

931-17-520-563 <sup>9310563-3</sup>

PROJECT STATEMENT

January 22, 1975

PD-AAC-822-D1

A. Summary.

1. Statistical:

27p.

Major Type of Activity: Health and its relationship to Water Supply and Waste Disposal

Project Title: Lower Cost Methods of Water and Waste Treatment in Less Developed Countries (LDC)

New or Extension: Extension - 18 months

Contractor: University of Oklahoma, Norman, Oklahoma 73069

Principal Investigator: George W. Reid, Regents Professor Civil Engineering & Environmental Science

Proposed Extension Period: January 1, 1976 through June 30, 1977

Budget: a) Funds obligated through CY 1975. . . . . \$269,000  
 b) Funds requested through CY 1976, and 1/2 of 1977. . . . . 133,771  
 c) Funds requested by FY 1976 (15 Mos.). . . . . 88,913  
 FY 1977 . . . . . 44,858

Project Manager: A. Dale Swisher, P.E.

2. Narrative:

Research on the present contract has been in progress for 22 months and an additional 12 months are remaining on the present contract. This proposed extension is intended to continue and strengthen this important research. The basic rationale of this project was to forecast which of the many water and waste water treatment processes exhibited maximum compatibility with in-country resources. The first objective is to develop a system of matrices dealing with processes and in-country resources which together would identify processes that would be optimal in terms of in-country resources. These processes could be either low or high technology, but must be appropriate to the ability of a country to supply the resources needed to build, maintain and operate the processes. The second objective, once the matrices are developed, is to conduct a global study at sites which are representative of appropriate and successful applications of water and waste water treatment processes in order to determine if the research approach is conceptually sound and to gather data on the state of the art. After the methodology is developed and tested, the next effort is to document it and determine the procedure in order to bring it to the useful attention of those involved in this activity.

The project to date has developed a methodology for comparing processes and resources directed towards the most compatible in-country process selection. Fourteen in-depth studies are now under contract, at ten global LDC sites, utilizing five different water treatment studies and six waste water disposal processes. In addition to these 14 studies, there are another seven collaborative studies, coordinated through the efforts of other interested groups, that are at no cost to the project. The site contracts are appropriately divided among Latin America, Africa, the Middle East including North Africa and the Far East. The contractual commitments to the 14 studies are \$71,500 and the collaborating ones, that are at no cost to the project, are estimated to amount to \$59,932. In addition to these studies there are smaller contracts on validating the application of the user's model, the historic studies of the use of water and sewage in developed countries, a test of an analytical support kit, a state of the art development and documentation, an innovative technology survey of unpublished information on processes in developing countries, a test of an analytical support kit, a state of the art development and documentation, an innovative technology survey of unpublished information on processes in developing countries, a technical workshop and several global conferences. These studies are mostly being conducted by the staff and collaborating staffs from international agencies and universities. The scope of this program is shown in Table 1.

The delay associated with this project is due to the slowness of individual communications and professional acceptance. Many facets of the project have been worked on by various people around the world and while individuals and organizations have made progress, many are quite jealous of their territorial prerogatives. This barrier has been largely resolved. In fact, the project has developed into a truly global one, with a "snowballing effect" with numerous national and international participants becoming meaningfully involved. The scope of the contracts developed are comprehensive in that the methods of treating water and sewage which may reasonably be used in developing countries are completely covered. The monetary amounts are rather small; the funds paying the sub-contracts are usually only for graduate assistants at universities and/or for providing special materials. Of real importance to the participants is their being involved with the global effort and having a mutual possibility of exchanging information at their various levels of expertise. This has actually separated those interested in money alone from those that are more interested in the concept and rationale.

Emphasis of this proposed extension then, will be to provide for the intensification of a truly global project. Additional time and support is being requested to provide for a more realistic study period and for more emphasis on dissemination and global use-acceptance. The extension in time will give each LDC contractor approximately two years on his contract. It will also provide the project staff with more time to coordinate the cooperative inputs, as well as the contractual

one, to integrate, document and present the final findings. All these efforts will include conducting the global workshop and conferences, short term model tests, preparing the user's manuals, compiling data, documenting the state of the art brochures, as well as making project visits by the staff and consultants.

## B. Purpose and Objectives

For many years LDCs have been using developed countries' technology without modification, often to their detriment in that the water and waste water treatment processes used simply have not been compatible with their in-country manpower and natural resources. Each failure of imported high technology wasted valuable local resources. Not only were public funds normally invested for such development, but the non-effective use of such funds in the particular country also deprived the country of other public services, and in some instances, the failure resulted in the default on loans used to develop water resources and treat waste water.

The main objective of this project is to develop a system of matrices dealing with processes and in-country resources that could be brought together in such a fashion as to identify processes that would be optimal in terms of in-country resources. These processes could be low or high technology, but in either case would be appropriate to the ability of a country to supply the resources to build, maintain and operate the process. An additional objective of this project, after the matrices have been developed, is conduction of a global study of sites representative of appropriate water and sewage treatment processes in LDCs to determine if the conceptual approach is sound, and gathering of data on the state of the art. Once the methodology is developed and tested in the field, the final order of business is to document it and bring it to the attention of those involved.

Questions also arise as to the types of activities necessary to get LDCs acceptance of the most appropriate technology, that is, to determine if LDCs will be willing to use older, tried and proven processes that are more in keeping with their resources rather than developed countries (DC) current technologies. The older types of treatment historically were adequate for DCs as they developed, so an effort will also be made to identify them. Because of the concern for utilization by WHO and UNEP both will assist in the publishing and disseminating of the project material once it is documented and verified by the global studies.

Additional enhancements of the project also include the development of the classification of performance tests to insure the adequacy of any given process, an in-country analytical kit, the identification of manpower requirements and, perhaps, educational remedies such as relevant short courses.

So the specific objectives are:

(1) To develop a system of matrices dealing with treatment processes and in-country resources that will help to identify and select the optimal process(es) in terms of in-country manpower, material and acceptability;

To develop data formatting adequate for these purposes;

To test the model and the user's manual for user acceptability and technical accuracy of the model.

(2) To develop a state of the art document on adequate LDC processes, through literature search, use of experts, LDCs mailing survey, as well as through the development of field validation studies of representative processes which are selected to cover the important processes and the global varieties such as human, social and economic resources, levels of technology, size, climate, etc.;

These studies are to be conducted by LDC contractors assisted and monitored by the University of Oklahoma staff and other experts.

