PD-AAQ-790

UNCLASSIFIED

UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D. C. 20523

ECUADOR

PROJECT PAPER

MALARIA CONTROL

AID/LAC/P-209

Loan Number: 518-U-062
Project Number: 518-0049

UNCLASSIFIED

PROJECT DATA SHEET

A = Add
C = Change
D = Delete: A

Amendment Number:

CODE: 3

2. COUNTRY/ENTITY: Ecuador

3. PROJECT NUMBER: 518-0049

4. BUREAU/OFFICE: LAC 05

5. PROJECT TITLE (maximum 40 characters): MALARIA CONTROL

6. PROJECT ASSISTANCE COMPLETION DATE (PACD): MM 01 DD 30 YY 90

7. ESTIMATED DATE OF OBLIGATION (Under 'B.' below, enter 1, 2, 3, or 4)

A. Initial FY 85 B. Quarter 2 C. Final FY 89

8. COSTS ($000 OR EQUIVALENT $1 =)

A. FUNDING SOURCE	FIRST FY 85 B. FX	C. L/C	D. Total	LIFE OF PROJECT E. FX	F. L/C	G. Total
AID Appropriated Total						
(Grant)	(1,200)	(300)	(1,500)	(2,000)	(1,000)	(3,000)
(Loan)	(2,300)	(200)	(2,500)	(5,500)	(1,000)	(6,500)
Other U.S. 1.						
Other U.S. 2.						
Host Country		500	500		11,500	11,500
Other Donor(s)	100		100	720		720
TOTALS	3,600	1,000	4,600	8,220	13,500	21,720

9. SCHEDULE OF AID FUNDING ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE 1. Grant	2. Loan	D. OBLIGATIONS TO DATE 1. Grant	2. Loan	E. AMOUNT APPROVED THIS ACTION 1. Grant	2. Loan	F. LIFE OF PROJECT 1. Grant	2. Loan
(1) HE	520	542	542	0	0	1,500	2,500	3,000	6,500
(2)									
(3)									
(4)									
TOTALS						1,500	2,500	3,000	6,500

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each): 549 510

11. SECONDARY PURPOSE CODE:

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)

A. Code	BR						
B. Amount	9,500						

13. PROJECT PURPOSE (maximum 480 characters)

To develop the institutional capabilities of the SNEM in such a way as to bring the current malaria epidemic under control, reduce nation-wide malaria incidence and maintain control over incidence levels.

14. SCHEDULED EVALUATIONS

Interim MM 08 YY 87 MM YY Final MM 11 YY 89

15. SOURCE/ORIGIN OF GOODS AND SERVICES

[X] 000 [X] 941 [X] Local [ ] Other (Specify)

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of a ____ page PP Amendment.)

17. APPROVED BY

Signature: [signature]

Title: Mission Director USAID/Ecuador

Date Signed: MM 11 DD 16 YY 84

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION

MM DD YY

AID 1330-4 (8-79)

UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON D C 20523

PROJECT AUTHORIZATION

Name of Country: Ecuador

Name of Project: Malaria Control Project

r of Project: 518-0049

Number: 518-U-062

1. Pursuant to Section 104 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Malaria Control project for Ecuador involving planned obligations of not to exceed Six Million Five Hundred Thousand United States Dollars ($6,500,000) in loan funds ("Loan") and Three Million United States Dollars ($3,000,000) in grant funds ("Grant") over a five (5) year period from the date of authorization, subject to the availability of funds in accordance with the A.I.D. OYB/allotment process, to help in financing foreign exchange and local currency costs for the project. The planned life of the project is five (5) years from the date of initial obligation.

2. The project ("Project") consists of assistance to Ecuador to reduce morbidity and mortality caused by endemic diseases. The major purpose of the project is to control malaria nation-wide to a level where it is no longer a public health problem, and to develop institutional capacities to maintain that level of control.

3. The Project Agreement, which may be negotiated and executed by the officer to whom such authority is delegated in accordance with A.I.D. reglations and Delegations of Authority, shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate.

a. Interest Rate and Terms of Repayment

The Government of Ecuador (GOE) shall repay the Loan to A.I.D. in U.S. Dollars within twenty-five (25) years from the date of first disbursement of the Loan, including a grace period of not to exceed ten (10) years. The Government of Ecuador shall pay to A.I.D. in U.S. Dollars interest from the date of first disbursement of the

Loan at the rate of (i) two percent (2%) per annum during the first ten (10) years, and (ii) three percent (3%) per annum thereafter, on the outstanding disbursed balance of the Loan and on any due and unpaid interest accrued thereon.

b. Source and Origin of Commodities, Nationality of Services (Loan)

Commodities financed by A.I.D. under the Loan shall have their source and origin in Ecuador or in countries included in A.I.D. Geographic Code 941, except as A.I.D. may otherwise agree in writing. Except for ocean shipping, the suppliers of commodities or services financed under the Loan shall have Ecuador or countries included in A.I.D. Geographic Code 941 as their place of nationality, except as A.I.D. may otherwise agree in writing. Ocean shipping financed by A.I.D. under the Loan shall be financed only on flag vessels of Ecuador or countries included in A.I.D. Geographic Code 941, except as A.I.D. may otherwise agree in writing.

c. Source and Origin of Commodities, Nationality of Services (Grant)

Commodities financed by A.I.D. under the Grant shall have their source and origin in Ecuador or in the United States, except as A.I.D. may otherwise agree in wiring. Except for ocean shipping, the suppliers of commodities or services financed under the Grant shall have Ecuador or the United States as their place of nationality, except as A.I.D. may otherwise agree in writing. Ocean shipping financed by A.I.D. under the Grant shall be financed only on flag vessels of the United States, except as A.I.D. may otherwise agree in writing.

d. Condition Precedent to Disbursement

Prior to any disbursement, or to the issuance by A.I.D. of documentation pursuant to which disbursement may be made, the GOE will, except as A.I.D. may otherwise agree in writing, cause the National Malaria Eradication and Vector Control Service ("SNEM") to recruit, identify and employ personnel for the positions of Chief of Operations and Assistant Chief of Operations in SNEM.

e. Special Covenants

The GOE shall covenant that, unless A.I.D. otherwise agrees in writing, it will:

(1) cause SNEM to prepare, in form and substance satisfactory to A.I.D., by December 1 of each project year, beginning in 1985, an annual plan detailing safety measures and procedures to be employed in the application of all insecticides used in the program.

(2) cause SNEM to prepare, in form and substance satisfactory to A.I.D., by November 1 of each project year, beginning in 1986, an annual program evaluation plan outlining criteria and benchmarks for each program component to be assessed during the annual program review.

(3) make every reasonable effort to ensure that each participant trained overseas under this Project works in malaria control activities in Ecuador for a period of not less than three times the length of time of his or her training program.

(4) take appropriate safety measures for the use of insecticides financed under this program, including the provision of safety equipment to insecticide handlers, training of handlers and supervisory personnel in the risks associated with insecticides, and instruction in proper procedures for safe handling.

(5) provide, or cause SNEM to provide, to A.I.D., in form and substance satisfactory to A.I.D., by December 1 of each project year, beginning in 1985, a certified copy of the approved SNEM budget for the following calendar year.

f. Waivers

(1) Hand compression spray pumps ("Hudson sprayers") having an approximate value of $231,000 may be procured from a single source on a negotiated price basis.

(2) The requirement that motor vehicles financed by A.I.D have their source and origin in the United States is hereby waived in order to permit the procurement of approximately sixty (60) motorbikes, with displacement of 125cc, in an amount not to exceed $55,000, from countries included in A.I.D. Geographic Code 935. The provisions of Section 636(i) of the Foreign Assistance Act of 1961, as amended, are also hereby waived.

(3) Pharmaceuticals having an approximate value of $100,000 may be procured from a single source on a negotiated price basis.

(4) A source, origin and transportation waiver from A.I.D. Geographic Code 941 to Code 899 is hereby approved in order to permit procurement and shipment of pharmaceuticals for use in the project.

g. Certification

I hereby certify that I have determined that exclusion of procurement from Free World countries in A.I.D. Geographic Code 935 would seriously impede attainment of U.S. foreign policy objectives and objectives of our foreign assistance program in Ecuador.

Victor M. Rivera
Assistant Administrator
Bureau for Latin America and
the Caribbean

Date

Clearances:
GC/LAC:RBMeighan date
LAC/DR:ILevy date
LAC/DR:DJohnson date
LAC/SA:KJohnson date
SER/COM:PHagan date

GC/LAC:PGJohnson/gw 0053B/01/07/85

MALARIA CONTROL PROJECT

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GLOSSARY OF TERMS

Active Case Detection (ACD) is a part of surveillance activities in which malaria personnel actively search for malaria cases through the collection of blood slides and epidemiological investigations.

Activated Passive Case Detection (APCD) is part of surveillance activities in which malaria personnel are assigned to health institutions and collect blood slides from patients attending the institution. Slides may be collected only from fever cases, from specific age groups or from all patients, depending on instructions provided to the personnel assigned.

Annual Parasite Incidence (API) is the proportion of cases of malaria detected on an annual basis in relation to the unit of population in which malaria occurs.

Biological Control is a method of controlling mosquitoes using living vertebrate or invertebrate predators, genetic control, or parasites.

Chemoprophylaxis is the use of drugs before infection with the aim of preventing disease.

DDT is the common abbreviation of the name Dichlorodiphenyl Trichloroethane, a chlorinated hydrocarbon type of residual insecticide.

Endemicity is a term applied to malaria when there is a constant measurable incidence in an area over a succession of years.

Epidemic is a term applied to malaria when the incidence of cases in an area rises rapidly and markedly above its usual level.

Epidemiology in a broad sense is the study of the environmental, personal, and other factors that determine the incidence of disease.

Fenitrothion is an organophosphorus residual insecticide.

Focal Spraying is residual insecticide house spraying around a malaria focus.

Incidence is the number of cases of disease occurring during a given time period in relation to the unit of population in which they occur.

Larvicide is a substance used to kill the aquatic larval stage of the malaria mosquito by ingestion, contact, or respiratory blockage.

Malaria Control is an operation aimed at reducing the prevalence of malaria to a level at which it is no longer a major public health problem.

Malaria Control Program (MCP) refers to the national malaria control effort of the Government of Ecuador.

Malaria Eradication is the ending of the transmission of malaria and the elimination of the reservoir of infected persons in a time-limited campaign, to the degree that when the effort comes to an end there is no resumption of transmission.

Malaria Focus is a defined and circumscribed locality situated in a currently or formerly malarious area and containing continuous or intermittent malaria transmission.

Malariogenic Potential is the degree to which an area is conducive to malaria, based on cumulative epidemiological colleted from each area regarding the parasite load, vector density, water-logging, climatic conditions, population movement, and other factors.

Malathion is an organophosphorus residual insecticide.

Malaria Parasite is a colloquial term for any of the protozoan organisms causing malaria infections.

Parasite Rate is the percentage of persons showing malaria parasites by blood smear examination.

Passive Case Detection (PCD) is a part of the surveillance activity in which the public health and medical services other than the regularly constituted malaria service assist surveillance activities by the collection of blood slides from persons requesting treatment.

