulic Instruments
Hydraulic Gradient through Sewage Treatment Plant
Hydraulic Gradient through Water Treatment Plant
Design of Dams, Masonry
Design of Dams, Earth
Alternate Types of Outlet Works, Flood Routing
"n" for Large Conduits
Wet Well Design for Booster Section
Siphon Design
Sanitary Sewer Design
Storm Water Sewer Design

ENVR 175: SANITARY ENGINEERING DESIGN IN DEVELOPING COUNTRIES

Lectures: Tuesday and Thursday, 10:00 A.M., Room 153

Design Lab: Tuesday, 2:00-4:00 P.M., Room 153

Texts: ASCE, AWWA, CSSE "Water Treatment Plant Design" (1969),
WPCF MOP No. 8, "Sewage Treatment Plant Design"

Subjects

Introduction

Basis of Design, Period of Design

Review of Plans and Basis of Design

Treatment Plant Layout

Field Trip [Chapel Hill Water Works]

Treatment Plant Hydraulics

Screens and Intakes

Design Lab: Water Treatment Plant Design

Aeration and Gas Transfer

Water Treatment Processes

Mixing

Field Trip: Durham Water Works

Flocculation Basin Design

Flocculation Basin Design

Design Lab: Water Treatment Plant Design

Chemical Handling and Feeding

Chemical Feed Installation Design

Design Lab (Testing)

Sedimentation Theory

Settling Basin Design

Design Lab: Water Treatment Plant Design

Flow Distribution

Filtration Theory

Design Lab: Water Treatment Plant Design

Slow and Rapid Sand Filtration

Rapid Sand Filters

Design Lab: Water Treatment Plant Design

Filter Media

Filter Design

Design Lab: Water Treatment Plant Design

Chlorination

Design Lab: Water Treatment Plant Design

Instrumentation and Control

Corrosion

Design Lab (Testing)

Special Topics

Other Field Trips: Raleigh, BIF Corporation (Cranston,
Rhode Island), Wilmington, and Wrightsville Beach
(for details the report summary on "Field Trips")

ENVR 181: GROUND WATER HYDROLOGY

Subjects

Potosity and effective porosity
Permeability
Classification of rocks on the basis of permeability

Geological framework for ground water
Types of aquifers

Groundwater movement
Darcy's law
Aquifer characteristics

Steady radial flow

Differential equations governing groundwater flow
Theis solution
Semilogarithmic approximation
Recovery methods

Pumping tests to determine formation constants

Prediction of drawdown for constant, variable and intermittent discharge

Multiple well systems

Aquifer boundaries
Method of images

Measurement of characteristics of wells
Effective well radius
Partial penetration
Specific capacity
Maximum yield of a well

Design of wells
Drilling methods
Construction of wells
Sanitary protection of wells

Exploration for ground water
Hydrologic equation
Safe yield of an aquifer

ENVR 182: WATER RESOURCES PLANNING IN DEVELOPING COUNTRIES

Subjects

Water and Health
Rationale for Community Water Supplies in Developing Countries
Introduction to the Planning Problem
International Water Supply Congress (Field Trip)
Economics and Public Policy
Engineering Economics: The Time Element
Equivalence
Rates of Return
Comparison of Alternatives
Multiple Alternatives and Purposes
Criteria and Standards
Benefit/Cost Analysis
Capital Budgeting
Cost Allocation
Water Pollution Control Federation (Field Trip)
Preliminary Engineering Studies
Design Periods
Population Forecasting
Water Use
Basis of Design
Economic Project Staging
Quiz
Critical Path Method
Critical Path Method Workshop
Introduction to Systems Analysis
Classical Optimization Methods
Linear Programming (3 sessions)
Other Optimization Techniques
Review
Quiz
Estimation of Stream Flows
Estimation of Floods and Droughts
Estimation of Reservoir Capacity
Estrapolation of Hydrologic Data
Water Rate Structures (2 sessions)
Review

