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PD-AAD-278-B1

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER FACESHEET

TO BE COMPLETED BY ORIGINATING OFFICE

1. TRANSACTION CODE ("X" appropriate box)
[X] Original [ ] Change
[ ] Add [ ] Delete

PP 33
DOCUMENT CODE 3

2. COUNTRY/ENTITY

3. DOCUMENT REVISION NUMBER

4. PROJECT NUMBER

5. BUREAU
a. Symbol: TAB
b. Code: 6

6. ESTIMATED FY OF PROJECT COMPLETION
FY 77

7. PROJECT TITLE - SHORT (stay within brackets)
Water Project Effects

8. ESTIMATED FY OF AUTHORIZATION/OBLIGATION
a. INITIAL mo. yr. 2 76 b. FINAL FY 77

9. ESTIMATED TOTAL COST ($000 or equivalent, $1 = 128)

a. FUNDING SOURCE	FIRST YEAR FY 76 b. FX	c. L/C	d. Total	ALL YEARS e. FX	f. L/C	g. Total
AID APPROPRIATED TOTAL						
(Grant)	(128)	( )	( )	(34)	( )	(128)
(Loan)	( )	( )	( )	( )	( )	( )
Other U.S. 1.						
Other U.S. 2.						
HOST GOVERNMENT						
OTHER DONOR(S)						
TOTALS						128

10. ESTIMATED COSTS/AID APPROPRIATED FUNDS ($000)

a. Appropriation (Alpha Code)	b. Primary Purpose Code	c. Primary Tech. Code	FY 76 d. Grant	e. Loan	FY 77 f. Grant	g. Loan	FY ____ h. Grant	i. Loan	ALL YEARS j. Grant	k. Loan
PH			94		34				128	
TOTALS										
11. ESTIMATED EXPENDITURES			80		48					

12. PROJECT PURPOSE(S) (stay within brackets) [ ] Check if different from PID/PRP

1. To expand a previously developed schistosomiasis transmission simulation (STS) model into a methodology which will permit national planners in schistosomiasis infected countries to determine the socioeconomic impact (in cost-benefit terms) of water resource development projects.
2. To assist AID to prepare for each water resource project an environmental analysis acceptable to the Council for Environmental Quality under the legal requirement of Section 102B of the National Environmental Policy Act.

13. WERE CHANGES MADE IN BLOCKS 12, 13, 14, or 15 OF THE PID FACESHEET? IF YES, ATTACH CHANGED PID FACESHEET.
[ ] Yes [ ] No

14. ORIGINATING OFFICE CLEARANCE

Signature: Edward P. Irons, M.D.
Title: Deputy Director
Office of Health
Technical Assistance Bureau
Date Signed: mo. day yr.

15. Date Received in AID/W, or For AID/W Documents, Date of Distribution
mo. day yr.

AID 1330-4 (7-75)

RESEARCH PROJECT STATEMENT

13 - Water Project Effects

Project Title: Socio-economic Analysis of Environmental Health Problems (Short title: Water Project Effects).

Proposal submitted to the May 24-25, 1976 RAC.

New or Extension: New

Time Period: Eighteen months

Estimated Total Cost: $128,000

Principal Investigator:

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Project Manager: A. Dale Swisher, P.E., TA/H

Narrative Summary:

Project evaluation and feasibility studies of water resource projects currently being prepared tend to concentrate on the direct economic costs and benefits of the proposed project, i.e., costs of construction and operation and benefits from increased employment and agricultural production. Virtually no considerations are given to possible adverse environmental impacts occasioned by the project which result in decreased human productivity and increased medical care costs.

One common example of environmental health impacts resulting from water resource projects is the increased spread of schistosomiasis. Schistosomiasis is a disease intimately associated with the introduction or increase in water availability in places as diverse as Brazil, Tanzania, Egypt, Iran, Philippines, and the People's Republic of China. Schistosomiasis also thrives at low levels of development in the presence of inadequate domestic water supplies, inadequate waste disposal facilities, lack of formal education, and malnutrition. The dual association of water and poverty makes schistosomiasis representative of the varied environmental health impacts from development projects.

NON-CAPITAL PROJECT PAPER (PROP)
SOCIO-ECONOMIC ANALYSIS OF
ENVIRONMENTAL HEALTH PROBLEMS

A. The Project Goal

1. Goal Statement

The goal of this project is to improve the quality of life of the some 700 million rural people living in areas of endemic schistosomiasis, 200 million of whom are afflicted by the disease, through the determination of more effective control programs.

2. Measurement of Goal Achievement

Progress toward accomplishment of this goal can be measured inter-alia by:

a. Reductions in morbidity and mortality rates.

b. Increased production of food and fiber.

c. Improved scale of living.

d. Enhanced dietary intake.

e. Greater employment opportunities.

3. Assumption of Goal Achievement

Pre-requisites for goal achievement all of which are believed to be present are:

a. LDC Governments have a sincere desire to improve living conditions of their rural poor.

b. LDC planners would allocate available resources in a more optimal cost-effective manner if they possessed an appropriate analytical tool.

c. LDC resources, although limited, are adequate to initiate optimally planned long range programs.

B. The Project Purpose

The project purpose is two-fold:

1. To expand a previously developed schistosomiasis transmission simulation (STS) model into a methodology which will permit national planners in schistosomiasis infected countries to determine the socio-economic impact (in cost-benefit terms) of water resource development projects.

2. To assist AID to prepare for each water resource project an environmental analysis acceptable to the Council for Environmental Quality under the legal requirement of Section 102B of the National Environmental Policy Act.

2. End of Project Status

Two categories of conditions are foreseen as marking the project end point:

a. The methodology is determined to be inappropriate for accomplishing the stated purposes, or the methodology is found appropriate for the purpose.

b. Data has been published and circulated to donor agencies and governments interested in schistosomiasis control.