(3) To develop and test an in-country analytical kit for supporting the control and/or the evaluation of treatment processes.

(4) To conduct a Technical Global Workshop on Low Cost Methods of Treatment of Water and Waste Water in Less Developed Countries to bring technical experts and contractors together to exchange ideas, approaches, and findings and to review and evaluate the program;

To integrate the findings into a technical document (or documents) to be published with WHO assistance, and to structure and conduct with UNEP three global conferences to bring the findings to representative decision-makers on the selection of treatment processes in LDCs.

### C. Progress to Date

The detailed matrices are completed and operational; the resources model with a user's manual is completed, computerized and operational; the process matrices that accompany the resource model are completed; the data formatting is completed and has been communicated to the World Health Organization International Reference Center for incorporating into a study to locate innovative technology in LDCs. The needs of water and waste disposal in terms of the demographic and socioeconomic parameters of LDCs are being determined. The problems of data availability are beginning to resolve themselves in sampling and data processing.

As was stated earlier, the work has been undertaken in two broad divisions. One, conducted mostly on campus, involves literature search documentation and the various matrices; the other involves the testing of these matrices and processes under actual LDC global conditions. It was envisioned initially in the proposal, that only three global sites be selected: one in Latin America, one in Africa, and one in Asia. This

approach has been modified since it has become apparent that we need several sites in Latin America (coordinated through CEPIS of the Pan American Health Organization) and perhaps two smaller ones in the Caribbean. It also became apparent that we need sites in the Middle East as well as in Africa. The division there has been between the dry arid and sea contiguous or fringe Middle Eastern Arabic countries and those that are basically in the East and West African domain.

All of the sites have been visited and are under contract. These contracts are tabulated in Table two. (Each project in this table is described in Attachment A.) As has been indicated earlier also, a number of complimentary studies have also been arranged. These are shown as no cost items in Table 2.

The technical experts will function in two roles, one to visit the projects, and the other to assist in the preparation of the State of the Art Documents. The experts have been selected and studies are underway. The historic use studies are underway also; the site data format is being finalized with the cooperation from IRC/NL. The Global Technical Workshop on Low Cost Methods, to be sponsored by USAID, OU, WHO, PAHO, IBRD, and the regional banks, has also undergone preliminary planning.

#### D. Significance and Rationale

An indication of increased relevance that occurred after the project was awarded and study undertaken, was the interest of the United Nations Environment Program (UNEP). UNEP has stated that one of its major concerns is with low cost water and waste water treatment technology for developing countries. After meeting with professionals of the WHO International Reference Center (IRC) and various faculty of many countries, and the presentation of the project at several international meetings, it became increasingly apparent that interest in the objectives of this project was worldwide. Few seemed to share the overall objectives (processes and system.) However, there appeared to be a greater interest in providing information on low cost technology (process model) On the other hand, there are groups such as the Club of Rome and the World Health Organization (WHO) whose activities in systems dynamics and other modeling techniques strongly show the increasing interest in models such as the project's resource model. The project remains unique in that it is attempting to put the two matrices (process and resource) together.

WHO recognizes the need to provide LDCs with appropriate technology guidance and has, in addition to supporting this project by agreeing to assist in the publication of the technical findings, estimated that these activities, plus training requirements and other implementation efforts, will require \$2,000,000 and has requested WHO funds accordingly.

The rationale is sound. Essential services such as water and sewage treatment are prerequisites for LDC's development. Appropriate technology

will make possible an expansion of their facilities with available funds, and will also assure their continuing operation. World banks, consulting engineers, and LDC officials have indicated a willingness to use our output.

#### E. Development of Linkages

The program so far has attracted considerable global interest from both national and international groups who are willing to cooperate in a compatible fashion. These cooperative efforts are shown graphically in Tables 1 and 2. Most of the contractors are also furnishing their own resources in the form of professional services. In addition to the listed contracts, efforts are coordinated with other relevant projects, such as those in Canada (Burton), England (Ives, Don, Bruce, etc.), Holland (Van Damme), Peace Corps (Govaerts) and Dartmouth (Meadows). At most of the sites, contacts with academics, local and national health agencies, USAID, National Science Agencies, WHO, UNEP, etc., are maintained.

#### F. Utilization and Dissemination

To date, Prof. Reid, the principle investigator, Mr. Swisher (AID), and Dr. Talboys (OIH, DHEW) have written and given seven papers at international meetings in Chicago, Tuscon, Bagdad, Mexico City, Bilthoven, El Paso and Monterey.

User manuals for the model, the Data Formatting and the Analytical Kit have been given a rather wide distribution to interested persons for user testing. Global workshops and conferences are programmed. AID, WHO, PAHO missions in particular countries are being kept informed, if not actually involved. The process of contracting with possible participants has also led to a general dissemination in the world of LDC professionals.

#### G. Budget Analyses

The budget presented by the contractor for the extended activities is reasonable and realistic in the scope of project development. It addresses itself to strengthening the LDC contracts and to Oklahoma staff consultation and allows for the development and integration of the findings. The extension will make the study period more realistic and thus assure a better product with emphasis on global transfer and users' acceptance.

A copy of the proposed budget is shown in Attachment C.

#### H. Internal and External Reviews

In the 22 months this contract has been operative, it has been subjected to three reviews: two reports to RAC, one at the conclusion of Phase I and a follow-up report one year later; and the annual Project Appraisal Report (PAR) conducted after twelve months of operation. Copy of the latter is

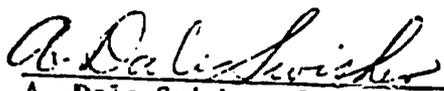
attached as Attachment B. In each case the project objectives and methodology were approved and the reviewers encouraged continuation.

This project statement is again being presented to the interbureau Research and Development Committee prior to formal review by the external Research Advisory Committee.

I. Proposing Office General Evaluation and Recommendation:

This project continues to hold the highest priority among the public health engineering projects supervised by the Office of Health, TAB. It addresses directly the critical problem of providing safe water and adequate waste disposal at low cost including the rural and peri-urban areas. This will significantly improve environmental health and sanitation and reduce pollution levels thus alleviating malnutrition and improving the lot of the poor.