Appendix G

Field Trip Itinerary

Fifteenth Session

Sunday, October 28, 1973: Flight to New York City

- 12:00 Meet in parking lot of Craige Dorm for drive to RDU Airport
1:19 Fly to Newark, New Jersey, on United #824
2:31 Arrive Newark, go to Taft Hotel: 777 Seventh Avenue
New York, N.Y. 10019

Monday, October 29, 1973: Attend ASCE

- 8:00 Meet in lobby of Taft Hotel to go to ASCE at Americana Hotel
and register for convention \$ 15/day

Tuesday, October 30, 1973: Attend ASCE

- 8:00 cont. attending Convention

Wednesday, October 31, 1973: Attend ASCE

- 8:00 cont. attending Convention

Thursday, November 1, 1973: Take train to Providence, Rhode Island

- 12:00 Check out of Taft Hotel and meet in lobby to go to Penn Station
1:10 Southern Crescent leaves for Providence
4:54 Arrive in Providence, check in Colonial Hilton Inn
1150 Narragansett Blvd.
Cranston, Rhode Island 02905

Friday, November 2, 1973: Return southward via New York City & Newark

- 8:00 Check out of motel and meet in the lobby
9:00 Tour BIF Co.
11:30 Lunch
12:54 Depart Providence on Minute Man Train for New York City
4:25 Arrive at Penn Station
6:45 Take United #627 from Newark arriving at RDU at 8:06

Appendix H

INTERNATIONAL PROGRAM IN SANITARY ENGINEERING DESIGN
Fifteenth Session Field Assignments, 1973-1974

<u>PARTICIPANT</u>	<u>AGENCY</u>	<u>COUNTRY</u>	<u>MUNICIPAL ASSIGNMENT</u>	<u>DESIGN OFFICE ASSIGNMENT</u>
ALAUDDIN, Mohammad	AID	Bangladesh	Water and Sewer Department City Hall City of Greensboro Greensboro, N.C. 27402 (Mr. Ray Shaw Tel.: 919 373-2055)	Gilbert Associates 525 Lancaster Avenue P.O. Box 1498 Reading, Pa. 19603 (Mr. J. R. Quin Mr. R. S. McMullen Mr. Raymond T. Kase Tel.: 215 376-3873)
BARBOVITCH, Igor H.	AID	Brazil	[Attended Academic Phase at U.N.C. Now enrolled in Graduate School International House #484 University of California Berkeley, California 94720 Tel.: 415 642-9037]	
BIENDICHO, Jose A.	AID	Panama	Hackensack Water Company 4100 Park Avenue Weehawken, New Jersey 07087 (Mr. Norman S. Nielsen Tel.: 201 863-0500)	Buck, Seifert, and Jost 429 Sylvan Avenue Box 1218 Englewood Cliffs New Jersey 07632 (Mr. George H. Buck Tel.: 201 567-8990)
CHEN, Rong-Tsang	NSC	Taiwan	[Further academic work at U.N.C. Spring Semester, 1974]	Hazen and Sawyer Engineers 360 Lexington Avenue New York, N. Y. 10017 (Mr. Richard Walter Tel.: 212 986-0033)