3. Basic Assumptions

Basic assumptions at this level are three:

a. There is a relationship between health inputs and socio-economic development projects which can be demonstrated quantitatively and qualitatively.

b. Both the costs and benefits of each component of various mixes of preventive and curative schistosomiasis abatement programs can be

identified and a cost-benefit model derived therefrom would constitute a useful planning tool.

c. AID will conduct an environmental assessment for each Capital and/or Technical Assistance project funded.

C. Statement of Project Outputs

1. Outputs and Output Indicators

The paramount output will be a methodology of calculating cost-benefit ratios associated with alternative schistosomiasis control strategies. This output will result from collecting, analyzing and synthesizing four types of data: epidemiological (including but not limited to prevalence, incidence, and intensity of infection); monetary costs (project capital costs and disease control costs); effectiveness of the various control methods; and benefit derived from preventing disease proliferation,e.g., medical costs avoided, extension of cultivable area or multiple cropping of existing area. (See Implementation Plan (Par. F. below).

2. Output	Indicator	Target Date
1. Ability to predict level of schisto prevalence resulting from a planned water resource project.	1. Epidemiological survey report. 2. Irrigation cost report	1. 9 mos. after initiation of project. 2. Incorporated in above.
2. Ability to determine cost-effectiveness of various disease control strategies	1. Milestone report ranking alternatives in terms of cost effectiveness	1. 11 mos. after beginning
3. Ability to determine economic and social benefits of prevention of spread of disease.	1. Milestone Report capitalizing benefits derived from water resources project.	1. 14 months after start.
4. Methodology for analyzing cost-benefit of preventing environmental health impacts of water resource projects.	1. Final report.	1. 18 months after start.

3. Basic Assumptions

Basic assumptions include the following:

1. Records of the schisto control program being done at the site of the proposed project include data on employment, agricultural productivity, disease reduction, etc. and are sufficiently comprehensive and lengthy enough to indicate a cause-effect relationship.

2. The present STS model can be modified to provide a sequential expenditure cost-effectiveness curve.

3. Established patterns of behavior, e.g., unhygienic habits, can and will be modified by health education and sanitation programs if those programs are designed in keeping with the customs, past experiences and present needs of the people and if they perceive individual benefits of the new way.

D. Project Inputs

1. The contractor's inputs will include but not necessarily be limited to:

a. The STS mathematical relationship formula.

b. General supervision of entire project.

c. Provision of requisite technical manpower.

d. Consultants.

e. Analysis and modelling capability.

f. Backstopping facilities (computer time, libraries, printing facilities, laboratories, etc.) as required.

2. LDC inputs include:

a. Access to site of study including water impoundment structure, irrigation systems, controls,etc.

b. Willing collaboration of the LDC officials responsible for an active ongoing schisto control program. This includes administrative, technical and operating personnel, use of vehicles, housing, messing, field laboratories, etc.

3. AID/W inputs:

a. Life of project funding.

b. Project monitoring.

c. Liaison with cooperating agencies (e.g., WHO, Near East Foundation, Government of Iran, etc.).

d. Reproduction and dissemination of final report.

Basic Input Assumptions

1. Personnel both from contractor and from present Bilharziasis Control Program (BCP) are competent and cooperative.

2. Present BCP will continue to receive independent (Government of Iran) funding throughout life of project study.

E. Rationale

The importance of schistosomiasis as a deterrent to social and economic progress in many developing countries has been recognized for many years. While the disease has been known for centuries, calcified parasitic ova having been found in two Egyptian mummies 1250-1000 B.C. circa, it has become of increasing concern during the last two decades as water resources development projects have proliferated and spread the snail vector into new areas. Today the disease undoubtedly is a costly burden contributing to inefficiency and waste in the use of natural resources, to needless consumption of food energy, and hindering cultivation of irrigated land. It remains a pervasive foe of the "Well-being of people" which is central to the objectives of U.S. foreign assistance. Numerous workers have developed models to analyse the dynamics of transmission. A joint AID/WHO

"Symposium on the Future of Schistosomiasis Control" in 1972 recommended that economic impact studies of schistosomiasis be conducted. To this objective, therefore, AID sponsored research on a transmission simulation model which for the first time considered the man-water-snail-water-man interaction as modified by the dynamics of environmental change, and control and/or treatment measures. Also in September 1974, the U.S. Secretary of State announced to the United Nations that the U.S. within the next few months would present its proposals for a concerted effort to control schistosomiasis.

The following study is therefore seen as being responsive to the Secretary's initiative. The study proposes to use schistosomiasis as an indicator of environmental health impacts from water resource projects to measure the costs and benefits associated with preventing those detrimental effects. Later studies will attempt to generalize the methodology to apply to other parasitic diseases and other projects, such as onchocerciasis and dracunculiasis.

In the past, project evaluations and feasibility studies of water resource projects have concentrated on the direct economic costs and benefits of the proposed project, i.e., costs of construction and operation, plus benefits from increased employment and agricultural production. Virtually, no considerations have been given to possible adverse environmental impacts occasioned by the project which have resulted in decreased human productivity and increased medical care costs. Examples of these studies are the guidelines for analyzing the costs and benefits of water resource development projects issued by UNIDO (1972) and OECD (1968). These along with more detailed works by Maass (1962) and

Eckstein (1958) concentrate on the economic problems involved: choice of appropriate discount rates, time horizons, direct and indirect monetary costs and benefits, allocation of joint costs and benefits, and other aspects of public investment criteria. Indirect costs due to adverse environmental health effects were not included nor were the benefits of preventing adverse effects through alternative project designs or protective measures.