The 18 month extension provides those foreign institutions collaborating with OU more time and permits OU more time to disseminate and insure utilization of their research findings. The Office of Health recommends Agency approval.

  
A. Dale Swisher, P.E.

  
James Banta, M.D.  
Associate Director, TA/H

## ATTACHMENT A

Research Plan

The project is divided into resource and process data, methodology or models, global field model verification and development. The Kit and Predictive Methodology, including a user's manual, are completed. The basic methodology shown graphically in Figure 1, is completed. This computerized program, using socio-economic inputs as well as process cost, predicts costs for operation, maintenance, and construction at four socio-economic levels and four scale levels.

The field work is just starting since it could not start until the technology to be tested in the field was developed. The site selections are developed to assure that all different types of innovative, adaptive and translative technology could be looked at. The literature search by OJ of published sources is completed. The basic data manipulation format has been established as the basis for a proposal made to the IRC to use some 900 participants of the IRC to detect the innovative and unusual techniques that are being done around the world. Documentation for the individual contracts with the global sites has been completed and instructions for the collection and modification of all kinds of relevant data have been undertaken.

The proposed extension of the project is shown graphically in Figure 2, Activities Chart. Ten of the global tests are being extended. The details of each study are discussed in Table 3. The staff support is shown in Figure 2.

These extended studies will require additional site visits. The site visits are indicated: Latin America in February, 1976, Middle East and Africa in June, 1976, and those of the Far East in July, 1976. The purpose of these site visits, in addition to monitoring and assisting in the local investigations will also help to strengthen the linkages between all the studies. (The consultants who will prepare the state of the art papers on water and sewage will also be used on the site visits along with the staff.). Once the draft of the state of the art documents has been developed, it will be presented at the global workshop. The experts, LDC study directors and consultants will evaluate the completed resource model and the global cost and demand studies, as well as experience a face to face exchange with contemporaries. Following the workshop with its suggested modifications and the assimilation of the state of the art papers, the literature surveys, the direct mailings, the cost demand studies, and the historic practices studies, the on-site global studies will be put together and documented, printed by WHO and presented in three UNEP global conferences. The report of the global conferences will constitute the project's final report. The global conferences address themselves to the important aspects on the problems associated with obtaining acceptance of recommended technology by the LDC's.

Because low cost methods are not necessarily low technology, the process matrices are being developed to include all relevant treatments of water and waste water (see Table 4). (This is for the purpose of model development and high technology methods will not be field tested at an LDC site.). Because of the credibility of acceptance, it is planned to study the problems that must be overcome in getting LDC's to use more suitable or appropriate technology.

## PROJECT APPRAISAL REPORT (PAR)

PAGE 1			
PROJECT NO. 563	2. PAR FOR PERIOD: March 1973 to	3. COUNTRY Worldwide	4. PAR SERIAL NO. 1
PROJECT TITLE Research in Lower Cost Methods of Water and Waste Treatment in LIC's			
PROJECT DURATION: Begin FY 1973 Ends FY 76	7. DATE LATEST PROP Aug. 9, 1972	8. DATE LATEST RFP N.A.	9. DATE PRIOR PAR N.A.
U.S. FUNDING	a. Cumulative Obligation Thru Prior FY: \$ 82	b. Current FY Estimated Budget: \$ 66	c. Estimated Budget to completion After Current FY: \$ 121
11. KEY ACTION AGENCIES (Contractor, Participating Agency or Voluntary Agency)			
a. NAME		b. CONTRACT, <del>Serial No.</del>	
Oklahoma University, Norman, Oklahoma		AID/Ci-ta-C-73-13	

## I. NEW ACTIONS PROPOSED AND REQUESTED AS A RESULT OF THIS EVALUATION

A. ACTION (X)			B. LIST OF ACTIONS	C. PROPOSED ACTION COMPLETION DATE
AIC	AID/W	EXEM		
		A.A.		
X	X	X	1) Visit Far East area to select prospective collaborating institutions, type and location of field studies.	1 June 1974
	X	X	2) Meet with PAHO/CEPIS personnel in Latin America to work out specifics of field studies in water treatment plants under subcontract; order equipment, supplies	1 July 1974
	X	X	3) Complete negotiations and sub-contractual arrangements for waste treatment studies with MEIU, Ankara; AUB, Beirut; UST, Kumasi; order equipment, supplies.	1 August 1974
	X	X	4) Finalize format and distribution plans of worldwide survey questionnaire on innovative, simplified methods with WHO/IRC, Netherlands	1 September 1974
	X	X	5) Complete negotiations and subcontractual arrangements with Far Eastern institutions; order equipment, supplies.	1 October 1974
	X	X	6) Refine and decide upon standardized data format, computer process procedures at University of Oklahoma.	1 December 1974
X	X	X	7) Evaluate progress during second year of project and further data collection, consultation needs.	1 April 1975

## ATTACHMENT C

BUDGET

	<u>FY 76</u>	<u>FY 77</u>	<u>Total</u>
<b>I. <u>Contracts (Process Studios)</u></b>			
1. CEPIS	10,000		10,000
8. AUB	7,900	2,180	10,080
9. Turkey	3,150	850	4,000
10. Kenya	1,000	-	1,000
11. Kenya	1,600	480	2,080
12. Philippines	3,850	1,150	5,000
14. Taiwan	5,700	1,800	7,500
16. Indonesia	4,750	1,250	6,000
17. Indonesia	2,250	750	3,000
18. Thailand	<u>2,400</u>	<u>800</u>	<u>3,200</u>
sub total	12,600	8,000	20,600

**II. Staff Operations - Supervision, State of the Art, Consultation, Synthesis, Documentation, Publication, Workshops, Conferences, and Dissemination.**

Salaries

Principal Investigator (Reid) 1/4 FTE for 15 months 3/4 FTE for 3 months	8,625	10,350	18,975
Asst. Director/Editor (Martin) 1/8 FTE for 12 months 1/4 FTE for 6 months	2,250	2,250	4,500
Sanitary Engineer/Systems Analyst (Law) 1/2 FTE for 12 months	3,000	1,500	4,500
Graduate Assistant (Maig)	3,800	600	4,400
Secretary, 1/2 FTE for 18 mos. sub total	3,800 19,875	900	4,700
<u>Fringe Benefits - 13.5%</u>	2,683	2,065	4,748