P. falciparum Malaria is a severe type of malaria caused by Plasmodium falciparum, a species of malaria parasite.

Presumptive Treatment is initial drug treatment given to an expected malaria case at the time when a blood sample is taken for examination.

Residual Insecticide is an insecticide which when suitably applied on a surface, maintains for a considerable period of time its insecticidal activity by either contact or fumigative action.

Surveillance is that part of a malaria program aimed at discovery, investigation, and elimination of continuing transmission and the prevention and cure of infections.

Total Spray Coverage is the application of residual insecticide during one spraying cycle to all sprayable surfaces in all sprayable houses within a given operational area.

Ultra Low Volume (ULV) Spraying is a method of insecticide dispersion by special air or ground equipment using very small amounts of finely dispersed particles of insecticide.

Vector is an infected non-vertebrate host which serves as a vehicle for transmission of a disease from infected man to uninfected man. A biological

vector is one in which cyclic development of the disease organism within the host is required before the host can transmit to man the infective form of the agent of disease.

Vector in malaria is any species of Anopheline mosquito in which the malaria parasite completes its sexual cycle within the host mosquito and which is thus able to transmit the disease.

Vector Density (in the context of malaria) is the number of female Anopheline mosquitoes in relation to the number of specified shelters or hosts or to a given time period, specifying the method of collection.

Vector Susceptibility represents the resistance status of a species of mosquito to the effects of insecticides.

Water Management as it relates to malaria control involves the reduction or elimination of sources of mosquito breeding through filling, draining, digging, changing water levels, flushing, canal trimming, and other engineering methods.

I. PROJECT SUMMARY AND RECOMMENDATIONS

A. Recommendations

USAID/Ecuador recommends authorization of a $6,500,000 Development Loan and a $3,000,000 Development Grant for a Malaria Control Project for Ecuador. The Loan would be repaid to the United States Government in U.S. Dollars within twenty-five years from date of first loan disbursement, including a grace period of not to exceed ten years, at a rate of interest of 2% during the grace period and 3% thereafter.

B. Borrower/Grantee

The Borrower/Grantee will be the Government of Ecuador, which, in turn, will provide the funds to the National Malaria Eradication and Vector Control Service (SNEM), a semi-autonomous agency of the GOE, on a non-reimbursable basis.

C. Project Summary

The purpose of this Project is to develop the institutional capabilities of the SNEM in such a way as to bring the current malaria epidemic under control, reduce nation-wide malaria incidence, and maintain control over incidence levels. The project will assist the GOE to implement a comprehensive program of malaria control. Incidence of malaria in 1984--detected at about 80,000 cases but estimated to be as much as five times that figure--is at an all-time high. While the predominant malaria parasite is Plasmodium vivax, which causes high morbidity but is not normally fatal, the more dangerous P. falciparum is increasing alarmingly, both in cases identified and in percentage of total cases.

The project is designed to enable SNEM to reverse the present trend of increasing malaria incidence and, thereafter, to maintain long-term control. These objectives require an action program which will: (a) immediately address the present epidemic; (b) investigate the problems of parasite and vector resistance; (c) institute training of SNEM personnel in modern malaria control technology; (d) undertake operational research programs in the fields of malaria and other vector-borne diseases; and (e) build within SNEM the institutional capacity to deal with malaria on a sustained basis after completion of the project. In the process, SNEM will move from its present vertically organized program emphasizing total coverage house spraying and active case detection surveillance to an integrated program using a selective mix of vector control measures, improved surveillance, epidemiological stratification to determine the appropriate mix of control measures and a better use of the capacities of other elements in the Ministry of Health (MOH), Ministry of Defense and the private sector. Successful execution will depend on a number of variables, including vector resistance to DDT and the possible need to increase the use of the more expensive

organophosphorus (OP) insecticides; epidemiologically accurate yet rapid interpretation of surveillance data, enabling the proper choice of vector control options; cooperation and participation of the staff of the Primary Health Care service, of other elements in the MOH and the GOE, and of the general public; reduction in the incidence of P. falciparum malaria; collaboration of municipal authorities; mobilization of community resources; and expanded use of feasible alternative control measures.

The project has five principal components under which assistance will be provided:

1. Program Management: $1,365,000 of grant funding will be provided for long and short term technical assistance to strengthen the SNEM malaria control operation in the areas of program management, epidemiology, surveillance, drug sensitivity, insecticide resistance and evaluation.

2. Operational Research: $535,000 of grant funds will be utilized to support operational research in a wide variety of fields, including vector ecology, insecticide testing, development of computer-based analysis of surveillance data for constantly updated stratification, exploration of fruitful interventions in the field of health education, and baseline prevalence studies of other vector-borne diseases.

3. Training: $900,000 of grant funds will finance long and short-term training of SNEM personnel in vector control field operations, epidemiology, entomology and administrataive management; short-term, in-country training for evaluators and volunteer collaborators; and, training of trainers in health education.

4. Evaluation: $200,000 of grant funds will finance the services of U.S. malariologists not provided under the master technical assistance contract to participate in annual program reviews and project evaluation summary reviews -

5. Commodity Support: $6,500,000 of loan funds will finance insecticides and insecticide application equipment; essential transport; laboratory supplies, health education and voluntary collaborator training, equipment and supplies; office supplies and equipment; and antimalarial drugs.

Total project inputs over the five-year period are calculated at $40,168,000, of which $29,948,000 consists of the actual and anticipated SNEM budget. PAHO will provide $720,000 in technical services and training opportunities. A.I.D. funds totalling $9,500,000 will finance the balance (about 24% of total Project inputs).

Counterpart costs under the Project will consist of unprogrammed increases to the SNEM budget attributable to the Project activities. The SNEM budget for the life of the project will increase by $11,500,000 above the

budget anticipated for approval without the Project. Thus, the GOE counterpart to the Project will be calculated only as that increase attributable to the Project; not the entire SNEM budget.

The project technical feasibility analysis comprehensively reviews the technical issues raised by the project, including the entire range of control measures, drug and parasite sensitivity testing, training and research. The project design provides appropriate technical assistance and training and includes an operational research component which will enable the GOE to implement technically sound approaches to malaria control.

Possible administrative constraints affecting project implementation were analyzed. Problems related to SNEM's organizational location within the MOH, personnel limitations, and logistics problems were analyzed. SNEM has been found capable of administering the project and desireous of building stronger links with the primary health care system. The project will strengthen SNEM's ability to overcome previous administrative limitations through training, TA and logistics support.

The economic analysis finds the project to be worthwile from an economic standpoint. The project was submitted to three primary test of value. The benefit-cost ratio is 2.93; project net present worth is $ 51.2 million; and the economit rate of return exceeds 50 percent.

The project financial analysis considered the timing, composition and amount of inputs to be financed by USAID, GOE and other donors (PAHO), as well as past SNEM performance in executing its budgets. Project inputs are shown to be appropriate, affordable and adequately financed over the LOP by both USAID and GOE. SNEM has demonstrated the capability to fully execute its past budgets and has obtained the highest level GOE pledge of adequate financial support to meet its commitment.

The social soundness analysis addresses the ability of the project to distribute benefits equitably; the cultural diversity of the population in malarious areas; and the social acceptance of malaria control methods to be used in the project. The project was found to be socially feasible in all three respects, but in addition builds in large support for sociological studies, TA and educational programs to further address these concerns in the future.

II. PROJECT BACKGROUND

A. Statement of the Problem

1. The Global Malaria Problem

With more than 1.8 billion people in the world living in areas at malaria risk, it is obvious why malaria eradication or control should be the goal of many developing countries, international organizations, and bilateral donors including the U.S. Although external assistance is fully supportable--and has often been justified--on humanitarian and health grounds, the economic consequences of uncontrolled malaria on development is always very significant and is frequently an absolute inhibition to development. Anti-malaria activities vary from vertical, free-standing programs organized to attack the disease directly to limited curative efforts integrated within the country's general health services. During the 1950's and 1960's, nearly 90 countries had national programs to combat malaria. The long struggle to contain this disease continues today in large areas of Asia, most of Tropical Africa and in Latin America.

Malaria deserves particular and specific attention because of its widespread prevalence in both temperate and tropical climates and its serious impact on the social and economic development of individuals and communities. In terms of social impact, malaria can retard the mental and nutritional development of infants and children, reduce school attendance, result in lost workdays and lower industrial productivity for the labor force, cut food production and shorten life expectancies. Malaria is itself a major cause of morbidity, when combined with other diseases which are common in many developing countries, malaria contributes to increased mortality rates.

The economic impact of malaria can be calculated in terms of lost income to its victims, reduction in national and human productivity, and expenditures to control and treat the disease. An important point is that the malaria mosquito vector and parasite are becoming increasingly more resistant to commonly used insecticides and anti-malaria drugs. As malaria spreads and resistance increases, greater quantities of increasingly expensive commodities are now required to combat the disease and to reduce it to levels where it is neither a public health nor an economic problem.

Malaria is a complex disease caused by a parasite. Man is the reservoir; the anopheline mosquito acts as the intermediary in spreading the disease parasite from one person to another. The female mosquito ingests the malaria parasite when biting an infected person. The malaria parasite develops within the mosquito and approximately 10-15 days later is transmitted to an uninfected non-immune person by the feeding mosquito. The parasite then moves through the blood to the liver where it multiplies for 6-15 days, whereupon malaria symptoms develop (fever, chills, etc.). Those most susceptible to the parasite are children under five, pregnant women and others not native to malarious areas, with little or no immunity.

Malaria transmission can be halted and/or reduced by interrupting contact between infected persons and the mosquito, between infected mosquitos and non-immune persons or by eliminating the parasite in man or the mosquito. Comprehensive malaria control programs today uses a combination of measures which are carefully planned and executed to reduce malaria. Until DDT and chloroquine became available in the late 1940's, the only means to provide widespread control of malaria was through measures which eliminated the mosquito through permanent source reduction (drainage) and water management, or through physical barriers which protected man from the mosquito (e.g. netting). Anti-malaria drugs were available but were costly and difficult to administer due to side effects. DDT applied on the walls of homes is still, in most areas, the cheapest, safest and most effective means to control the disease rapidly. However, with the appearance of mosquito resistance to DDT, very largely due to extensive agricultural use, and parasite resistance to drugs, in combination with the relatively high cost of constant epidemiological vigilance and surveillance (to detect, treat, investigate and classify each malaria case), antimalaria programs have been reconsidering their strategies and methods for control of this disease.

Thus, although many countries and regions have successfully eradicated malaria or dramatically reduced malaria-related morbidity and mortality, the overall objective of controlling the disease world-wide has not been achieved.

Since the inception of the world-wide malaria eradication effort in 1955, 12 Western Hemisphere countries have succeeded in terminating the transmission of malaria within their borders. Yet, throughout most of the hemisphere--especially in the tropical and semi-tropical nations--malaria continues to be the major cause of morbidity, a significant cause of mortality, and one of the greatest constraints to economic and social development. Between 1961 and 1982, the percentage of malarial infection in the hemisphere among individuals tested quadrupled.