On the other hand, the economic effects of schistosomiasis have studied by Wright (1972), Farooq (1964), Fenwick (1972), Weisbrod (1973) and Jobin (1972) et al. Wright and Farooq estimated costs of the disease on a national basis, considering in each case the total costs of medical care, unemployment, and decrease in labor productivity. The others have each taken a specific project area to estimate the costs and benefits of control programs on the economic effects of the disease. Only Jobin has attempted to develop a more generalized methodology for cost-benefit analysis of control measures based on a model that simulates transmission of the disease in populations and snails. Despite these works and others concerning health resources planning and health economics there are few if any analyses of environmental health impacts resulting from development projects wherein the environmental health impacts have been quantitatively included in the original economic analysis of the project.

One common example of an adverse environmental impact resulting from water resource projects is the increased spread of schistosomiasis. Schistosomiasis is a disease intimately associated with the introduction or augmentation of water availability in places as diverse as Brazil, Tanzania, Iran, Philippines and the People's Republic of China. Numerous

water resource development schemes located in endemic schistosomiasis areas have been financially assisted by AID. The disease thrives at low levels of development in the presence of inadequate domestic water supplies, inadequate waste disposal facilities, lack of formal education, and malnutrition. The dual association of water and poverty makes schistosomiasis representative of the varied environmental health impacts from development projects.

In summary, to arrive at a socio-economic analysis of the benefits and costs of preventing environmental health impacts resulting from water resources project construction in developing countries, it is necessary to 1) predict the environmental health impact, 2) estimate costs of preventing the impact, 3) estimate benefits of preventing the impact, and 4) develop the methodology within the same framework as that used in the traditional project analysis. The purpose of this study is to develop and apply the appropriate methodology for environmental health analysis in an area where a water resources project is already being planned and where data exist on the pre-project health conditions.

F. Course of Action

1. Implementation Plan

The objectives of this study which will lead to a practical methodology for cost-benefit analysis of environmental health impacts of water resource projects are based on a knowledge of the epidemiology of the environmental health impact under study, i.e., schistosomiasis, the design of the water resources project and the costs and benefits of the alternative strategies for controlling/preventing the disease from

spreading. The study will be based on the previously developed STS model and a familiarity with the techniques of benefit-cost analysis. Overall time schedule and cost data are attached hereto. As indicated above the complete study consists of four phases or objectives.

a. Objective 1 - Prediction of level of prevalence of schistosomiasis resulting from a planned water resource project.

This objective will be reached through appropriate modification of the STS model which has been verified with data from an irrigated area in Iran. Prior to conception of the STS model it was known that the two fundamental processes of infection and de-infection of schistosomiasis may be expressed as one simple rate process by the following equation (Muench, 1959):

$$dy / dt = A(1-Y) - BY \qquad (1)$$

where Y is the fraction of the population infected with schistosomiasis, A is the force of infection, B is the force of de-infection. Equation 1 states that the rate of change in schistosomiasis prevalence is a function of the rate at which healthy people become infected and infected people lose the disease. An important assumption in the equation is that as infected individuals lose the disease, they join the pool of susceptible individuals. In contrast to previous models (Hairston, 1965b), immunity to re-infection is not considered in this model. With S. haematobium infections there is reason to doubt that immunity plays a significant role in the disease cycle.

A solution for Equation 1 for the boundary conditions Y = 0 at t = 0 has been given by Muench (1959):

$$Y = \frac{A}{A+B} \left(1-e^{-(A+B)t} \right) \qquad (2)$$

The new STS model is based on three equations derived from the basic transmission Equations 1 and 2. These equations and their components are shown in Table 1 attached. In the STS model, the numerical values for the infection rate A, have been determined for several villages from 1964 through 1973 from data collected by the Bilharziasis Control Project (BCP) staff through annual examination of a selected group of 0 to 10 year olds initially diagnosed as negative on the basis of 3-day urine tests. These field values of A are directly related in the model to transmission factors of the disease, snail habitats and number of people infected, by regression analysis. After several different trial regressions, the most successful equation for estimating A was found to be the interaction of meters of accessible snail habitats (H) and number of people infected (P):

$$A = b_0 \left(H^{b_1} \times P^{b_2}\right) \qquad (3)$$

where b_0, b_1, and b_2 are determined in the regression analysis.

The force of de-infection, B, is the natural loss rate of the disease. The value used in the model was estimated from steady-state data to be 0.2, and is considered constant over all ages and years in the model. The value agrees closely with values estimated by Hairston (1965b) for S. haematobium in Syria and Egypt.

Estimates of the forces of infection and de-infection are used in the simulation of changes in prevalence over time. The time unit for

the model is one year because that is the unit of time the BCP used for their data collections. Simulation of prevalence is accomplished with iterative use of the following equation:

$$Y_{t+1} = I\ (1-Y_t) - BY_t + Y_t \qquad (4)$$

where Y_t is the fraction positive in the beginning of year t, B is the force of de-infection, and Y_{t+1} is the fraction positive predicted for the end of year t or beginning of year t+1. I is the fraction of uninfected people who become positive at the end of one year. I can be expressed as a function of A and B by solving Equation 2 for Y_t when t = 1:

$$I = Y_1 - Y_0 = \frac{A}{A+B}\ (1 - e^{(A+B)} \qquad (5)$$

The STS model simulates changes in levels of prevalence over time. A flow diagram which schematically represents use of the model is given in Figure 1. With values of A, B, I, and Y_0 a model run is accomplished by solving for Y_1, Y_2, ..., Y_T, where T is the number of years in the planning period, by successive application of Equation 4.

Data on prevalence (Y_0) are required for the initial year of operation. Data required for each year include meters of accessible snail habitats (H) and total population. The data used in the model are corrected to account for actual events that occurred during the year of analysis. For this reason, only meters of accessible snail habitats not molluscicided nor improved by engineering measures are included. A chemotherapy correction factor, (Q), the fraction of total number of infected people treated over total number infected, is applied when appropriate.