Consultant - Experts

(Canter, Ayoub, Miller, Huisman, Malina, Meadows)	2,500	2,000	4,500
<u>Supplies, services, communi- cations and Reports</u>	2,625	525	3,150

Staff Travel

(Consultations, Conferences, etc.)	7,500	7,500	15,000
<u>Indirect Costs - 56% personnel</u> sub total	11,130 24,315	8,568	19,698

<b>III. <u>Total</u></b>	<u>24,315</u>	<u>15,958</u>	<u>40,273</u>
			133,771

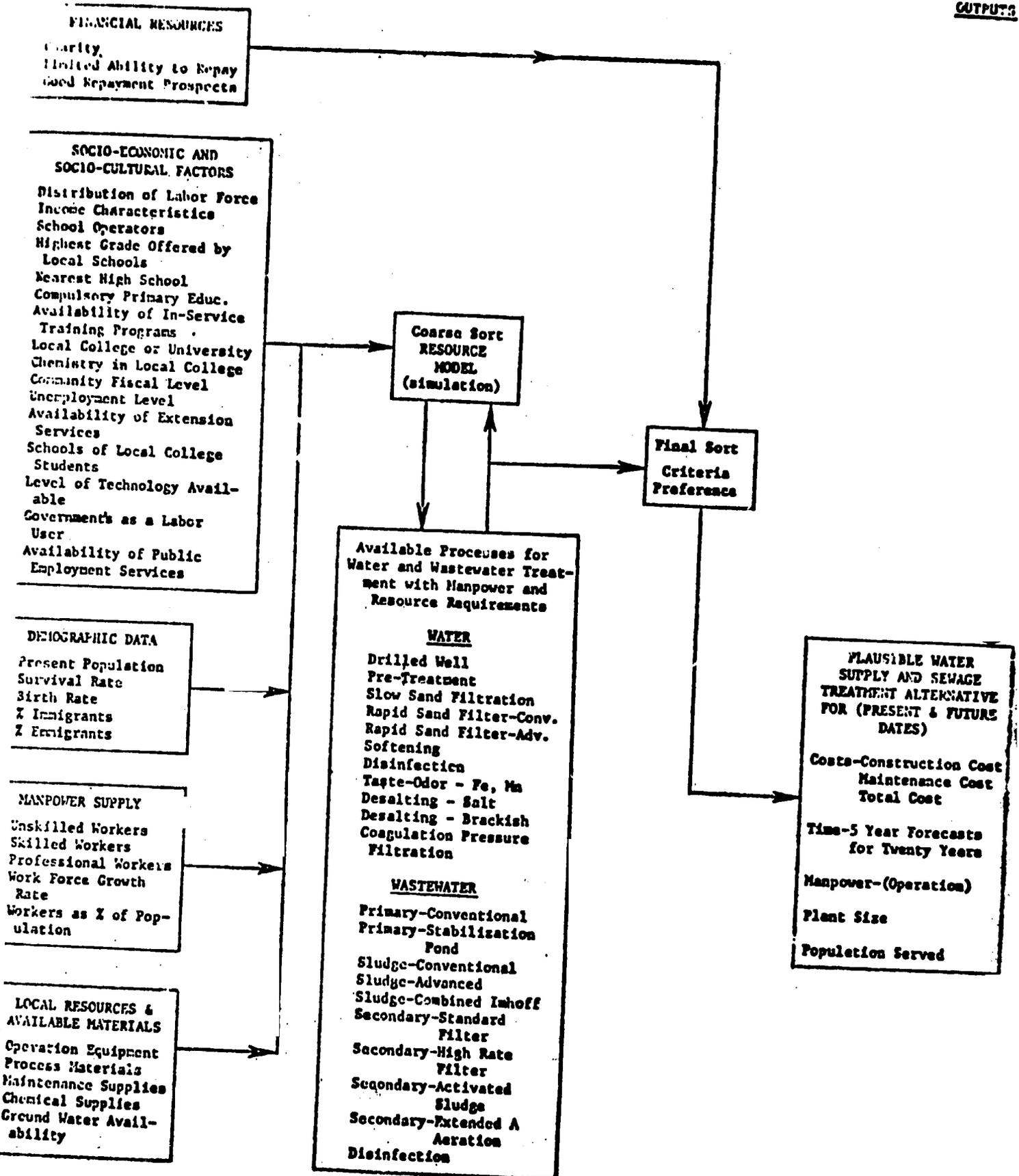
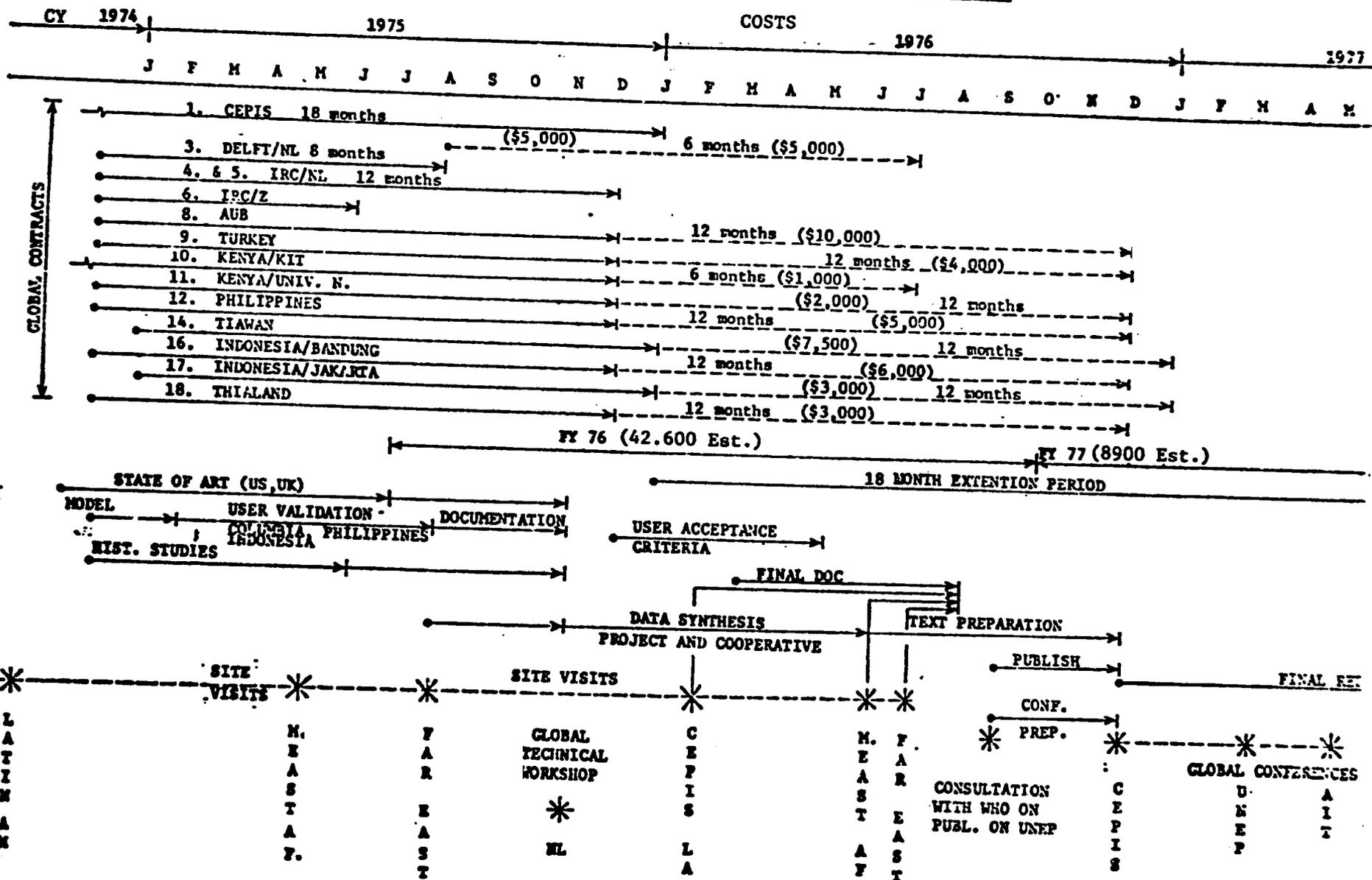