The malaria burden in Latin America is not evenly divided; seven countries, including Ecuador, accounted for 85.8% of 827,727 identified cases in 1983, and five of these (again, including Ecuador) account for 93.5% of the 290,035 confirmed P. falciparum infections. Additionally, Latin America has witnessed a rapid development of resistance to many insecticides on the part of the mosquito vectors which transmit the disease. In South America, falciparum malaria parasites are increasingly resistant to the leading therapeutic drug, chloroquine.

Most countries in Latin America have continued to seek the program goal of country-wide eradication of malaria. Not until 1983 was there a general agreement among the Directors of Malaria Services of the Americas on the need to concentrate efforts and resources in areas where malaria is of critical importance; to adapt control tactics in each area to the epidemiological situation and to utilize the capabilities of their Primary Health Care services--in brief, to adopt a strategy of malaria control rather

than of malaria eradication. Ecuador is presently developing and institutionalizing a malaria control activity adapting new and supplementary control methodologies to Ecuadorean conditions.

2. Malaria in Ecuador

a. General Overview: Approximately 60 percent of the total surface of Ecuador lies in malarious areas. In a total population of 8.3 million (1983), 5.42 million or 62 percent of the population are at risk of malaria. Malaria is found in 18 out of 20 provinces in the country. Malaria control is the Number one health priority of the GOE.

b. Background: Ecuador's struggle against malaria began in the late 1950's as a part of the world-wide malaria eradication program of the World Health Organization (WHO). The program activities were based primarily on the use of residual insecticides and the use of anti-malaria drugs such as chloroquine. The first insecticide used, Dieldrin, was applied in three annual applications starting in 1957. During the 1957-1965 period with assistance from UNICEF, PAHO and A.I.D., virtually total coverage of the operational areas of the country was achieved, with semi-annual applications of DDT and the establishment of a network of some 6,000 voluntary malaria workers who provided treatment and collected blood films. The net result of this effort was a dramatic reduction of malaria and the establishment of an effective malaria organization, the Servicio Nacional de Erradicación de la Malaria y Control de Vectores (SNEM). Unfortunately, in subsequent years, delays in funding support were encountered; by 1969, malaria had risen to over 51,000 reported cases. The malaria situation was improved through residual spray applications and remained relatively stable at around 10,000 until 1979, when a combination of factors, administrative, geographical, epidemiolocal and social, caused the number of malaria cases to rise first gradually, then dramatically.

The budget for malaria control has grown slowly while inflation and salary levels have soared. As a result, salary costs have gradually consumed the bulk of the budget; funds for insecticides, equipment, training and research have fallen below minimal operational levels. At the same time, mosquitos in some areas of northern Ecuador acquired detectable resistance to DDT, which is still the main control chemical used. Due to the shortage of funds and, specifically, the two-year-old foreign exchange crisis, the malaria program has not been able to purchase adequate supplies of new, more expensive and more effective control chemicals nor to finance research on measures of control.

Other trigger mechanisms--each reinforced by SNEM's inability to provide even normal-year campaign supplies of insecticide, drugs and equipment--include the atypical weather patterns and flooding which accompanied the 1982-83 cyclical reversal of the dominant ocean current, and the ever-quickening pace of population movement into Ecuador's economic development areas.

c. Present Situation: The current malaria epidemic, still centered on the northern coast of Ecuador, is now spreading southward. The spread of the disease from the Province of Esmeraldas, where it was considered a local health problem in 1980, to the Provinces of Manabi, Pichincha, Cotopaxi, Los Rios, and Guayas, as well as Napo Province in the Oriente, indicates a seriously deteriorating and dangerous situation which is rapidly destroying past program achievements.

A 19-year record of reported malaria cases is presented in Table II-1 to provide a rapid review of the past incidence of malaria and its present epidemic status. (It must be noted that Ecuador has had a relatively low annual blood examination rate, and that actual malaria incidence is roughly five times the number of confirmed "cases" of malaria. This would indicate over 250,000 infections in 1983 and 400,000 in 1984, among a population at malaria risk of 5.4 million--one of the world's most serious epidemics.)

3. Critical Aspects of the Malaria Problem

There are four key aspects of the malaria problem in Ecuador which affect the capacity of the Government of Ecuador to exert a significant effect on the disease. These major factors are geographic, socio-demographic, technical and administrative.

The climate (temperature, humidity, rainfall patterns) and the difficult terrain are in large areas of the country ideally suited to both the widespread production of the mosquito vector and the transmission of the malaria parasite. Natural climatic disturbances such as the recent appearance of "El Niño" affect rainfall patterns, and expand and extend natural breeding sites. The rural population lives in close contact with the malaria mosquito, and without adequate control measures the disease is easily transmitted. In the major epidemic areas of Esmeraldas and Napo, the lack of roads and access to malaria areas makes malaria control difficult. It is necessary to plan and execute any malaria control effort carefully in order to overcome these geographic barriers.

Socio-economic factors include such elements as population movements, low education levels, certain cultural practices and poor housing conditions. These factors have a major impact on malaria epidemiology, and must be taken into account in developing control methodologies suitable to Ecuadorean conditions.

The technical epidemiological aspects include the inter-relationships of the malaria parasite, man and the mosquito. These relationships have been made more difficult in Ecuador by the appearance of resistance in both the parasite and the vector mosquito. The major malaria parasites in Ecuador include P. falciparum and P. vivax. The majority of the cases (70%) were P. vivax in 1983. However, P. falciparum, the most serious form of the disease and frequently fatal, especially to infants and children,

TABLE II-1

SUMMARY OF REPORTED MALARIA INCIDENCE

IN ECUADOR 1966-1984

YEAR	MALARIA CASES	% INCREASE OR REDUCTION		ANNUAL PARASITE INCIDENCE*	% INFECTIONS OF P. FALCIPARUM
		FROM BASE YEAR (1966)	FROM PREVIOUS YEAR		
1966	4,736		-	1.8	8.1
1967	10,765	127.3	127.3	3.8	8.9
1968	37,046	682.2	244.9	12.6	11.2
1969	50,938	975.5	37.5	16.8	8.3
1970	28,373	699.1	- 44.3	13.7	10.0
1971	9,233	95.0	- 67.3	4.2	9.8
1972	6,709	41.7	- 27.3	1.8	10.6
1973	6,810	43.8	1.5	1.8	14.6
1974	5,841	23.3	- 14.2	1.4	18.1
1975	6,555	38.4	12.2	2.1	18.6
1976	10,974	131.7	67.4	2.6	17.3
1977	11,275	138.1	3.0	2.8	23.1
1978	9,815	107.2	- 12.9	2.4	22.5
1979	8,207	73.2	- 16.8	1.7	32.3
1980	8,748	84.7	6.2	1.8	31.5
1981	12,745	169.1	46.0	2.6	26.9
1982	14,633	209.0	14.8	2.7	21.4
1983	51,606	989.7	250.6	10.1	32.0
1984**	79,194	1,572.2	53.5	14.6	21.6

* Annual Parasite Incidence (API) represents detected cases per 1,000 population

** Projected from January-September, 1984 actual data.

NOTE: Data obtained from Government of Ecuador (GOE), Servicio Nacional de Erradicación de la Malaria y Control de Vectores (SNEM).

is increasing. To add to this difficulty, P. falciparum is becoming resistant to normally applied anti-malaria drugs. The primary mosquito vectors of malaria are Anopheles albimanus, An. punctimacula and An. pseudopunctipennis. There are other secondary vectors, such as An. darlingi and An. nuñeztovari, but their role in malaria transmission in Ecuador has not been fully established.

SNEM reports indicate wide-spread DDT resistance in An. punctimacula in many areas of the country, especially in the northern coastal areas. An. albimanus also appears to be losing susceptibility to DDT. All the confirmed malaria vectors are susceptible to both malathion and fenitrothion, organophosphorus (O.P.) compounds (see Annex G for details). The epidemiological aspects of these technical questions on the malaria control project are discussed in the project description and technical analysis portion of the Project Paper.

The administrative considerations which must be brought to bear on a range of technical and operational activities require trained staff, informed and motivated leadership and a strengthening of the reporting and management systems. The SNEM institution is established and has a past history of accomplishment when provided sufficient materials and funding. However, field management and adequate supervision remain areas for improvement. There is also a need to simplify and standardize reporting and to make these reports more quickly available to the decision makers. In a control effort, it is essential to be flexible, adaptive and responsive to local problems in order to create a cost-effective organization. Administrative constraints which face SNEM include among other items the shortage of foreign exchange, poor coordination with the existing health infrastructure and low staff morale (see Technical Annex H).

Part III (Project Description) and Part IV (Project Specific Analysis) describe how the proposed project is designed to build upon the strengths of SNEM and to help resolve the variety of technical, operational and administrative questions. USAID/Ecuador believes that while the problems and constraints are substantial, a sound and effective anti-malaria program is feasible and should be initiated through the implementation of this project.

4. Importance of Other Vector Borne Diseases

Besides malaria, four other vector borne diseases that have been studied in Ecuador are Leishmaniasis, onchocerciasis, Chagas' and yellow fever. Basic investigation data show that they are significant in relation to the national health of Ecuador. Without doubt, there exist other vector borne diseases which at this time have not been discovered and studied (see Annex I, "Other Vector-Borne Diseases").

a. Onchocerciasis

The major focus of onchocerciasis (river blindness) in Ecuador, discovered in 1980, is located in the Rio Santiago Basin in the

province of Esmeraldas. Here approximately 10,850 people are exposed to risk of infection with 2,250--over 20% of the population known to be at risk--already diagnosed as having onchocerciasis. Those who live in the interior region of the river basin are the most affected. A 1982 study showed that 51-85% of the population in this area, Rio Zapallo (100 kilometers up river) to the headwaters, Rio Hualpi (270 kilometers up river) had the disease. A repeat survey in the same area in 1984 showed a raw prevalence of 100%. This increase of prevalence over a two year period is alarming. Along with this increased prevalence, the intensity of the disease has also grown.

A recent ophthalmological study of this same area showed that 44.9% of those infected had some type of ocular pathology due to the disease. Of these, 18.8% have permanent posterior eye lesions which lead to blindness. This has very serious socio-economic consequences in that the resulting blindness will reduce the efficiency of these primitive agricultural communities to below survival level. The greatest incidence of the permanent eye lesions is found in the adult males who form the backbone of the labor force. With blindness and possible shortened life they become a burden to themselves and to the community.

Another factor of concern is the dissemination of the disease to other provinces. The vector has been shown to exist in all coastal and eastern jungle areas up to an elevation of 1,000 meters. With the heavy and constant migration of microfilarial-positive young people to other provinces for reasons of employment, new foci have already been identified in three other provinces. This advance of the disease to other areas of the country threatens to be a serious public health problem.

With no mass, safe or low-cost treatment available for this disease, control of the vector is the only solution. Thus the transmission of onchocerciasis in Ecuador needs to be addressed and dealt with in order to prevent the serious consequences of a full-blown, long-term and wide-spread chronic infection.

b. Leishmaniasis

Medical documentation of leishmaniasis in Ecuador indicates that the disease has existed for centuries. However, only since 1978 have records of reported incidence of the disease been kept. These records show that the provinces most affected are the coastal and eastern jungle areas. The provinces of Napo and Morona-Santiago in the Oriente and Esmeraldas, Pichincha, Guayas and El Oro on the Coast have the highest incidence, particularly in areas where the climate and ecology are favorable for the endemicity of the disease. It is in these areas that logging and agriculture are main sources of employment.