TABLE 1 - STS EQUATIONS AND NOTATION

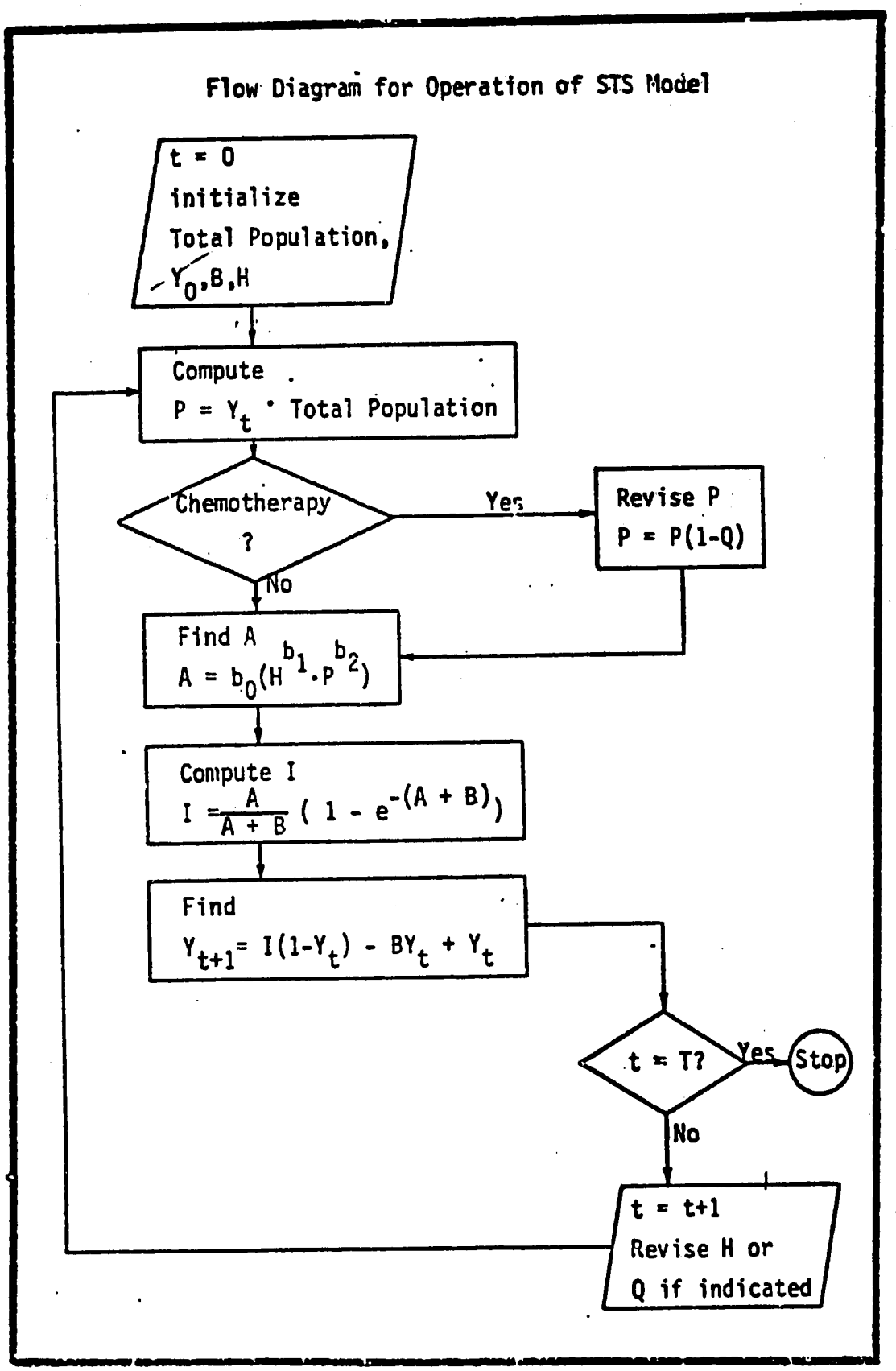
$$A = b_0 \, (H^{b_1} \times P^{b_2}) \qquad \text{(regression)}$$

$$I = \frac{A}{A+B} \left\{ 1 - e^{-(A+B)} \right\} \qquad \text{(transfromation)}$$

$$Y_{t+1} = I \, (1-Y_t) - BY_t + Y_t \qquad \text{(simulation)}$$

A	=	force of infection per village.
b_0	=	intercept of line of best fit in regression equation.
H	=	accessible snail habitat (meters per village).
P	=	people infected (number per village).
b_1	=	regression computed exponent of H.
b_2	=	regression computed exponent of P.
I	=	incidence rate per village (fraction of people that becomes positive over one year)
B	=	force of de-infection per village (natural loss rate).
e	=	base of natural hogarithms.
Y_t	=	fraction of population positive in year of analysis per village.
Y_{t+1}	=	fraction of population positive in following year per village.

Figure 1


Flow Diagram for Operation of STS Model
t = 0
initialize
Total Population,
Y_0,B,H
Compute
$P = Y_t \cdot$ Total Population
Chemotherapy ?
Yes
Revise P
$P = P(1-Q)$
No
Find A
$A = b_0(H^{b_1} \cdot P^{b_2})$
Compute I
$I = \frac{A}{A+B}(1 - e^{-(A+B)})$
Find
$Y_{t+1} = I(1-Y_t) - BY_t + Y_t$
t = T?
Yes
Stop
No
t = t+1
Revise H or
Q if indicated

The advantages of this methodology are that the model is based on environmentally sensitive parameters of disease transmission (i.e., meters of snail habitat) and that the data requirements are few.

In operation prediction of the population positive with schistosomiasis is made by iterative use of equation (3). The effects of the irrigation project may be postulated by assuming changes in the meters of snail habitats resulting from increased water availability due to the project. Obviously, two basic categories of data are required, epidemiological and irrigation project.