Figure 1. The Water and Sewerage Treatment Model

Figure 2: ACTIVITIES CHART





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Table 2  
CONTRACTS AND SPINOFF

No.	Project	Original			Extended			Total (Original & Extended)	
		Budget U.S. \$	Date Start/End	Duration	Budget U.S. \$	Date ** Start/End	Duration	Budget U.S. \$	Duration
1	CEPIS/PAHO/Lima-Water treatment Witt/Sperandio - Technology	20,000 (26,432*)	6-1-74/ 12-31-75	19 Months	10,000	1-1-76/ 7-1-76	6 Months	30,000 (26,432*)	25 Months
2	ENPIS/AID-Columbia-Model test Kearney	no cost (3,000*)	12-1-74/ 6-1-75	6 Months	none			no cost (3,000*)	6 Months
3	IRC/NL/Delft-Historic Methods- Sewage Professor Knoppert	2,000	12-1-74/ 8-1-75	8 Months	none			2,000	8 Months
4	IRC/NL--Inventory, Survey, Village Emergency Methods Van Damme	5,000 (2,000*)	12-1-74/ 12-1-75	1 Year	none			5,000 (2,000*)	1 Year
5	IRC/NL--Sand Filters-Water Van Damme (Kenya, Ghana, Brazil)	no cost (3,500)	12-1-74/ 12-1-75	1 Year	no cost (3,500*)	12-2-75/ 11-30-76	1 Year	no cost (7,000*)	2 Years
6	IRC/Zurich-Historic, Colonial Methods-Water Wasmer	2,000 (2,500*)	12-1-74/ 6-1-75	6 Months	none			2,000 (2,500*)	6 Months
7	Tunisia/Oswald/AID-Lagoons- Opt. Oswald	no cost (2,500)	12-1-74/ 12-1-75	1 Year	no cost	12-2-75/ 11-30-76	1 Year	no cost (2,500*)	2 Years
8	AUB--Sand disposal, asbestos filter Ayoub/Acra	7,500	12-1-74/ 12-1-75	1 Year	10,000	2-2-75/ 11-30-76	1 Year	17,500	2 Years

Table 2 (cont'd)  
CONTRACTS AND SPINOFF

No.	Project	Original			Extended			Total (Original & Extended)	
		Budget U.S. \$	Date Start/End	Duration	Budget U.S. \$	Date Start/End	Duration	Budget U.S. \$	Duration
9	Turkey--IE GR. Lagoon-Aerator Ulug/Arceivala	7,500 (2,500*)	12-1-74/ 12-1-75	1 Year	4,000	12-2-75/ 11-30-76	1 Year	11,500 (2,500*)	2 Years
10	Kenya/P.C. - Lagoons Goverts	no cost (5,000*) test kit 1,000	1-1-75/ 12-31-75	1 Year	Kit- 1,000	1-1-76/ 7-1-76	6 Months	2,000 (5,000)	18 Months
11	Kenya/Demand Study Muga	5,000	12-1-74/ 17-1-75	1 Year	2,000	12-2-75/ 11-30-76	1 Year	7,000	2 Years
12	Manilla -- Water Steriliza- tion Lesaca/Philippines	5,000	12-1-74/ 12-1-75	1 Year	5,000	12-2-75/ 11-30-76	1 Year	10,000	2 Years
13	Manila -- Model Studies CDM/Lesaca	no cost (1,500)	12-1-74/ 6-1-75	5 Months	none			(1,500)	6 Months
14	Taipei -- Night-Soil, Sludge, Algae, etc. Liu/NSC	7,500 ?	1-1-75/ 12-31-75	1 Year	7,500 ?	1-1-76/ 12-31-76	1 Year	15,000	2 Years
15	Indonesia -- Model Studies CDM/Reyes	no cost (1,500)	12-1-74/ 6-1-75	6 Months	none			no cost (1,500*)	6 Months
16	Indonesia -- Lagoon-fish- Bandung U:V/Reyes	4,000	12-1-74/ 12-1-75	1 Year	6,000	12-2-75/ 11-30-76	1 Year	10,000	2 Years
17	Jakarta/Dutch Ditch Webb	2,000	1-1-75/ 12-31-75	1 Year	3,000	1-1-76/ 12-31-76	1 Year	5,000	2 Years

Table 2 (cont'd)  
 CONTRACTS AND SPINOFF

No.	Project	Original			Extended			Total (Original & Extended)	
		Budget U.S. \$	Date Start/End	Duration	Budget U.S. \$	Date Start/End	Duration	Budget U.S. \$	Duration
8	Bangkok/Filters Praphorn/Thai Govt. Coordinated with AUB/Taipei/IRC, Frankel, et.al.	3,000	12-1-74/ 12-1-75	1 Year	3,000	12-2-75/ 11-30-76	1 Year	6,000	2 Years
9	OU/AID Sewerless Alternatives Swisher/Reid	no cost (3,000)	12-1-74/ 12-1-75	1 Year	no cost (3,000)	12-2-75/ 11-30-76	1 Year	no cost (6,000)	2 Years
0	Algeria -- Model Test WHO/Europe	no cost	12-1-74/ 6-1-75	6 Months	none			no cost	6 Months

Those shown inside the parentheses are matching funds.