The three different forms of leishmaniasis found in Ecuador all have serious health and social consequences to the patient. Patients infected with the cutaneous ulcerated lesions due to Leishmania tropica, have permanent scarring and are generally disfigured due to secondary bacterial

infection that augments tissue destruction. Patients living near rivers found to be infected with Leishmania mexicana have lesions on the face and especially on the ears, where it causes chronic ulcers. These ulcers may persist as long as 20 years and cause total destruction of the external ear. Patients in certain areas in the eastern jungle have micro-cutaneous lesions caused by Leishmania braziliensis. This infection produces gross facial disfiguring and at times causes death. Intractable, fungating ulcers break out on the tongue and in the buccal and nasal cavities, obstructing and destroying them. Death may result from secondary infections after exhausting years of suffering.

The incidence and severity of leishmaniasis in Ecuador has risen in the last three years to the point that it is threatening to become a serious public health problem. Data show that the incidence has risen 100% in the last two years alone. This increase has occurred for several reasons. There has been a continuing absence in the country of the basic medication needed for treatment so that presently many are experiencing the consequence of untreated chronic infections. In any event, treatment costs would exceed $100 equivalent per case. Also the density of the vector, the sand fly, has risen in certain geographical areas, explaining the increase in prevalence of disease. Given the high cost of medication and since the main single factor influencing the extent of human exposure to infection is the infective density of the vector, the only practical solution to leishmaniasis is vector control. Thus studies to define the vector population, breeding sites, and transmission potential are of utmost importance.

c. Chagas' Disease

Chagas' disease is a serious public health problem in Latin America. WHO estimates that more than 15 million people are infected and 60 million exposed to the risk of infection. Cardiomyopathy, an advanced manifestation of Chagas' disease, is the leading cause of cardiovascular death in South America. Overall, in endemic areas, it is the most important cause of death among males between the ages of 25-44 years.

In Ecuador, there have been clinically confirmed as well as fatal cases of Chagas' disease in the provinces of Guayas, Esmeraldas and Loja. In 1983, with PAHO assistance, SNEM began a pilot epidemiological survey of the disease in the Province of Guayas to determine the entomological identification and degree of infestation of the vector. Studies were also initiated to determine the morbidity of the disease based on serological data.

Of the 316 communities investigated for the presence of the vector, Triatoma dimidiata, 8 (2.5%) were found positive. However, only 0.75% of the homes investigated were found infested by the vector. Of the vectors captured, 29.3% were positive for the parasite, T. cruzi. Serological studies showed that of 2,078 persons tested 2.5% had a positive immune response to Chagas'.

Further studies are required to evaluate the geographical, cultural and ecological status of the eight communities positive for the

vector and to determine the house infestation rate in these areas. Studies are needed to determine the incidence of vector and disease in the other coastal provinces, as the ecological environments of the provinces are conducive to the maintenance of the vector's blood-dependent cycle. Support of this epidemiological work is critical in order that base-line data can be obtained to determine if and what control program should be instituted.

d. Yellow Fever

Ecuador has both the urban and sylvatic types of yellow fever infections. Urban yellow fever (epidemic yellow fever), transmitted predominantly by *Aedes aegypti*, is located on the coastal areas of Ecuador. Sylvatic or jungle yellow fever (epizootic and enzootic yellow fever), in which humans are accidental hosts, transmitted predominantly by *Aedes haemagogus*, is located in the eastern amazonic regions.

In the coastal regions of Ecuador, the vector *Aedes aegypti* was eradicated in the 1960's. Because of the presence of the mosquito in Colombia and its possible dissemination to Ecuador, SNEM in 1974 initiated a surveillance program to control the re-infestation of the vector. In the last ten years, five re-infestations have been discovered in the province of Manabi. Appropriate measures were taken on each occasion to eradicate the vector. No detected case of urban yellow fever has been reported in the coastal region. However, continued surveillance is essential to the protection of this area.

In the eastern amazonic regions of Ecuador there has been significant incidence of sylvatic yellow fever. Confirmed cases have been reported since 1975. In 1979 in the Province of Zamora Chinchipe, 21 deaths were reported due to yellow fever. In 1983, in the Province of Morona Santiago, 8 deaths due to the same virus were reported. From 1975 to 1983, 73 cases of sylvatic yellow fever have been detected in the Provinces of Napo, Pastaza, Morona Santiago and Zamora Chinchipe.

The method chosen to combat this serious health problem has been immunization against the disease. SNEM in cooperation with provincial health officials has implemented a program of yellow fever vaccination for the four provinces affected.

The maintenance and improvement of the existing SNEM program in the eastern jungle is important, for this area is the source of Ecuador's richest natural resources. The national economy is heavily dependent on the exploration and exportation of petroleum of this area.

The other potential public health problem posed by *Aedes* is dengue. It is important to note that although only one case of dengue has been detected (in 1980) in the Province of Esmeraldas, the country is in constant danger of reintroduction of the disease. Epidemics of dengue are frequent in the Caribbean and Pacific and there is continued travel between Ecuador and the infected areas. With no known treatment, vector surveillance and control offer the only solution.

B. Relationship to GOE Development Plans

This project is directly related to GOE development programs in the fields of agriculture, irrigation, and health services. GOE has assigned to malaria control its highest priority in the field of health. The GOE request for malaria control assistance stressed the economic and social importance of malaria. In fact, every economic activity in the malarious portion of Ecuador is affected directly or indirectly by this disease. The surge of malaria in Napo poses a serious threat to workers in the petroleum producing area. The successful development of the Province of Esmeraldas relies on adequate control of malaria. The entire province lies in the country's zone of intense, stable transmission of malaria. Endemic malaria has spread to the Provinces of Manabi, Los Rios, Guayas, Napo and others; these provinces will be subject to epidemic malaria unless and until adequate control measures are in place.

Participation in malaria control is in many if not most countries considered an essential element in the responsibilities of the Primary Health Care (PHC) system. In Ecuador, as in other countries, the Primary Health Care system has yet to develop the capacity to play a major role in the malaria program as it is currently planned; yet it is fair to say that malaria control may constitute the most essential element in the development of the GOE's emerging PHC system. In a country facing malaria problems like those in Ecuador today, the creation of a PHC system which lacked a major malaria control component would constitute a gross misunderstanding of the very concept of PHC.

This project is specifically designed to assist the GOE in the development of the malaria control component of their PHC system, which aims at the global objective of "Health for All by the Year 2000". Without a viable malaria control activity in Ecuador, primary health care cannot meet public needs in a large portion of the country. (See also Section II-E-2. below).

C. Andean Regional Activity

While this paper has identified the malaria problem in national terms, it is clearly an Andean regional problem, affecting all members of the Andean Pact. Ecuador particularly is affected by the border areas of Colombia and Peru, where malaria is also rampant, with little effective control activity underway. It is clear that a regional approach makes good technical and economic sense, but international cooperation to address this situation has thus far been absent. The current AID Malaria Project in Ecuador has, however, served as a catalyst to initiate a regional effort, involving PAHO and the Andean Health Ministers, under the auspices of the sub-agreement for Health - "Hipolito Unanume".

As a first step a small regional meeting of SNEM Directors and VBD scientists is planned for Lima in late November 1984. The purpose will be to review current malaria epidemiological data in each country, identify the constraints to effective program implementation and propose the outline of an Andean Regional Project for consideration of the Coordinating Committee of the

"Hipolito Unanume" Agreement (HUACC). PAHO will organize and staff this meeting, USAID/Ecuador will finance two representatives from SNEM and the research community. Informal inquiries made to USAIDs in La Paz and Lima elicited positive response for support. PAHO and USAID also hope to secure Venezuelan and Colombian participation.

The HUACC should then present this Project idea as an agenda item for the Andean Ministers of Health-HUA meeting scheduled for December in Lima. If there is a political decision to support such a Project, the detailed project proposal would be developed with a financing plan for presentation at the subsequent HUA Minister's meeting six to nine months later. As far as Ecuador is concerned, there is a clear indication of support from top MOH officials. It would seem reasonable to anticipate cooperative efforts in sharing of epidemiological information on border areas, joint research projects on vector and parasite resistance, and multi-country participation in training courses held in the region.

Given the uncertainty of the kind and scope of Andean regional activity that will ultimately be defined at the December meeting and subsequently, no project funds are specifically budgeted for this Activity, but minor reprogramming of project funds during Project Year Two may be considered, to the extent that it would advance the objectives of the Ecuador malaria control program.

D. Relationship to Country Development Strategy Statement (CDSS)

The most recent CDSS for USAID/Ecuador states that focus will continue on the overall objectives of expanding food production, increasing employment generation and incomes, and improving human productivity and well-being. Malaria control directly relates to two of these stated major objectives. First, expanded food production will be mainly accomplished through increased irrigation. The design and use of these facilities will determine whether a malariogenic environment is created, supporting the rise of Ecuador's malaria-carrying mosquito which prefers clean, pooled water. There are numerous examples in Latin America of irrigation systems which, through poor design or improper usage, have created serious malaria epidemics. Second, the relationship of adequate malaria control to both human productivity and human well being has been adequately documented since the early 1900's.

USAID/Ecuador's CDSS specifically identifies malaria as a major and priority health problem:

> Malaria is an increasingly serious problem in coastal areas. Severe flooding throughout the Coast in 1982-83 has contributed to a resurgence of this disease. The total number of diagnosed cases increased by 350 percent in 1983 over 1982. In addition, there are growing signs of resurgence of other vector borne and parasite diseases including yellow fever, leishmaniasis, and onchocerciasis

which can be expected to become increasingly serious problems during the CDSS period."

The malaria effort is also directly linked to the USAID strategy to help mitigate the damage to the productive base and to social infrastructure caused by the 1983 flooding. The rapid rise of malaria resulting from this flooding is demonstrated by examination of Table II-1; the number of detected cases in 1984 is the highest since Ecuador has maintained records. Over a fifth of detected cases are Plasmodium falciparum, a virulent species of malaria which causes high infant and child mortality. The CDSS states that USAID recognizes the growing malaria problem and the needs of the GOE's Malaria Program to strengthen its institutional capabilities and existing infrastructure.

E. Relationship to A.I.D. Strategy

1. A.I.D. Health Sector Strategy

A.I.D.'s health sector guidelines[1/] outline a series of strategies to achieve A.I.D. goals in the broad fieldof public health and specifically, in the field of primary health care. The degree of coincidence between these PHC strategies and those which underlie this project is striking:

a. To improve and expand the coverage of services through the transfer and further development of selected, cost-effective technologies, in direct response to country needs and resource constraints, by assessing:

i. Epidemiology -- the causation, nature, magnitude and severity of the problem.
ii. Technology -- availability of appropriate diagnostic, prevention and treatment technologies to address these problems.
iii. Economics -- investment and recurrent cost requirements of the services.
iv. Feasibility -- the political, managerial, social, infrastructural and administrative feasibility of proposed interventions.