The epidemiological data include information about the forces of infection and de-infection of the disease and about the prevalence of disease and extent of accessible snail habitats.

Additional data that are not essential but would increase the reliability of the predictions are the prevalence of the disease in animals (also useful for the economic analyses), the extent of human contact with snail habitats, and seasonal variations of the snail populations. By choice of a study area where a health station or facility is already established, as is the case in the areas of expanding irrigation projects in Khuzestan Province, Iran, it will be expedient to rely on the epidemiological information collected by the health staff and to request their assistance in collecting additional data. If no field station or health facility is present, a field team which includes a parasitologist, a malacologist, and an engineer would have to be hired to obtain the necessary epidemiological data. This would likely extend the total study by three months, i.e., from 18 to 21 months. If a field station is already established the collection

of epidemiological data can begin three months after the study is initiated and will require three months. If done by sub-contract, the three-man team, car, driver, interpreter and clerical assistance will cost $41,800. Six additional man-months on the part of the principal investigator and her assistant will bring total costs for epidemiological collection to $48,100.

Collection of irrigation project information is necessary for the prediction of prevalence of schistosomiasis resulting from project construction and operation. Required data include design of canals and drains, proximity of canals and drains to the villages, construction schedule for the project, construction materials, provisions and costs of operation and maintenance, project cost-benefit analyses, and infrastructure provisions such as road construction and training programs. These data will be used to estimate the increase in water availability, increase in number of sites permitting human-water contact, and appropriate engineering control measures in the project area. The economic information will be used in the later analyses, while the type of materials used will be considered under the analyses of control measures.

This stage is estimated to require a total 4 man-months of effort from the proposed investigator and assistant for $4194. Work will begin on this stage as soon as the project begins and will continue for 4 months. Additional expenditures for car rental, interpreter, clerical assistance, office expenses and international fares of the two investigators will approximate $7500 for a total cost of $11,700. A milestone report will be submitted at the conclusion of this stage.

b. Objective 2 - Calculation of costs and effectiveness of different combinations of control strategies to prevent or limit the spread of the disease.

Activities under this objective will lead to an estimation of the costs and effectiveness of alternative control strategies. Included in the analyses will be considerations of possible alternative combinations of control measures, such as the traditional ones of molluscicidng, chemotherapy, and engineering and also the more infrequently used controls of improved sanitation and water supplies, and health education. In addition, the design of the irrigation system will be examined as a way of preventing the spread of schistosomiasis. The costs of different programs will be estimated. Finally, different measures of effectiveness will be studied such as reduction in the absolute level of schistosomiasis, preventing the disease from spreading, minimizing man-years sick (the latter is particularly relevant to the benefit analyses). The final output will present the rankings of alternative control programs based on the results of the cost-effectiveness analyses. Discussion of the different effectiveness, or environmental health goals, will take place with both health and development personnel in the field area.

It is expected that the total time required for this stage is seven months, with the first 3 months spent analyzing different control possibilities and the last four estimating the costs and effectiveness

of the different strategies. This stage will begin in the fifth month of the study, after the conclusion of irrigation data collection and after 1 month of epidemiological data collection. Analysis of the costs and effectiveness will begin when all of the epidemiological data have been collected. This objective will require 7 man-months of effort on the part of the principal investigator and her assistant at cost of $7400. Computer time, office supplies will bring total cost to $8200.
A milestone report will be submitted at the conclusion of this stage.

c. Objective 3 - Calculation of economic and social benefits associated with preventing the spread of the disease.

In traditional benefit cost analysis, benefits are calculated as the discounted sum of benefits over the life of the project:

$$\sum_{t=o}^{T} \frac{B^t}{(1-r)^t}$$

Where B is benefits, t is the length of the project (t = 0, 1, 2,..,T), and r is the discount rate. There is much discussion in the literature about the evaluation of r either as the social discount rate or as the

internal rate of return. This will be worked out in coordination with the stated policies of AID, the World Bank, and other donor institutions. As important is the evaluation of benefits. For schistosomiasis three types of benefits may be considered: direct, indirect, and intangible. The direct benefits include income gains to individuals from controlling schistosomiasis through increased employment or increased production gains to the agricultural sector. This measure requires some information about the effects of the disease on man, and it may be possible to use results of other studies, as in Brazil, to make a rough estimate for this term. Indirect benefits may be considered to be medical costs avoided by the individual, reclaiming of land from engineering control measures so that more acres are available for farming, and the availability of money that would have been used for schistosomiasis control for other uses such as broader health care delivery, education and/or better housing. In addition, indirect benefits from schistosomiasis control could include control of other parasitic diseases if engineering and sanitation measures are implemented. The intangible benefits such as the alleviation of human suffering and the improvement in quality of life are not easily quantified in dollar terms but should be included in any discussion of benefits. In fact it may be possible to quantify these benefits if one can estimate the villagers' "willingness-to-pay" for not having schistosomiasis or for living in better sanitary conditions. (One example in Iran of how much the villagers are willing to pay for better living conditions is the price they paid for moving from traditional villages to the newly constructed ones in the area).

To acquire baseline data, villages will be surveyed to describe living conditions that contribute to limiting the population's ability to work (for example, poor sanitation might result in infections with other debilitating parasitic diseases besides schistosomiasis, e.g., hookworm, ascariasis) and to delineate conditions that might be improved by attempting to limit the spread of schistosomiasis (e.g., engineering, sanitation, and health education measures). In addition, a survey of employment records kept by agricultural businesses in the project area will be undertaken. By comparing records of absenteeism with records of disease history for employed individuals, it may be possible to make more accurate estimates of the employment or production benefits obtained from reducing the disease Data for this objective will be obtained by a survey based upon observations made in the villages of the project area. The willingness-to-pay term will be evaluated. Survey design will be prepared in consultation with statisticians in the United States and in the field area. The services of an anthropologist, preferably a native of the country in which the field area is located, will be necessary to determine applicability of the survey design to the life styles of the population and to the evaluation of intangible benefits. A total of approximately four man-months of professional services plus clerical and supporting services at a cost of about $5200 will be required.