These dates reflect calendar times as an extension. There are expected to be several fiscal overlaps. The CEPIS contract extension could start prior to the beginning of the 1976 calendar year.

Table 3

## DESCRIPTION OF COMPONENT STUDIES

This table indicates briefly the content of each of the sub-contract studies and is collated with (Table 2 No. 1 - No. 20). Also shown in this table are brief descriptions of the historic studies, the state of the art documents, the global technical workshop and global conferences.

1. CEPIS - This project is the largest in scope and support. It will encompass two years. PAHO (CEPIS) will contribute effort and funds equal to or greater than that of the subcontract under the direction of Dr. Sperandio, assisted by Drs. Arboleda and Bartone, and will select three or four water treatment processes technologies in Central and South America. These will be of different size and different socio-economic relationships and include such things as valvelless filters, multi-deck, multi-media sedimentation and filtration, and the employment of polyelectrolytes. There will be at least three process test sites. The final selection of sites are yet to be made, but they will probably be in Brazil (Sao Paulo-ABC), Bolivia (Cochabamba), Ecuador (Cuenea), and Peru (Lima - La Atarjea).
2. INPES - This is a no cost project in which presents the opportunity to test the OU model in the selection of small town sewage treatment processes in Colombia. This will be the first real life use of the User's Manual.
3. IRC Netherlands - This will be part of the "Historic Methods of Treatment Sewage" study. There is evidence that the Colonial or earlier North European or North American processes would be ideal for less developed countries at the present time. There are probably some of the earlier processes that have been overlooked because of more developed technology. OU plans to study historically how Northern Europe and England and the United States handled water and sewage at the mid-19th Century, or even in earlier times. This is a small contract of eight months that will have a professor and students look into the historic sewage processing methods used in the Netherlands and other European Countries. This is a complementary project with No. 6.
4. A Data Information Collection Inventory Study will be performed jointly with the IRC/NL. OU has developed a data format which they are reviewing. The formatting will be used on all test field programs. Reference Center personnel will use this format to accumulate everything they can on innovative and unique technology adaption to the needs of less developed countries. IRC will donate two or three man-months to the project. The project provides funds for students' assistance.
5. The Netherlands (Van Damme) has fielded a sand filter study in Kenya, Ghana and Brazil, as a direct result of the Bilthoven Conferences. They will use OU data formats and furnish the information/data needed.
6. Number six is similar to number three in that the Zurich IRC group (in conjunction with the Swiss Federal Water Board - EAWAG) will look at the colonial and even pre-Roman times on water treatment. Actually, water had a lot earlier attention than sewage. The only costs to the project will be some travel. This should be a short term project of two months.

Tunisja

7. Dr. Oswald through Public Law 480 is developing quite an elaborate lagoon study in Tunisia and has invited OU to assist. He will use the OU data format. The project director, Professor Reid, will probably visit the Tunisia study at their expense to assist them.
8. AUB Lebanon - This will be possibilities of sea disposal of sewage achieving precipitation with sea water and naturally occurring dolomites. The separated solids will be diluted with sea water for disposal without an outfall. In other words the outfall becomes a trade-off against the circulation of sea water. AUB will also conduct a study using asbestos/pine needles for filtration. The results will be collated with the studies at Thailand. This is a two year contract with the American University of Beirut although they actually suggested seven and eight programs that they would like to see undertaken. However the subcontract is for the development of the two discussed above. AUB will contribute in-kind services.
9. Turkey, in a two year program, will use lagoons and aerators to form oxidation ponds. This would be under Drs. Ulug and Arceivala. They tried to build their own aerator without success. The contract will furnish one in an attempt to upgrade the lagoon. Professor Reid has also agreed to provide some lectures.
10. Kenya will conduct a study of lagoon operation. OU will furnish the data format and a test kit. This is a cooperative study with the Peace Corps. Dr. Govaerts, who was on this project at the University of Oklahoma, is now the Director in Kenya and will supervise it. Govaerts will also coordinate the sand filter study as indicated in Number 5.
11. In Kenya also is a water demand study. It is a small, socio-economic study which can be accomplished in one year and will be directed by Mr. Muga at the University of Nairobi.
12. Manila - Their primary interest is in the maintenance problems in processing, especially the use of chlorine. The National Water and Air Pollution Control Commission will attempt through a two year project under the supervision of Dr. Lesaca to find alternatives to chlorination such as metallic salts, lime, chlorides, etc. This project is concerned with middle and smaller level cities and towns.
13. Manila and Indonesia - There will be two projects in which Camp, Dresser and McKee, a Boston consulting firm will collect information from Philippines and Indonesia that is needed for OU model studies. The model will generate for their consideration the optimal process to be used in the development of several treatment plants in each of these countries by this consulting firm. The only cost will be to run the model.

14. Taipei - Because of wide use of night soil and the problem of disposing of it, there are two studies: one on sterilization and another on ultimate disposal by aerobic digestion using both algae and photosynthetic bacteria and finally gravel separation. This will be a two year study under Professor Liu and the National Science Council in Taiwan.

15. Indonesia - See No. 13.

16. Indonesia - This is a two-year study involving seven or eight lagoons using graduate students of the Bandung Technical Institute under the supervision of Professor Reyes to study the ultimate disposal of lagoon effluents as nutrients for fish production (milk fish). The primary motivation here is the fish production. Hopefully additional studies will be made on the possible health implications of eating fish.