A.I.D. health sector guidelines specifically address the malaria issue:

"Where malaria constitutes a major public health problem, A.I.D. will assist countries in the planning and management of a locally appropriate mix of control methods including vector control, chemotherapy and chemoprophylaxis and integration of malaria control activities with other primary health care services.

1/ A.I.D. Sector Strategy: Health, May 1984. Pages 2-4

2. A.I.D. Malaria Policy

The A.I.D. policy paper on malaria, issued in July 1984, pays particular attention to the role of the Primary Health Care (PHC) system in malaria control. The paper observes that: "From a strategic standpoint, and depending on the extent and severity of the malaria problem and the extent and capacity of the PHC system, A.I.D. may support malaria control selectively within the PHC program, but may also support malaria control per se in selected areas of the country when justified by malaria's impact on developmental activities or by catastrophic malaria incidence.1/

"Where the PHC system is weak, overburdening of inadequately prepared and supported PHC workers with additional malaria control tasks can be expected to lead not only to further weakening of PHC services, but also to ineffective malaria control activities.1/

"Economy of execution demands that all malaria programs make the maximum use of existing (and potential) PHC systems, consistent with the capacity of such systems to carry out their assigned roles".2/

3. Malaria Strategy for Latin America and the Caribbean3/

The proposed program in Ecuador is also fully consistent with the recently adopted malaria strategy for Latin America and the Caribbean. This document observes the tenacity with which the countries of the Western Hemisphere have preserved the goal of eradication of malaria even as the nearly vertical recent rise in the malaria incidence --and nowhere faster than in Ecuador-- provides evidence that the real problem is not mere failure to pursue the chosen strategy of anti-malaria effort. In fact, the nations of the region have been pursuing a strategy which was in many countries, programmed for failure. Clearly, they are a decade late in reaching the conclusions which emerged from the Fourth Meeting of the Directors of the Malaria Services of the Americas, convened in Brasilia in July 1983. These conclusions, well expressed in the address to the group by the Director of Ecuador's SNEM, may be briefly summarized: in place of time-limited malaria eradication, it is now necessary to recognize the need for a program tailored to the epidemiological zones into which each program must be stratified, pursued at an affordable pace, to bring malaria incidence down to a level where it does not constitute a public health problem. The conversion will be neither quick nor easy, and will require assistance.

1/ AID Policy Paper: Malaria, July 1984, page 10
2/ Idem, page 14
3/ Malaria Strategy for Latin America and the Caribbean, February 1984

The Malaria Strategy for Latin America and the Caribbean also takes a strong stand on an additional concern of the project under consideration: vector-borne diseases (VBD) other than malaria. The strategy statement notes that while malaria continues to present the major obstacle to socio-economic development, particularly in the rural areas, other VBD also pose significant public health threats in Latin America and the Caribbean. Dengue-hemorraghic fever, yellow fever, onchocerciasis, American trypanosomiasis and leishmaniasis rank high on the list. The factors which have frustrated control of malaria are also important to the transmission and control of other VBD: increasing numbers of development projects, together with demographic imbalance; mobilization of labor in colonization and agriculture; new settlements and migration due to socio-economic and political pressures; weak health infrastructure; limited utilization of general health services and community participation. Moreover, the dispersion of Aedes aegypti represents a continuous threat of urbanization of yellow fever and the appearance of dengue-hemorraghic fever epidemics.

The identification of vulnerable sites for effective intervention in the dynamics of transmission is a gap in VBD control. For the endemic countries it will be impossible to cope with the challenge that VBD is placing if they are not helped to create or strengthen their own capabilities.

F. Relationship of Project to Other Public and Private Sector Programs

At present, malaria and vector control are left largely to SNEM. Other GOE institutions, including the General Health Service (Primary Health Care) of MOH limit their efforts to taking blood samples and providing initial drug treatment to symptomatic patients who appear. With this Project, AID and SNEM, with full encouragement of the GOE, expect to work much more fully with the network of MOH health centers and hospitals, as well as community health workers (promoters) where these operate in malarious areas. As SNEM now is organizationally under the Director General's Office rather than (as in the past) under the coastal subsecretariat of the MOH, this program coordination will be facilitated.

The Ecuadorean Armed Forces have nearly 40 health clinics providing health and family planning services, currently receiving AID support in Family Planning. These clinics are often located in remote tropical areas where malaria is rampant--e.g., Esmeraldas and Napo Provinces--and could readily include malaria chemotherapy among their services.

In addition, conversations are underway between SNEM, the Ecuadorean Armed Forces and U.S. South Command on how to initiate a civic-action program which might be, among other things, directed at malaria. In the past, SNEM

has supplied military bases with chloroquine and done spraying, but there has been little if any reciprocal action from the Armed Forces. Under the stimulus of this project and the combined GOE-U.S. interest in military civic action, it is expected that spray brigades of army recruits can be trained and deployed in and around military bases, especially in border areas (see Annex N).

Source reduction through drainage efforts could be undertaken by the Ecuadorean Army Corps of Engineers, which collaborated effectively with U.S. efforts in Guayaquil to drain flooded slum areas during coastal flooding in 1983. Training in treatment of tropical diseases, including malaria, can be provided to military personnel jointly with SNEM or through South Command programs in Panama.

Within the private sector, SNEM collaborates with various private missionary groups, both Protestant and Catholic, both in the Oriente and in Esmeraldas. Mission hospitals and clinics provide treatment, take blood samples and provide data to SNEM. An interesting joint effort between SNEM and the Foster Parents Plan health project in Guayaquil has just begun under which Plan health promoters are being trained to provide presumptive treatment to clinically diagnosed malaria cases, take blood slides and refer them to SNEM facilities for interpretation.

Texaco, in consortium with the national oil company CEPE, operates the extensive oil drilling operations throughout Napo Province, in areas with high incidence of malaria. During the period of project paper preparation, discussions were held with Texaco on possible joint operations for malaria control with SNEM. There appear to be several possible joint efforts which could develop during the project. For example, Texaco might provide identification materials to volunteer collaborators and participate in public information/education campaigns, and undertake spraying in its installations. Texaco is already donating the diesel oil used for larviciding in the vicinity of its operating area.

G. Other Donor Activities

To date, other donor activities in the field of malaria control have been limited to those of PAHO. PAHO has projected a minimum contribution of $720,000 to the malaria control activity over the five-year LOP. PAHO draws on this budget during the course of the year to provide, on an as needed basis, long-term technical advisors, fellowships, short-term consultants, and support for in-country seminars and workshops. PAHO also supplies kits for testing susceptibility of vectors.

In addition to the full-time services of a PAHO malariologist, SNEM has been able to rely on the part-time (in practice, far more than half-time) presence of PAHO's Regional Advisor. This is expected to produce a bonus in developing mutually supporting efforts with neighboring Peru, which also relies on the services of PAHO's Regional Advisor.

III. PROJECT DESCRIPTION

A. Rationale and Project Purposes

To combat the spread of malaria, to reverse the present trend of increasing incidence, and to maintain long-term control, an action program is required which will (a) immediately address the epidemic; (b) investigate the problems of parasite and mosquito resistance; (c) institute training in modern malaria technology; (d) undertake operation research programs in the field of malaria and other vector-borne diseases; and (e) build institutional capacity to deal with malaria on a sustained basis after completion of the project.

SNEM has major needs for personnel trained in alternative and more cost-effective control methodologies. The transfer of new malaria control technology is required if Ecuador is to provide efficient and cost-effective health services to its people. The requirements for imported commodities to combat and overcome the present malaria epidemic and to institutionalize a sound anti-malaria effort in the country cannot be met by the present foreign exchange resources of the country. The proposed project is directly designed to meet these needs.

The goal of this project is to assist the GOE to reduce morbidity and mortality caused by endemic diseases. The major purpose of the project is initially to bring the current malaria epidemic under control; to control malaria nation-wide to a level where it is no longer a public health problem and to develop institutional capacities to maintain that level of control. Secondary but important purposes are (1) to reduce and virtually eliminate indigenous P. falciparum malaria, and (2) to investigate the extent of and to design control activities aimed at other vector-borne diseases, especially those diseases linked to Ae. aegypti. Indicators of the achievement of the project purposes by the End-of-Project are:

1. By 1987, to control the present epidemic of malaria,

2. By 1989, to reduce malaria incidence to an annual parasite incidence of 1.6 cases/1000 or less,

3. By 1989, to reduce P. falciparum malaria to a point where it represents no more than 10 percent of the total yearly caseload of malaria.

The project's inputs, outputs and vital linkages in support of the goal and purposes are more fully detailed in the Logical Framework (Annex A).

The Servicio Nacional de Erradicación de la Malaria y Control de Vectores (SNEM) is the primary implementing agency of the Ecuador Government for malaria control as well as control of other vector-borne disease such as yellow fever, onchocerciasis (river blindness), leishmaniasis and Chagas disease. SNEM is established by law to carry out anti-malaria and other vector-borne disease control activities. The project will assist SNEM to undertake a technologically sound malaria control effort which is both

cost-effective and productive. This assistance will take the form of support of operational research, training and educational activities; provision of technical assistance and commodity import support; and evaluation.

SNEM will prepare and submit an annual Plan of Action which details its projected operational, technical and administrative activities for the forthcoming year. The Plan of Action will include budget and staff requirements, required procurement and procurement schedules, operational plans, training requirements, operational research proposals for applied field studies, planning and evaluation timecharts and administrative actions. The Plan of Action must receive both PAHO and A.I.D. approval prior to disbursement of project funds.

B. End-of-Project Status

In addition to the major end-of-project indicators presented earlier in this section, the project will achieve a wide variety of specific accomplishments. These specific end-of-project indicators are provided in the Logical Framework in Annex A.

The project is structured to make possible measurable achievements which include (1) a technologically correct and cost effective insecticide application through intra-domiciliary spraying, larviciding and Ultra Low Volume (ULV) operations; (2) an improved epidemiological reporting system which will lead to focus-specific control measures; (3) increased community participation in anti-malaria measures; (4) improved and more productive cooperation with the primary health care system and, as possible, with other Ministries and organizations of the GOE and of the private sector; (5) development of national vector-borne disease research capacity; and (6) accomplishment of large segments of training, substantially strengthening SNEM as an institution.

It is also anticipated that SNEM will have increased and more effective coordination with other government sectors and agencies to minimize the potentially disastrous effect of "man-made" malaria which frequently results from construction undertaken during agricultural irrigation, settlement and other development projects which create malariogenic conditions. This will be important in peri-urban areas in some cities as population movements into these areas take place.

C. Project Requirements

To attain these goals, GOE has requested and USAID/Ecuador has agreed to give consideration to a program of major assistance to SNEM. SNEM's 1981 budget is $3.68 million equivalent. SNEM has proposed a five-year program, in the course of which its budget would expand by 24% in the first year, and in suceeding years to 136%, 170%, 175% and 209%, respectively, of the 1984 base year. SNEM's malaria budget proposal for the five-year LOP is approximately $30 million equivalent, of which about $11.5 million represents an increase over what SNEM's budget would be without the project. The increase will

finance gradual salary increases, over LOP (at the rate projected for MOH employees)-63%; and increases in contract services-89%; supplies and materials-89%; capital equipment-50%; and yellow fever vaccination-50%. SNEM's projected five-year budget, by year and object class. See Annex H, Table H-5. These goals are, initially to bring under control the major resurgence in malaria in Ecuador, but then, over the life of the project, to redefine the policy of MOH with respect to malaria, to build in SNEM the institutional capacity to cope with malaria on a sustained basis and to appraise the problems inherent in SNEM's other area of responsibility, vector-borne diseases other than malaria.