Estimation of benefits is a somewhat longer and more complex task. It will begin in the tenth month of the study and require about five months. Both the villages and employment surveys will require the assistance of an interpreter and of LDC field personnel in contacting public and private officials for permission to conduct the surveys in the villages and for the review of available employment and production records.

anthropologist will participate in the early stages of the surveys. Estimation of benefits from the alternative control strategies such as reduction in man-years sick contributing to increased employment opportunities will begin after completion of the cost-effectiveness analyses for the alternative programs, i.e., about the tenth month of the total progam. Four man-months time of the investigator and assistant, 19 man-months of local support, transportation, clerical expenses, etc., will total about $18,650. A milestone report will be submitted at the conclusion of this stage, i.e., about 14 months from project commencement.

d. Objective 4 - Methodology for analyzing cost-benefit of preventing environmental health impacts of water resource projects.

The final activity for the study, based on the results of the above analyses, will be the development of a quantitative, yet practical, methodology for analyzing the economics of preventing environmental health impacts from water resources development projects.

The costs and benefits will be measured via the essential STS parameters - meters of snail habitat and number of people sick. The costs of reducing both of these terms by alternative methods will be evaluated and then compared with the direct, indirect, and intangible benefits of preventing schistosomiasis. The results are expected to be in a form compatible with development project analyses completed by AID, the World Bank, and other donor agencies. In addition to obtaining a benefit-cost ratio, other results will include the damage function for costs of controls - e.g., how much will reduction in disease reduce damages from the disease (in dollar and physical terms), and consideration of other objective functions in the context of linear programming,-e.g., minimizing costs of disease and

maximizing number of people healthy etc. No matter what technique is used, the overall objective is to mazimize the net benefit to society from reducing schistosomiasis.

Computer analyses using the STS model for predicting the benefits and costs of alternative control strategies will be undertaken. Two months of the work for this stage will take place in the field area; the remaining two months of the study will take place back in the United States for final report preparation. It is expected that this stage will require 4 months for completion. At the end of the 18th month of the study, a final report will be submitted to AID. Inputs for this stage include time of the principal investigator and her assistant (4 man-months), a computer modeler (one month), interpreter, driver, clerical help (12 man-months), transportation, computer time, etc., all valued at $19,500. The final report will be available to AID at the conclusion of this stage, at approximately 18 months after initiation.

2. Contractor and site

It is expected that the study will be conducted under the auspices of the Resources for The Future, a non-profit corporation. The Organization will provide office space, secretarial assistance, computer facilities and overall guidance. Consideration has been given to the Near East Foundation which admittedly has considerable expertise and experience in the Middle East. However, that experience has been primarily in the fields of agriculture and technical education and the NEF program appears

to be increasingly circumscribed, especially in Iran. The STS model was developed and verified using 13 years of data supplied by the Bilharziasis Control Project, the Dez Pilot Irrigation Project, and the University of Tehran. All three are activities of the Government of Iran. In addition, the GOI is rapidly moving to enlarge the irrigated area to include the new West Irrigation Project as a part of its bilharziasis experimental control project. The combination of opening virgin agricultural land adjacent to contaminated area both under the influence of an active control effort makes the Dez, Iran site preferable to any other presently known.

3. Review

The above document in draft form was circulated for review and constructive criticism to each Regional Bureau, to various offices of TAB, and to two internationally recognized schistosomiasis experts. Each was also asked specifically to comment on the time span and on whether Iran is the most favorable site for the proposed study. Replies as to format, procedure, clarity, etc. have been included in the above revision. Replies as to the optimal site location are not unanimous. One reply suggested that it might be preferable to have an affluent country such as Iran for methodology development, plus another not so affluent LDC in the planning stage of a water resource development project.

On the more technical side, one expert contended the lower costs of control in Iran are associated with the discontinuous nature of the transmission pattern, the relatively low prevalence rates and the relatively low intensity of infection and concluded that cost figures from Iran cannot be applied to most other endemic areas. He made no comment on what effect the use of a low cost figure would have on the development of the systematic

methodology for comparing costs and benefits which this project seeks to establish.

The second technical analysis was made by the individual formerly in charge of the WHO worldwide effort to control schistosomiasis. He is one of todays foremost authorities on the disease. Extracts from his review follow:

> "I'm very enthusiastic about the need to do studies of the kind proposed. ---- Iran has the resources and trained manpower (trained to work on schisto) to assist the project adequately. --- The two-fold "project purpose" (page 2) can be met by the proposed study in broad terms. --- However, the "outputs" (page 3) may not all be attained. Data on epidemiology and costs can be obtained in all probability. Effectiveness of control measures may be very hard to assess because control measures have been in widespread use in the endemic area for years and the transmission rate is now probably very low. Also, benefits of control work will be very hard to assess because infections are relatively light and the damage to the infected people may therefore be quite small. The problem is to <u>measure</u> the damage. For that one needs to work, if possible, in areas where the infections are severe. Iran may not qualify on that score. --- Finally, I see the advantages in working on the problem in Iran. I would suspect

that there is no area, at the moment, which offers a comparable opportunity and comparable data and an ongoing program. It seems, then, that there may not be a better alternative." (underlining supplied).

To these comments the principal investigator responds:

1) The costs of control in Iran may be lower than in other countries and this may well be associated with the low intensity of infection. However, the absolute level of costs is no detriment to the development of a rigorous methodology for considering and evaluating each component of these costs.