<u>PARTICIPANT</u>	<u>AGENCY</u>	<u>COUNTRY</u>	<u>MUNICIPAL ASSIGNMENT</u>	<u>DESIGN OFFICE ASSIGNMENT</u>
CHOI, Myung Joon	UNDP	Korea	[Further academic work at U.N.C. Spring Semester, 1974]	East Bay Metropolitan Utility District P.O. Box 24055 Oakland, California 94623 (Mr. Gordon L. Laverly Tel.: 835-3000)
CHOWDHURY, Jahangir A.	WORLD BANK	Bangladesh	Department of Water Resources City of Durham P.O. Box 225 Durham, N.C. 27702 (Mr. Thomas K. Bruce Tel.: 919 682-0503)	[Attending Graduate School Dept. of Civil Engineering University of Texas Arlington, Texas 76019 (Dr. J. E. Caffey Tel.: 817 273-2201)]
MILASZEWSKI, Rafal	KOSCIUSZKO FOUNDATION	Poland	Public Utilities Dept. City Hall, City of Raleigh P.O. Box 590 Raleigh, N.C. 27602 (Mr. J. S. Goodman Tel.: 919 755-6541)	Planning Division Water and Air Office Dept. of Natural & Air Resources 226 Jones Street Raleigh, N.C. 27605 (Mr. John Wray Tel.: 919 796-9141)
NATAPRADJA, Paul A.	AID	Indonesia	Pasadena Water Dept. City of Pasadena 100 North Garfield Avenue Pasadena, California 91101 (Mr. Carl Johnson)	James C. Montgomery Consulting Engineers, Inc. 555 East Walnut Street Pasadena, California 91101 (Mr. Lee A. Francis Tel.: 213 796-9141)
OVIEDO, Francisco J.	AID	Panama	Water and Sewer Dept. City Hall City of Greensboro Greensboro, N.C. 27402 (Mr. Ray Shaw Tel.: 919 373-2055)	Black, Crow and Eidsness P.O. Box 1647 Gainesville, Florida 32601 (Mr. J. I. Garcia-Bengochea Tel.: 904 377-2442)

<u>PARTICIPANT</u>	<u>AGENCY</u>	<u>COUNTRY</u>	<u>MUNICIPAL ASSIGNMENT</u>	<u>DESIGN OFFICE ASSIGNMENT</u>
PALIT, Tarapada	WORLD BANK	Bangladesh	Water Department City Hall City of Fayetteville Fayetteville, N.C. 28302 (Mr. James Freeman Tel.: 919 483-1382)	[Attending Graduate School Dept. of Civil Engineering University of Texas Arlington, Texas 76019 (Dr. J. E. Caffey Tel.: 817 273-2201]
RASOOL, Qazi Ghulam	WHO	India	Bureau of Public Water Supply New York State Health Dept. 845 Central Avenue Albany, New York 12206 (Mr. John C. Bumstead Tel.: 518 457-2091)	Hazen and Sawyer, Engineers 360 Lexington Avenue New York, N.Y. 10017 (Mr. Richard Walker Tel.: 212 986-0033)
SIDDIQUE, Abu Bakr	AID	Bangladesh	Water Utilities Dept. 202 C. Street San Diego California 92101 (Mr. Richard W. King Tel.: 714 236-6164)	Brown and Caldwell 100 E. Huntington Drive Alhambra California 91801 (Mr. L. B. Dunlap Tel.: 213 289-6185)
SU, Cheng-Yee	NSC	Taiwan	[Returned to Taiwan after completing Municipal and Consulting Phases with Kramer, Chin & Mayo, Inc.]	Kramer, Chin & Mayo, Inc. 1917 First Avenue Seattle, Washington 98101 (Dr. Paul Liao Tel.: 206 447-5376)
TSAY, Jaw-Sen	NSC	Taiwan	[Further Academic Work at U.N.C. Spring Semester, 1974]	Malcolm Pirnie, Inc. Two Corporate Park Drive White Plains, N.Y. 10600 (Dr. Paul Busch Tel.: 914 694-2100)

Appendix I

University of North Carolina at Chapel Hill

School of Public Health

Department of Environmental Sciences and Engineering

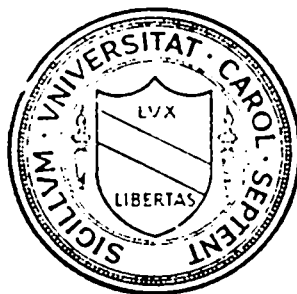
To all persons to whom this writing may come, Greeting:

Be it known that in recognition of the completion of the course of study in the
International Program In Sanitary Engineering Design,
we confer upon

this Certificate of Achievement

This day of 19

Dean, School of Public Health



Head,
Department of Environmental
Sciences and Engineering

Director, International Program
in Sanitary Engineering Design