Based upon a careful examination of SNEM's long-range plans, USAID/Ecuador proposes to support SNEM's endeavor in the following ways:

1. To support the capital needs of this five-year project, and, in particular, to control the present epidemic, reverse the trend of rising malaria incidence and maintain long-term control, a dollar-repayable loan in the amount of $6.5 million, to be used to update SNEM's vehicle fleet ($1.5 million) and to finance insecticides and application equipment ($3.173 million), chemotherapeutic drugs ($400,000), and other supplies and equipment ($580,000). The balance of the loan ($847,000) covers a 10% provision for inflation and a 5% contingency allowance.

2. To institute training in modern malaria technology, explore the problems of malaria parasite and vector resistance, undertake operational research programs in the fields of malaria and other vector-borne diseases, and to create in SNEM the institutional capacity to deal with malaria on a sustained basis after completion of the project, a grant in the amount of $3.0 million, to be used to finance, over the five-year life of project:

a. Long and short-term technical assistance ($1,365,000).

b. A major training program, covering SNEM training needs at all levels ($900,000).

c. A program of operational research designed to sharpen program focus, improve program execution, increase the effectiveness of health education efforts ($535,000).

Of the $3.0 million in grant funds, approximately $2.6 million will finance the costs of a five-year contract with an American firm or institution capable of providing, through its own staff or through subcontracts, the necessary long and short-term technical assistance to SNEM; of making arrangements for essential external training and critically important internal training; and of guiding the operational research effort. The prime contractor will also arrange subcontracts with local Ecuadorean firms and educational institutions in such areas of operational research activity as health education, maximization of community participation and prevalence studies of VBD other than malaria. The Mission has identified Ecuadorean institutions of higher education, private organizations and qualified individuals known to be interested in and capable of performing the kinds of operational research, identified above.

Approximately $200,000 will be used to finance a PASA covering insecticide testing at CDC; an in-country training course in drug sensitivity testing at the outset of the project; epidemiological studies to define the strategy of malaria stratification and to develop the concept of computer-based data analysis for stratification; and a two-year vector ecology study emphasizing integrated control of the vectors of malaria and other VBD.

d. A.I.D. participation in a regularly scheduled cooperative program evalation effort over the life of the project ($200,000).

(Details on each component in this proposed effort, both grant and loan-funded, are set forth in Section V, A.I.D. Financial Plan.)

D. Project Strategy and Expected Achievements

This project will support and strengthen various activities of the program of the Servicio Nacional de Erradicación de la Malaria y Control de Vectores (SNEM) over a five-year period. The project strategy is primarily directed at firmly establishing an epidemiological and operational system which is responsive and effective in reporting the levels of malaria and implementing the necessary levels of operational interventions to overcome the epidemic malaria problems. The project will support operational research and training to try innovative, alternative and cost-effective control methodologies and to adapt these practices to Ecuador's field conditions. In addition, the project will endeavor to make fuller use of all available elements in Ecuador's health structure, public and private, down to the community level. The existing program requires substantial commodity support over the 1985-1989 period (1) to control the epidemic situation; (2) to institutionalize adequate control throughout the country; and (3) to develop operational research and training capabilities. It is also planned to bring malaria to a level where (under SNEM direction and supervision) some if not all malaria and other vector borne disease control activities can be assumed by the general health services. When epidemic malaria is reduced, SNEM will be ready to utilize considerable technical transfer in the field of malaria and vector control. The proposed program is designed to assist them to move ahead to establish cost-effective and responsive malaria and vector control.

The need for rapid control of the epidemic situation is directly related to the institutional aspects of this strategy. If epidemic malaria is allowed to continue, then the program will be forced by social and political pressure to carry out the widespread spraying effort which has proved prohibitively expensive in both domestic and foreign exchange costs. Such an effort would frustrate present stratification plans; strengthen the widespread feeling within the GOE that malaria is SNEM's responsibility; and cause the program to revert to continued totally vertical activity, focussed on large scale operations rather than an epidemiologically based strategy and integration with the general health services.

E. Detailed Project Activity Description

1. Malaria Control Field Operations Improvement

SNEM's major field operations activities include (1) preventive measures such as house spraying of residual insecticide, source reduction (environmental modification) to reduce mosquito production potential, larviciding and ULV applications against the vector mosquito and (2) the surveillance and epidemiology activities which include treatment, blood slides collection, and conduct of a variety of epidemiological services including investigation and reporting.

There are certain basic facts that can be made in considering Life of Project (LOP) improvements in field operation:

. The resources available to SNEM will not allow a total coverage program and epidemiology will play an increasingly important role in selecting operational sites for application of technologically sound control methodology.

. The methodology selected in a given operational site will be a function of, at a minimum, the vector, the epidemiology, the climatic conditions, the ecology, the accessibility of the site, the technological capabilities of the staff and the resources available. Consequently, its possible components may be predicted in advance, but the precise mix of components is not predictable. This is, in fact, the essence of stratified malaria control.

. The country (and SNEM) will have to accept the fact that a certain amount of malaria morbidity will continue to occur over LOP but that mortality from malaria is to be considered unacceptable.

. There are a number of control methodologies available to SNEM for use in selected areas. The control methodologies which are available to SNEM are discussed below.

a. Intradomiciliary Spraying

SNEM plans to use a combination of insecticides in its residual spraying operations during the 1985-1989 period. These insecticides include DDT, malathion and fenitrothion. The insecticide of choice for a given area will be based on vector susceptibility, malaria morbidity data, cost and toxicity of the insecticide. The spraying program is planned for a 2.78% annual increase in house targets to provide sufficient insecticide (see Annex G) for 1985-1989. In all cases, health safeguards will be built into the storage, handling, transporting, application and disposal operations for all insecticides used.

The operational spray program for the first year will concentrate on control of the epidemic along the northern coastal areas. The 1985 plan (see Table III-1) has scheduled (a) fenitrothion, 40% wdp for 48,000 houses four times during the year and (b) DDT, 75% wdp for 261,000 houses twice a year.[1/] All insecticides are being applied at 2 grms. (actual insecticide) per square meter. It is planned to use malathion in selected areas during CY 1986-1989 at 2 grms. (AI) per square meters. All other areas requiring residual spray interventions will be treated with DDT at 2 grms. (AI)/square meter in two cycles. Attention is being given to other dosage rates through applied field research activities with the objective of testing the effectiveness of lower dosages of application, especially with malathion and fenitrothion.

Careful entomologic and epidemiological evaluations are planned to monitor the effect of spraying on malaria transmission. SNEM practices with regard to safety precautions to protect both spraymen and families in sprayed houses have been judged satisfactory and will be maintained.

Project plans call for entomological evaluation of all insecticides, with major attention given to vector susceptibility and insecticide effectiveness. Susceptibility tests will be carried out in any area where spray operations are being introduced and will be repeated as epidemiological evidence indicates need.

Selective, epidemiologically determined intradomiciliary spraying (spraying the interior walls of dwellings) is by all odds the most effective (and most cost-effective) mechanism available to SNEM for the rapid control of the present run-away epidemic. Total A.I.D. project inputs into this phase of program activity, exclusive of specific technical assistance and training in insecticide testing and resistance determination, include approximately $3.5 million in organophosphorus (O.P.) insecticides and application equipment, about half in the first two years of the project. Another $2.9 million equivalent will be provided from its budget by SNEM, which will purchase all of the DDT to be used. This concentration of 54% of A.I.D.'s total loan-financed input and over 45% of total project costs for supplies and equipment represents a joint investment in reducing the epidemic's extent and intensity to the point where the presently required massive spray operation and foreign exchange outlay can be reduced to an epidemiologically determined control operation in those areas where malaria transmission continues (Foci) and from which it can spread if not controlled--with lower over-all costs and a lower foreign exchange component, in keeping with the ability of GOE to sustain a control effort beyond the LOP.

1/ SNEM: Propuesta de un Plan Operativo para el Control de la Malaria, 1985 - 1990, page 28

TABLE III-1

The 1985 work plan, by houses per zone and by insecticide of choice as well as in total, is as follows:

ZONE[1/]	NUMBER OF HOUSES TO BE COVERED DDT	FENITROTHION	TOTAL
Zone I Sto. Domingo	26,000	-	26,000
Zone II Oriente	25,000	-	25,000
Zone III Central	114,000	-	114,000
Zone IV Loja	3,000	-	3,000
Zone V Los Rios	46,000	-	46,000
Zone VI Manabi	47,000	-	47,000
Zone VII Esmeraldas	-	48,000	48,000
TOTAL	261,000	48,000	309,000

Note: All applications are made at 2 grm/sq. meter

1/ For map of SNEM zones, see Annex H

b. Mosquito Larval Control

The control of mosquito larval populations of the vector mosquito will be carried out at selected localities and urban areas each week. In selected spray areas of SNEM's operational Zones III, VI, and VII (see Annex H, Figure H-3) approximately 1000 hectares of area will be covered weekly. In selected surveillance areas of Zones III and VI approximately 200 hectares will be covered weekly.

The larvicide being applied in the SNEM program is diesel oil which is to be supplied over the life of project by GOE resources.

Larviciding is particularily useful in urban and peri-urban areas during periods of the year when there is scanty rainfall, and where permanent breeding is limited to specific and accessible sites. Larval control can be cost-effective in areas of population concentration, but this method has to be carefully evaluated in rural situations. There is some possibility that communities themselves may be able to carry on some larval control activities in their immediate areas.

Newer larvicides and larvicidal methods are now available or are in the process of development for mosquito control use. Larvicides which may be available include monolayer films, synthetic pyrethroids and Bacillus thuringiensis (BTI-14) or B. sphaericus. These newer larvicides could be real candidates for applied field research studies in Ecuador. Apart from possible small-scale purchase of such commodities for field testing, A.I.D. inputs into larval control will be limited to technical assistance and support of operational research.

Whatever larvicides are used, baseline studies together with a continuing entomologic evaluation are to be used to provide timely epidemiological evaluation of their effectiveness.

c. Adulticiding through ULV applications

SNEM has proposed to use limited Ultra-Low-Volume (ULV) spray applications in its urban programs in the spray areas of Zones VII, VI, IV, and III, and, as need is evidenced, in the surveillance areas, as well. The principal value of ULV is the rapid control of epidemic occurrences of fever cases in relatively densely populated urban and peri-urban areas, especially when vector densities increase after a heavy rainfall. ULV applications will be used sparingly.

While the most cost-effective insecticides used in ULV applications are organophosphorus (O.P.) compounds such as malathion, their use may increase the risk of selection for resistant vector strains. Resistance to one kind of insecticide is quite generally reflected in resistance to other insecticides in the same chemical family. Thus, the use of O.P. insecticides in ULV application may increase the risk of cross-resistance in the mosquito vector to the O.P. insecticides used in the residual spray operations.