17. Jakarta - Mr. Webb of the WHO will monitor a two year study of the effectiveness of a Dutch Ditch.

18. Bangkok - This is a study correlated with a previous contract of AID with SEATEC through the government of Thailand to study slow and rapid sand filters and the coconut hull, charred-rice filters. This is a two-year study in which OU will pay for some labor.

19. This project will take a look at "Sewerless" alternatives. This will be of no cost to the project but has great implications in the project. It will be conducted by an OU graduate doctoral student who will look at some fifty different ways that sewage could be disposed of rather than sewer the cities and then developing a sewage plant. Most Far East cities are 6 or 7 percent sewerd. Therefore before U.S. technology can be used there is a necessity of developing the sewers. In terms of U.S. technology, direct sewerage cost to a city runs somewhere between \$12,000 and \$15,000 per house. Consequently, it is almost impossible at this time to estimate a realistic cost of sewerage cities such as Taipei and Bangkok.

20. WHO/Europe has indicated that they would like to use the model to test their sewage treatment program in Algeria.

### Historic Studies

It has been increasingly evident that processes used in the past by DC countries might well be valuable today in LDC's. The purpose of this study is to approach the problem from two standpoints at one time in order to (1) synthesize from socio-economic parameters the possible solutions available to treat water and sewage and (2) investigate actual historic and colonial practice in LD's. These studies will be compiled into a document appraising historic technology and its relevance to present LDC's needs. This work involves students and faculty at Delft and Zurich and Professors Reid (Project Director) and Don (University of London).

### State of the Art Documents

Four state of the art documents are under preparation: one on waste water treatment in LDC's; one on water treatment in LDC's; one on essential, rural, temporary, etc. techniques; and one on application of planning models to LDC's essential facilities, etc. The state of the art document on waste water treatment involves Reid and Canter (both from Oklahoma University) and Malina (University of Texas) and students. The state of the art on water involves Miller (United Kingdom), Huisman (Delft University) and Ayoub (AUE), and again university students. Messrs. Canter, Malina, Miller, Huisman and Ayoub are also global project consultants.

### Global Technical Workshop

The objective of this workshop is to bring together key field people and selected experts on water and wastewater treatment technology to enable them to exchange information and to establish a basis of commonality, thus furthering a global acceptance of concepts of adaptive and innovative technology for developing countries. The main sponsor of this workshop will be the USAID/OU project and IRC/NL, while UNEP, WHO, PAHO, IBRD and regional banks will be co-sponsors. The workshop is tentatively scheduled for the fall of 1975. Participants will be by invitation, paid by co-sponsor.

The tentative program schedule for this workshop includes: (1) Program methodology, (2) Study group by substance - water, sewerage, and transfer technologies, (3) Discussion by geographical areas - Latin America, Middle East, Africa, and Asia, (4) Presented by categories - Literature and data, technology transfer, model-systems-forecasting, and basic rural non-nuclear areas.

### Global Conferences

The dissemination of the project findings to the appropriate decision-makers is of initial concern and it is hoped that this will be accomplished through conferences - one for each of three global areas - UNEP headquarters in Nairobi (February 1977), AIT in Bangkok (April 1977), and CEPIS in Lima (December, 1976).

The conferences will be structured to insure that participants represent all types of decision-makers. That is the structuring process of the conference involves finding out who makes decisions and on what basis the selection of urban water and sewage treatment installations are made. An initial cut at the appropriate audiences will be made by AID, WHO, and UNEP based on field exchanges and experiences. Some more orderly explorations may be undertaken by OU staff, for example by professional categories. In other words, the primary goal would be to insure that all of those acting are identified, and that the proposition, "Low Cost Methodology" is cast so that they can understand what's being proposed. The feed back from the conferences will assist in the preparation of the state of the art documents for distribution.

Table 4

WATER PROCESSES

PW1	Drilled Well
PW2	Pre-Treatment
PW3	Slow Sand Filtration
PW4	Rapid Sand Filter - Conventional
PW5	Rapid Sand Filter - Advanced
PW6	Softening
PW7	Disinfection
PW8	Taste-Odor - Fe, Mn
PW9	Desalting - Salt (Sea water)
PW10	Desalting - Brackish
PW11	Coagulation Pressure Filtration

WASTE PROCESSES

PS1	Primary - Conventional (e.g., settling and discharge)
PS2	Primary - Stabilization Pond
PS3	Sludge - Conventional (e.g., anaerobic digesters)
PS4	Sludge - Advanced (using commercial filters)
PS5	Sludge - Combined Imhoff
PS6	Secondary - Standard Filter (e.g., slow-sand or trickling filter)
PS7	Secondary - High Rate Filter (e.g., high rate trickling filter)
PS8	Secondary - Activated Sludge
PS9	Secondary - Extended Aeration (e.g., aerated lagoon, Dutch ditch)
PS10	Disinfection (e.g., chlorination)
PS--	Irrigation, dilution

Informal Minutes of Research and Development Committee Meeting  
Held on March 18, 1975

Project: Health and Its Relationship to Water Supply and Waste Disposal (extension), 18 months, \$133,771.

Contractor: University of Oklahoma

Project Manager: A. Dale Swisher, TA/H

Discussion Highlights:

Dr. Long referenced the review of a report on the status of this project by the RAC with their recommendation to refer the extension request back to the R & DC for its consideration.

Art Silver, LA/DP, expressed concern that the benefits of this project were being directed to the urban centers thus bypassing the rural poor as target groups. Dale Swisher indicated that this was not the intent, and that, on balance, there was an orientation towards small communities. Art Silver then pointed out that low cost does not necessarily mean small scale, and that, if both are implied, then the Project Statement should clearly state this relationship and emphasis.

Woodrow Leake, AFR/NARA, questioned whether consideration was being given to the use of waste products for agricultural purposes. Dale Swisher stated that this is not the case.

Project approved without objection.

TA/RIG:WSchaefer

RAC meeting  
~~May 5-6~~ 1975  
May 8-9

Lower Cost Methods of Water and Waste  
Treatment in Less Developed Countries -  
University of Oklahoma

Mr. Wittnebert, Chairman of the Subcommittee composed of Drs. Adams, Merrill, and D. Peterson, reported as follows:

This extension proposal for 18 months at an estimated cost of \$134,000 is designed to permit completion and wrap-up of work underway or planned in part because of unanticipated past delays and otherwise because of an expansion of the project beyond its originally intended scope. The project purpose is primarily to devise a computer model capable of predicting the optimum type of facility for providing potable drinking water and for treating waste water or sewage in any LDC community, considering the available resources and socio-economic circumstances of that community. Other purposes include development of state-of-the-art documentation, test kits, and to disseminate information.