2) Most LDC farmers are subjected to a multiplicity of diseases and environmental hazards which makes it difficult to allocate the proportion of costs and damages caused by a single disease factor or to ascribe the benefits resulting from control of that single disease. On the contrary, the Khuzistan area of Iran is substantially free of malaria and other debilitating diseases which would mask the effects of schistosomiasis. Damages, costs and benefits observed all may be reliably ascribed to the specific disease under study.

3) The mine of data available is believed to exceed that available at any other site. Disease control operations have been underway for thirteen or fourteen years and large scale agro-business operations for perhaps half that time. Other sites may furnish equivalent data on specific control measures for limited periods but it is believed other sites can not provide reliable data over a sufficient period of time to establish a statistically valid cause and effect relationship as well as can Iran.

4) The principal investigator is known personally by all the Iranian officials engaged in their control program. Keenly interested in her objective and methodology they have supported her work, asked her to present her findings at the First National Seminar on Parasitic Diseases and, by means of a personal communication from the Vice-Chancellor of the University of Tehran representing the Minister of Health of Iran, requested her to continue her work. The intensity and degree of cooperation might be duplicated at another site but only at the expense of time and additional funds.

5) The presence of a large scale government backed agricultural development program conterminous with a large schistosomiasis government operated control program is not known to exist elsewhere. Because the Iranian government is so intimately involved on both sides of the problem it is believed that the cooperation and assistance made available will exceed that available under other combinations of government, foundations and private entrepreneurs operating at other sites.

On balance TA/H believes this project should go ahead, that the preferred site is in Iran, and so recommends.

4. Project Budget - see attachment.

5. Project Schedule - see attachment.

NPUTS	First two Fiscal Years Man Mos.	Est'd Cost $	Man Mos.	Est'd Costs $	Total Estimated Life-of-Proj Man-Mos.	Costs
.Salaries*	24	21,600	12	10,800	36	32,400
. Fringe Benefits @ 20%		4,320		2,160		6,480
. Overhead						
Salaries + benefits 25920 @ 40%		10,368	12960 @ 40%	5,184		15,552
. Consultants	9	27,000	1	3,000	10	30,000
. Travel		2,800		1,400		4,200
. Allowances		6,750		750		7,500
. Other direct costs						
. Equipment, vehicles, materials and supplies		7,730		4,030		11,760
. Services by Non-U.S. personnel (incl. anthropol.)	37	13,800	12	4,350	49	18,150
. Report Prep.			2	1,000	2	1,000
. Printing & Reproduction				1,000		1,000
Total Costs by Inputs	70	94,368	27	33,674	97	128,042

*For proposed investigator and research assistant

LIFE...-PROJECT SCHEDULE

Activity/Output	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J
	.976												FY 1977					
1. Objective 1.-Environmental Health Impact																		
a. epidemiological data				s	-	-	-	-	c									
b. irrigation data	s	-	-	c														
Prediction of environmental health changes-report									M									
2. Objective 2.-costs of Preventing Environmental Health Impacts																		
a. alternative strategies analyses					s	-	c											
b. cost and effectiveness analyses of alternatives							s	-	-	-	c							
cost-Effectiveness Analyses Estimates - Report											M							
3. Objective 3.-Benefits from preventing environmental health impacts																		
a. survey design	s	-	c															
b. benefit estimation										s	-	-	-	c				
Benefit Analyses-Report														M				
4. Objective 4. Benefit-Cost methodology for environmental health impacts																		
a. computer analyses															s	-	c	
b. final report preparation															s	-	-	c
FINAL REPORT																		FR

s-start of work
c-completion of work
M-milestone report
FR-Final Report

AID 1020-28 (1-72)

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Project Title & Number: Socio-Economic Analysis of Environmental Health Problems

Life of Project: From FY 1976 to FY 1977
Total U.S. Funding $128,000
Date Prepared: Dec. 6, 1975

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: 1. Improve quality of life for the 700 million rural poor residing in schistosomiasis-infected areas through control of the disease, one of the many adverse environmental impacts to which they are subjected.	Measures of Goal Achievement: 1. Reduced mortality, morbidity rates. 2. Increased production of food and fiber. 3. Improved scale of living 4. Improved dietary intake.	1. Official health statistics. 2. FAO Production Yearbook. 3. Higher average scale of living as measured by a sociological scale (e.g. Belcher). 4. Growth curves of infants and children.	Assumptions for achieving goal targets: 1. LDC governments sincerely desire improvements in living conditions of rural poor. 2. LDC planners will utilize, if available, a cost-effective method of allocating available resources. 3. Available resources are adequate to initiate a long range program.
Project Purpose: 1. To expand a previously developed Schistosomiasis Transmission Simulation (STS) model into a methodology which will assist national planners in determining the socio-economic impact in cost-benefit terms, of the presence of schistosomiasis in the area of water resource. 2. To assist AID to prepare an environmental impact statement acceptable under Section 102B of the National Environmental Policy Act for each water resources project undertaken.	Conditions that will indicate purpose has been achieved: End of project status. 1. Methodology found to be inappropriate for objective. 2. Methodology is found appropriate and transferable. 3. Methodology acceptable under NEPA.	1. Model used in one or more LDCs. 2. Is used by AID in preparing environmental analysis annex.	Assumptions for achieving purpose: 1. Relationship of health inputs to socio-economic development can be demonstrated quantitatively and qualitatively. 2. Cost-benefit model can assist in resource allocation of various mixes of preventive and curative abatement programs. 3. AID will conduct environmental assessments for each capital and/or TA project.
Outputs: 1. Ability to predict level of prevalence of schisto resulting from a planned water resource project. 2. Ability to determine cost-effectiveness of various disease control strategies. 3. Determination of economic and social benefits associated with abatement of the disease. 4. Methodology of calculating cost-benefit ratios associated with alternative control strategies.	Magnitude of Outputs: 1. Report of epidemiological and irrigation data. 2. Report of cost-effectiveness of alternative control strategies. 3. Report of social and economic benefits available from prevention of disease proliferation. 4. Model for cost-benefit analysis. 5. Recommended strategy of choosing and sequencing alternative control methods for optimal suppression of disease.	1. Project design, blueprints and cost estimates. 2. Reduction of disease prevalence. 3. Increased employment opportunities. 4. Increased agricultural production. 5. Improved scale of living of workers (Belcher scale?). 6. Production records. 7. Derivation of sequential expenditure cost-effectiveness curve. 8. C-B Model.	Assumptions for achieving outputs: 1. Data on epidemiology, employment and agricultural productivity are available at site of pilot project. 2. A sequential expenditure cost-effectiveness equation can be derived. 3. Established patterns of behavior can be altered if inhabitants perceive benefits of change.
Inputs: AID/W: Funding, monitoring, liaison with cooperating agencies, dissemination of final report. CONTRACTOR: Mathematical relationship formula, provision of technical manpower, supervision, computer times, analysis and modeling capability. LDC: Site, cooperating institution, manpower, facilities and equipment.	Implementation Target (Type and Quantity)		Assumptions for providing inputs: 1. Personnel (Contractor and indigenous) are technically competent. 2. Present Bilharziasis Control Program will continue to be funded by LDC.