A portion of the loan-financed funding for procurement of insecticide application equipment ($119,000) will be applied to the purchase of equipment for ULV spray applications.

d. Source Reduction (Environmental Modification)

Source reduction methodology such as filling and draining mosquito breeding sites has been carried out in mosquito control programs since the early 1900's. This method can be a supplementary measure in Ecuador's anti-malaria activities. By reducing mosquito breeding sites the risk of transmission can be reduced. Such methods can be best used in areas which are densely populated, but they can also help in other situations where proper canalization will result in reduced mosquito breeding. On a small scale, this methodology is frequently suitable for action programs carried out by the communities themselves, using their own resources with only limited outside technical assistance. SNEM is already supporting source reduction activities in a few areas of the country, supplying technical assistance to municipal organizations which do the work, e.g. in Esmeraldas.

SNEM does not itself possess any heavy equipment for such work, nor is provision made for such equipment in present SNEM planning, but it may be possible to contract specific jobs of source reduction with other GOE organizations --e.g. to the Ministry of Public Works or the Army Corps of Engineers. Such activity would be of assistance to the country's malaria control effort. The SNEM staffing pattern lists both civil and sanitary engineering positions.

The prevention of "man-made malaria"--malaria having its foci in vector breeding sites created by poorly designed or executed development construction--will require SNEM continously to identify and, by working with other GOE agencies, correct or prevent situations which provide new or expanded mosquito breeding sites. Agricultural irrigation systems are a particular threat to increasing the malariogenic condition of a locality. Ecuadorean military groups may be interested in such activities and be willing to work with SNEM on such projects. Conversations have been held between U.S. military personnel and senior officials in the Ecuadorean Armed Forces on possible civic action programs that could include source reduction activities as well as other aspects of malaria control (see Annex N).

No USAID assistance in support of source reduction activities is planned, apart from technical assistance.

e. Biological Control

Biological controls are natural enemies of the mosquito, usually at its larval stage, which may be introduced into the environment to reduce mosquito densities and therefore the likelihood of malaria transmission. SNEM has used and will continue to use larvivorous fish in its program, primarily as a supplementary rather than as an independent control mechanism. The use of such fish and other biological control methodologies is gaining renewed interest world-wide. To date, however, biological controls

other than larvivorous fish have had little use in operating malaria control programs. It is an area for additional operational research which might be carried out by SNEM. Apart from possible support of such operational research, no USAID funding of biological control is contemplated.

f. Chemotherapy

As stated earlier, SNEM is responsible for field surveillance which includes treatment, reporting, investigation and evaluation of the disease and its control through use of anti-malaria drugs.

The primary SNEM chemotherapy distribution system is composed of SNEM-associated voluntary collaborators. There are approximately 6,000 of these volunteers; they are reported as being available to treat cases and take blood slides. The project recognizes the importance of this group in reducing the parasite load in the community and in providing clinical relief to the individual patient. It is necessary to assure that all malarious areas of the country are covered and to see to it that such posts are within a reasonable distance from every resident. It may be determined that some posts could be eliminated as others are established. Key factors in the maintenance of such a system are regular and effective supervision, timely re-supply of required materials and encouragement to the Volunteer. Project plans include support of annual training experiences for the malaria volunteers. It may be possible in some situations to expand the role of these volunteers to include surveillance--at least reporting--of the prevalence of other vector-borne diseases.

The extent to which SNEM relies on its voluntary collaborator network underscores the importance of maintaining a high level of morale within the network. This implies more training (which is specifically programmed), better supervision and more regular replenishment of supplies, faster return of the results of blood slide examinations, and recognition. Over the LOP, some $300,000 in loan funds will be used to finance health education and voluntary collaborator training and supplies, including such incentives as diplomas, equipment kits, house plaques, etc. The major USAID direct input into chemotherapy, however, is $400,000 in drug purchases, together with technical advisory and training services on drug sensitivity and drug resistance testing.

Distribution of chemotherapeutic drugs is a normal function of the Primary Health Care system in many countries. As this Project Paper is being drafted, the health promotores of Ecuador's PHC have just been authorized to administer chloroquine.

Mass drug administration (MDA) in areas of high malaria transmission and high malariogenic potential may prove useful; in fact, the MDA technique has been used by SNEM from time to time over the past decade. Under such a system, the individual is given a single dose of chloroquine or chloroquine-primaquine. Such mass treatments may be repeated. Mass drug treatment is used only when it is epidemiologically justified, either to lower

the mortality and morbidity of malaria in an epidemic outbreak or to prevent outbreaks resulting from environmental changes due to severe storms, abnormal amounts of rainfall or unusual movements of people. Mass drug administration applied prior to the outset of seasonal malaria can reduce transmission temporarily, but has not been a very successful method of long-term reduction of transmission on a major scale. Careful epidemiological assessment is necessary not only for the initiation of such a method, but to evaluate its impact after it has been given.

2. Malaria Surveillance System

Malaria case detection in Ecuador has conformed to the standard surveillance methods utilized in other malaria programs in the Americas. These detection methods derive from the strategies of malaria eradication, and may be of limited efficiency when malaria programs have either restricted resources or program objectives other than eradication.

During the period 1982-84, the surveillance of malaria cases in Ecuador has been taxed beyond its capacities. It is probable that the network of voluntary collaborators (VC) who collected blood slides from all fever cases, administered presumptive treatment and, upon notification of a positive malaria infection, provided curative (radical) treatment, functioned adequately during the 1970's when malaria transmission was at low levels. With the resurgence of transmission, however, several glaring problems have been noted by SNEM staff:

a. Supervisory staff have been insufficient, leading to inadequate collection, supervision and validation of Passive Case Detection (PCD) data. It is clear that PCD surveillance has not been able to keep abreast of population expansion.

b. Laboratory services are even more heavily over-taxed. Great backlogs of referred blood slides have accumulated; in the areas of highest transmission, Esmeraldas and Napo, the vast majority of probable malaria infections are being treated without blood slides being taken, since health providers know that laboratory diagnosis is impossible. Data are not comparable from year to year or between geographical areas.

c. The standard procedure of cross-checking of laboratory proficency, in which central laboratories check all parasite-positive and 10% of negative slides read by peripheral laboratories, no longer functions in Ecuador. Consequently, the accuracy of the limited microscopic operations cannot be ascertained.

The 1982-84 record of surveillance shows a marked increase in all parameters, and most impressively in the reported P. falciparum infections. There is no doubt that Ecuador is currently experiencing a major resurgence of malaria, and most importantly, of P. falciparum infections. This resurgence is occurring in all malarious areas; data suggest that northern coastal areas and Napo have the most intense problems, yet with the deficits in case

detection, geographical variations in malaria transmission intensity have not been clearly identified. Such determinations may be made by parasitological and serological surveys. In addition, the use of malariometric surveys in specific areas may be used to determine the effectiveness of SNEM's control interventions.

Attention during the LOP will be paid to evaluating the proficiency of the current laboratories and their location. Central laboratories need to be strengthened and their function of cross-check of peripheral laboratories emphasized, to confirm the accuracy of parasitological data. Above all, laboratories must be so placed as to facilitate maximum access to VC posts which submit blood smears, and to assure the shortest turn-around time between slide submission and the returned diagnosis.

Training or refresher training in the basic tasks for malaria surveillance and in newer methods of control has been deficient in recent years. Field staff, particularly at the supervisory level, need continued upgrading of their technical knowledge and administrative skills to be maximally effective. Great priority will be given to systematic training of malaria staff at all levels in the AID-supported project--both didactic, formal training and intensive, in-country field experiences.

Rapid and accurate interpretation of the epidemiological data produced by the surveillance system lies at the heart of the whole concept of stratification--the matching of a mix of malaria control options to the epidemiological variables in different locations. The proposed program provides both capital assistance and technical support to this important program element: loan-financed laboratory equipment and supplies ($160,000), plus grant-financed short-term consultations in epidemiology and epidemiology reporting and support for operational research to define a strategy of stratification and to develop a program of computer-based data analysis for stratification. Related to these program elements are two-day (in-country) training courses for 5,000 voluntary collaborators.

See also Annex G, Supplementary Technical Information, for fuller description of the SNEM malaria surveillance system; Section V, Financial Plan, for detailed coverage of A.I.D.-supported loan-financed laboratory supplies and equipment and grant-funded technical assistance, operational research and training program elements which support improvement of SNEM's surveillance system.

3. Institutional Strengthening of SNEM

Many of the project inputs will contribute directly or indirectly to strengthening SNEM. In particular, both long and short term T.A., training, research and vehicle acquisitions will help to fortify SNEM.

The provision of an experienced senior malaria advisor working within SNEM during the LOP will make a significant impact in the agency's approach and practices in vector control. The advisor, together with PAHO's long term resident advisor, can help SNEM move from its traditional dependence

on mass household spraying to a more selective, flexible approach based in epidemiological analysis and stratification of malarious areas with varying tactical approaches. Complementing these advisors will be short-term specialists to provide guidance on specific problem areas impeding SNEM performance, as identified by the long term advisor.

Training activities will complement the TA. Public health training will be provided; at least five individuals will receive MPH training in Mexico. In addition a substantial volume of short-term training in vector control, surveillance, epidemiology and management will provide in-country, in-service experience to upwards of 300 SNEM employees, exclusive of 2-day courses for 5,000 voluntary collaborators. The output of this major training effort will be a vastly strengthened SNEM, both technically and administratively.

The large scale operational research program will also contribute to building up SNEM's capacity to address the problems of malaria and other vector-borne diseases over the long run. SNEM epidemiologists, entomologists and field supervisors will learn much about research methods, field research techniques and how to analyze data and reach practical solutions as they work with expert research consultants. In effect there should be major training and technology transfer spin-off from this investigation.

On a different plane, SNEM's ability to function is circumscribed by its logistics system and its ability to maintain that system. The SNEM vehicle fleet is on its last legs; its maintenance crews have performed wonders in keeping relics from the 1960's on the road, but at a cost in down-time and repair expense which is unacceptable. The project will expend $1.5 million of the A.I.D. loan funds for over 115 trucks, jeep-type vehicles and cars, plus boats and motors, to replace SNEM's obsolete transport system and to improve it. As is the case with insecticides and insecticide application equipment, purchase of transport equipment is heavily concentrated--84%--in the first two project years. In this connection, at the time of arrival of the new vehicles, a three-week course in hands-on maintenance training will be supplied by the award winning supplier--necessary since SNEM mechanics are unfamiliar with American-made vehicles less than a decade old.

The least tangible, yet in the final analysis perhaps the most valuable contribution to SNEM's institutional strengthening may take the form of improved morale from top to bottom. Given the priority which GOE is placing on malaria control, the significant infusion of new resources, and five years of assured GOE funding of salaries, it is reasonable to anticipate institutional enthusiasm from employees who have in the past been left without the tools to do their job.