Project accomplishments to date are quite indeterminate, notwithstanding the fact that there has been a considerable amount of activity and related rhetoric. Attainability of the objective within the framework of the present or extended project is highly doubtful. Interest has been expressed by a number of outside organizations with a total investment of outside funds estimated by the project director as being of the order of \$89,000.

The predictive model involves "coarse sort" involving some 31 factors as determinants of the best of 12 preselected water treatment processes and/or 10 preselected sewage treatment processes. A second or "final sort" is the one of computing the cost based on assessed developing country costs. This represents a horrendous field of unknown values and relationships. The "heuristic program" involves intuitively estimated relationships among the many variables based on interviews and observations. The original proposal was to test the model at some 3 to 7 field sites; now expanded to 19 or more. Test kits serve to facilitate the collection of data for feedback.

The latest project statement says that the report of the global conferences will constitute the project's final report. It is hoped that this is not the case, and not in lieu of a clear-cut summary of what has been accomplished technically and what utility it has. A report of a recent project review by TA/H was received this morning, stating substantively that; (1) the work was proceeding satisfactorily, (2) an extension of contractual time is in the interest of AID, and (3) the research findings are likely to provide better services at less costs.

Dr. Adams reported: (1) as a function of modifications the project now being executed is not the project approved in 1973; (2) the contractor has so broadened the scope of processes to be studied that 13 of the 19 water processes and 20 of the 24 sewage processes were not included in the original list, while two of the original are not now covered; (3) although the models have been available, or should have been available for over a year, there is no record of their utility, testing, or acceptance; (4) the original purpose of the field studies was to test the model, yet only 4 of the 20 subcontract studies mention this as one of their objectives; (5) the contractor stated that systems now in use in DCs are probably not applicable to LDC problems, yet he has expanded the scope to encompass every conceivable modern and sophisticated methodology; (6) 13 of the 20 subcontracts shown in the October 22, 1974 report terminate within one month of the parent contract termination leaving no time for analysis, integration, and preparation of a final report, and thereby forcing the issue of project extension; (7) it would appear from an analysis of the reported fiscal obligations that there are sufficient funds remaining to complete the project. In sum then, this project is completely and hopelessly out of control. It should be terminated as expeditiously as possible, with no additional funding. The best that the Agency can hope to get out of it is a set of matrices, and a series of discrete and disjunctive subcontractor reports.

Dr. Merrill stated that he had nothing substantive to add.

Dr. D. Peterson spoke of the model as being the interaction between a resource vector and an optimal process vector but data to relate these two vectors will not be available because the variables of both vectors have been unreasonably and unnaturally expanded beyond the variables earlier agreed upon. Some of the tests do not even relate to the stated model variables. We should forget the model and Oklahoma should be instructed to spend no more effort on it because it is hopeless, but should concentrate on getting the best final reports from each of the 19 sub-projects. At least solid process data under various environmental conditions will be useful in advancing the art heuristically.

Dr. Montgomery stated that the clear deficiency of this project is as a research project; an advantage is as a network project. Activities have become a grab-bag, irrelevant to the original purposes. How does it fit into the three-tier concept of international networks? How do we justify the kinds of activities that have been going on in Norman, Oklahoma? If this is extended for an additional 18-month period, then the network concept becomes hopelessly confounded.

Mr. Dale Swisher, TA/H, stated that there appears to be a lack of understanding of the matrix approach which Professor George Reid has built into the project. Errors have been made. He reported on a recent meeting of some seven international agencies interested in the continuation of this type of work to bring improved water supplies to

rural populations. With reference to money, as of this morning there is \$74,600 unencumbered, but a drastic increase in subcontract support in the last six months was anticipated. Delays in country responses necessitate the proposed extension. One contract with the PAHO in Peru covering work in Ecuador, Peru, and Brazil over a two-year period would need to be terminated if the project were terminated December 31, 1975 as the contract now reads. Mr. Swisher stated that the original proposal was virtually unlimited. RAC foresaw problems and asked that limits be imposed. Oklahoma in the interest of compiling a complete model for all situations proposed further expansion. Three regional sites were originally contemplated, each to subcontract in turn with several countries.

Dr. D. Peterson stated that he understood the model very well.

Motion: That the project be extended for six months to permit time to effectively report out the work that has been undertaken and programmed to date, and that additional funds of up to \$50,000 be appropriated for this purpose.

Moved by Mr. Wittnebert, seconded by Dr. D. Peterson.

Dr. Ruttan commented on his uneasiness. What are we going to learn for the investment? We have a project with bad design, but it is also a very cheap project. He still has not heard what will be learned of value.

Dr. Adams proposed an amendment to delete the \$50,000 from the motion.

Seconded by Dr. Wishik.

Dr. Wishik stated that he had formed his opinion on what he had heard and on the very analytical report by Mr. Wittnebert. He admired detail and the selection of emphasis. It was the most devastating report of any project he had ever heard since being in the RAC. He saw no argument as to why the project should not be terminated as quickly as possible. He would vote in favor of cutting the project off at the earliest date and with the smallest amount of money that would not impose hardship on the subcontractors. We should allow as little money as possible to carry the two subcontracts, Indonesia and PAHO-Peru. The date should be terminated as early after January 1, as permissible.

Vote: Amendment to delete \$50,000 from the original motion.

Aye: carried, one Nay vote.

Dr. Long asked for some discussion on the problem of fitting the report data into a model that is unlikely to address the problems with

precision. Is there any plan for the analysis of the subcontract findings as a group outside of the model worthy of consideration that might be eliminated by this action? Dr. Adams stated that he would hope there was some value and that it could be handled in some separate contract. He believes that it would be a mistake to extend the present contract in any manner. Dr. Long stated the sense of the group that the reports should be moved into some competent hands after we see what the reports contain. Dr. Montgomery suggested that the analysis that has been applied to these projects has probably not resulted in the asking of the right questions that would permit the building of any cumulative knowledge. He urged the staff to start from scratch to find some way, if possible, to influence the data gathering while it is going on to get something of merit out of the field studies.

Vote: On the motion for an extension of six months without additional funding. Unanimously approved.