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RESEARCH AND DEVELOPMENT COMMITTEE

Minutes of the March 24, 1976 Meeting

Project: Socio-Economic Analysis of Environmental Health Problems (Schistosomiasis impacts of water resource development projects) (New), 18 mo., $128,042.

Contractor: Resources for the Future

Project Manager: Dale Swisher, TA/H

Discussion Highlights:

There were no issues raised.

Motion: That the project be approved.

Moved by John Blumgart; seconded Wm. Feldman

Vote: Unanimous approval.

UNITED STATES GOVERNMENT

Memorandum

TO TA/PPU, Mr. Carl Fritz

DATE: December 8, 1975

FROM TA/H, Edward P. Irons, M.D.

SUBJECT: Proposed FY 76 Project - Socio-economic Analysis of Environmental Health Problems

ACTIONS REQUESTED

1. Project Approval.
2. Review at December R & DC meeting.

BACKGROUND

The accompanying paper was originally presented to TA/PPU, to Regional Bureaus and to two internationally recognized experts for critique and/or approval on April 1, 1975. For this reason, it is submitted as a PROP rather than a PP. On the basis of comments received the paper was revised and re-submitted to TA/PPU where it was considered by Mr. Farrar at the TAB program review on July 2, 1975. The decision of the AA/TA was:

1. It would be useful to have a systems analyst see if the model will function the way it should

2. TA/H will push WHO to do this project but if it would take WHO another 18 months to start the activity we might go ahead with it.

Subsequently, TA/H obtained approval from AA/TA (Ms. Belcher) to submit this project for funding by AID in FY 76 and remove from the WHO "package".

Also subsequent to the TAB review of July 2, the proposed principal investigator has severed her connections with The Johns Hopkins University and is now on the resident staff of Resources for The Future, Inc. RFF is a non-profit corporation which devotes a considerable portion of its resources to the appraisal and interpretation of the problems of environmental quality. RFF is fully aware of the fact that perhaps 700 million people live in areas plagued by endemic schistosomiasis; that the socio-economic consequences of the disease are largely unquantified; that an attempt to study these and the impact on the environment of the 700 million is in close congruity with the objectives of RFF. For these reasons it is willing to assign its staff and to provide computer equipment, office space, publications facilities, etc. as required to collaborate with AID in the contract proposed herein.

ACTION

In compliance with the AA/TA decision, TA/H instituted three actions, viz, a) a review by Dr. Richard Smith, Systems Analysis Group of the U.S.

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project; that no funds are currently available for project associated costs; and, if by some miracle all these problems were solved, the four remaining components proposed by AID would impose considerable pressure on WHO's current resources. He felt that it would be in the best interests of both WHO and AID to separate this proposal from the five part package under discussion.

As an AID project Dr. Davis made three substantive suggestions:

1. The establishment of a methodology of determing cost-effectiveness and cost-benefit ratios is fundamental to effective, economical and rational control programs. The sooner such analytic methods are established, the more effective the anti-schistosomal efforts of all donors. Therefore, AID would be well advised to initiate and support this program as quickly as possible.

2. WHO be permitted to collaborate with AID and to provide such input as is within WHO capabilities, including technical and practical advice, review and evaluation of field data and assistance in dissemination of results.

3. That data acquired by WHO during the last three years be evaluated by Dr. Rosenfield as an additional portion of the present project. A WHO control program in Tanzania has accumulated two years of pre-project baseline data plus one year of project results. A WHO project in Ghana has operational data for one year. In neither case are the data components precisely known nor is their compatibility with the requirements of the STS model established. Likewise, data quality and quantity are unknown. If the data proves to be adequate they should be used to improve the STS model; if lacking in desirable elements, that available might be used to demonstrate the applicability of the present model under a different set of environmental disease parameters. It should be noted that this procedure is very similar to that suggested by the African Bureau in its original review and noted on page 22 of the basic document.

RECOMMENDATIONS

TA/H makes the following recommendations:

1. That AID enter into a contract with Resources for The Future, Inc., requiring RFF to provide the services of Dr. Patricia L. Rosenfield as principal investigator plus the auxiliary personnel, services, travel and other backstopping outlined in the attached proposal.

2. The WHO offer of assistance and collaboration be accepted and incorporated in the final contract.

3. The site of future work be subject to examination of the WHO data on Tanzania and Ghana. Should either country provide data superior to that found in Iran, the basic AID-RFF contract shall be amended accordingly.

Attachment: as stated