4. Community Resource Mobilization

SNEM has recognized the necessity of coordination with communities, other governmental and non-governmental agencies, municipalities and the private sector to support its malaria control activities. This is

particularly important since most of the public does not fully understand SNEM's malaria control objectives and the ways in which their participation can accelerate achieving these objectives. Malaria is exacerbated by community ignorance of the disease, improperly planned "development" activities and popular confusion of malaria vector with nuisance mosquitoes. The first step is to develop an educational strategy which increases awareness of malaria control objectives, provides the necessary information about malaria as a preventable disease and targets messages and educational activities for specific key groups.

To strengthen SNEM's capacity to mobilize existing community resource will require the strengthening of its health education section and the expansion of the use of effective health education and community involvement techniques at each point of interface between SNEM and potential collaborating groups.

Included in the retraining of SNEM staff at all levels, discussed elsewhere in this paper, will be skill development aimed at assisting SNEM staff in identifying local leaders and motivating them and the public to participate more fully in the program. SNEM's community mobilization strategy has two elements--community education and community action. Community education is aimed at increasing utilization of the VC and PHC workers for rapid treatment of fever and increasing community awareness of other self-help (individual or community) measures to reduce the risk of malaria, e.g. rapid treatment of fever cases, reduction in mosquito breeding sites, avoidance of mosquitoes, etc. Community education activities will encompass a range of carefully planned activities from radio spots and public health professional education to group meetings with community leaders in highly malarious foci, large employers, local church officials, educators, municipal leaders and local representatives of Ministries of Agriculture, Public Works and Health. Beyond enhancing awareness of malaria and its transmission, treatment and prevention, such meetings will be aimed at increased community action. Community support can take many forms from cash contributions to in-kind support of volunteers and use of local buildings and equipment. The nature of the local malaria problem will determine the type of community assistance which is required. In some areas drainage of mosquito breeding sites is indicated; in others the use of larvivorous fish and cleaning of drainage canals will help reduce the mosquito population. It is anticipated that when communities are more aware of the local problem and its effect on their health, they will be more active in seeking solutions. When SNEM control interventions such as household spraying are launched, the target community leaders will be involved to facilitate complete coverage.

Community mobilization in municipalities is more complex, impersonal and difficult than in the villages. The problem in these towns is complicated by diffuse responsibility for urban services and lack of communication among service agencies. In addition, urbanization which concentrates poorer immigrants on the least suitable land, often poorly drained and without municipal services, tends to exacerbate existing mosquito problems. There is preliminary evidence that one of Ecuador's principal vectors, An. albimanus, may be adapting its breeding behavior to polluted

urban standing water (it normally prefers clean streams, ditches and rice fields). If this occurs, malaria control, particularly in Guayaquil, will be far more difficult and the cost of malaria as a disease greater as the more productive urban population is affected.

The SNEM strategy for urban community action involves a number of institutional contacts, all of which should be informed and involved. These contacts include but are not limited to the municipality, neighborhood association and leaders, private doctors and medical laboratories, major employers, GOE service agencies such as Public Works, health centers, hospitals and PVOs.

The problem is complicated by the general association of malaria with all mosquitos. Urbanites tend to want mosquito control which, while a desirable comfort goal, has little to do with malaria control Politically, mosquito control is very attractive. However, funding for mosquito control must be found apart from the limited malaria control budget. Possibilities for financing mosquito control activities include a special tax on tourists or hotels, member levies by neighborhood groups, commercial and business associations. One key issue in mosquito control is the economic trade-off between the highly visible fogging activities and the less visible larviciding. Fogging and space spraying (adulticiding) are expensive and, while useful in knocking down anopheline populations during epidemics or at the onset of a malaria surge, do not provide a lasting solution to the problem. In contrast, properly designed drainage can provide permanent relief from the mosquito nuisance. Thus, the need for better understanding at the municipal level of malaria as contrasted with other mosquito problems is clear. Unless local communities and municipalities assume responsibility for mosquito control, SNEM resources for the battle against malaria will be diverted.

The importance of mobilization of community support cannot be over-emphasized. Malaria rapidly identified and treated can be controlled. Intradomiciliary spraying by SNEM in highly infected areas is designed to reduce transmision. Ultimate maintenance of control will depend in appreciable amount on the communities and their active efforts to identify and obtain treatment for every suspected case while reducing potential exposure to the anopheles mosquito. SNEM health education activities will create awareness of the problem and its solutions. Epidemiologic surveillance will provide information on how well SNEM and the communities are doing in controlling malaria. The voluntary collaborator will play a large and active role at the local level in ensuring rapid treatment of suspected malaria. The interaction between the VC and the community and ways to improve the program is part of the operational research planned under this project.

Greater use of community outreach and motivation techniques will include greater efforts to coordinate with municipalities to mobilize local resources for mosquito control and source reduction.

Important as community resource mobilization has shown itself to be, however, it is and must continue to be the responsibility of SNEM, the MOH and other elements in the GOE. A.I.D.'s program inputs are in the form of technical assistance, training and operational research into the maximization of community resource mobilization.

5. Control of Other Vector-Borne Diseases

While the current malaria epidemic is the priority concern of this project, growing importance of other vector borne diseases will also receive attention, principally through operational research concentrated in the latter half of the project period. Baseline epidemiological and entomological surveys will be conducted on the vector borne diseases of major importance - leishmaniasis, onchocerciasis, chagas', and diseases associated with aedes aegypti. Given their similar geographical distribution with malaria, similarities of vectors, and the fact that SNEM is responsible for all these vector borne diseases, the project will seek to provide information on their magnitude, effective control measures, and possibilities for efforts aimed at simultaneously addressing these diseases within the malaria control program.

a. Leishmaniasis

Although the geographical distribution of leishmaniasis in Ecuador coincides with the malaria-infested areas, very little is known as to its transmission. Efforts will be made in this project to include basic epidemio-entomological studies of leishmaniasis as a part of SNEM's activities. The project provides specific external training in vector-borne diseases (including leishmaniasis) for the initiation of base line investigation in designated areas of Ecuador. In addition, the project provides $30,000 for operational research: basic prevalence studies, parasite identification, and vector ecology studies, with emphasis on integrated control of the vectors of malaria and other VBD. Although project inputs are limited during the LOP, they are considered essential to the development by GOE, at a later date, of a soundly based control effort.

b. Onchocerciasis (River Blindness)

With the constant migration of microfilarial positive persons from the major onchocercal focus on Rio Cayapas, province of Esmeraldas, to adjacent provinces, and with the recent immigration of migrant agricultural workers to the onchocercal focus, there is a potential danger that the disease will explode to all parts of Ecuador. Though the geographical distribution of the vector (simulium) is known, the project will provide specific training in vector-borne disease--including black fly taxonomy and its disease transmission methodology and potential. Thereafter, SNEM will provide specific information concerning the transmission potential of onchocerciasis by the identified vector(s) in designated areas. The project will also

provide for consultation of a vector specialist and supported operational research ($90,000) to ensure adequate technology for this base-line study. This information is necessary for the planning of any future surveillance or control program.

c. Chagas' Disease

Investigation to determine the prevalence of Triatomas (vector of the disease) infected by the parasite T. cruzi in Ecuador is already a part of SNEM's activities. Serological studies (with PAHO assistance) to determine the level of human infection by T. cruzi and its relationship to the infected vectors are in progress. The project supports this program by providing the means for proper instrumentation of the SNEM's laboratories so that modern technology can be used in this investigation. Provision is also given for the acquisition by SNEM of adequately trained technical personnel, so that the necessary investigative testing can be done accurately. In addition, the project will provide opportunity for SNEM personnel to observe and evaluate an endemic focus of Chagas' in Brazil. The information drawn from this observation and the experiences of the Brazilian project will serve as guidelines in the planning of a future Chagas' control program in Ecuador based on the locally acquired epidemiology data. Funding in the project for support of basic prevalence studies and regional study tours totals $26,000.

d. Aedes aegypti - vector of Dengue and Yellow-fever

Ecuador successfully eradicated Aedes aegypti in the 1960s, but was unable to sustain the interruption of vector reproduction. The surveillance of Aedes aegypti in Ecuador has been the responsibility of SNEM since 1974. With the presence of the mosquito in Colombia and its possible dissemination to Ecuador, the program is of major importance to the country. In the years 1974-1978, five re-infestations of the vector were detected and eradication procedures were carried out in each case to avoid a serious epidemic. The project will further improve SNEM's surveillance program by providing means of acquiring replacement for worn-out transport, equipment and the necessary insecticide to combat any detected re-infestation. In addition, opportunity will be given for the SNEM personnel to observe and evaluate the control programs of dengue in Puerto Rico and Panama. The acquired information will be of great value to the improvement of the present surveillance program in Ecuador.

A.I.D.'s inputs into these programs are all in the form of grant-funded training in the control of vector-borne diseases, operational research to establish baseline prevalence data and to measure disease impact, and a two-year vector ecology study emphasizing integrated control of malaria and other VBD. The program does not contemplate A.I.D. support of active programs to control VBD other than malaria.

IV. Project-Specific Analyses

A. Technical Feasibility

This project is designed to incorporate a wide variety of malaria control measures which will enhance SNEM's operational impact and efficiency. While malaria control is far more technically complex than malaria eradication, the basic methodologies of malaria control are similar to those used in eradication programs. The difference is in how these methods are used to direct and evaluate operations. This project emphasizes increased data analysis to guide operational decisions on the part of the SNEM Director and his senior staff and to provide the basis for implementation of alternative control measures. Program operations will rely on (1) continual stratification of the malaria program, using a range of epidemiologic, entomologic and other data and (2) the application of a variety of control measures, as dictated by the stratification and the resources available. The discussion below describes the technical and operational feasibility of applying the various malaria control techniques and methodologies in the Ecuador malaria program.

1. Stratification of Malarious Areas

A critical epidemiologic issue for malaria control is the setting of priorities for operations. The important factors determining priority are data on the intensity and seasonality of transmission, measurements of mosquito vector density and inoculation rates, and estimates of the potential for intervention (e.g., insecticide and drug resistance, human population variables such as migration and accessibility), and measurements of the public health impact of malaria (e.g., estimates of mortality). Obviously, an epidemiologic data base is required for stratification, and sufficient data are not presently available in Ecuador.

Using available malaria case reports, the SNEM program has identified areas of high priority, based upon estimates of 1983 incidence to malaria. (Informe Anual del Departamento de Epidemiología, 1983, page 6). The areas of highest priority constitute 26% of the malarious areas of Ecuador, yet the cantones identified are in several different Provinces and considerable additional epidemiologic study will be required to better stratify the malarious areas.

The Ecuador malaria control organization (SNEM) understands and endorses the stratification concept and has demonstrated this understanding in preparing the new Plan of Operations. SNEM is committed to stratification and to annual re-stratification over LOP to improve program quality and impact, with expanded and improved data collection on entomologic, ecologic, climatologic, anthropologic and sociologic factors. With the planned strengthening of SNEM personnel, management procedures and epidemiological systems through planned technical assistance and training, the project will provide technically feasible and cost effective assistance to SNEM and the

GOE. In order to insure progress in the program's development, an evaluation of the stratification effort is planned in FY 1986, approximately eighteen months after the initiation of the project. This evaluation will provide guidance for course corrections in program directions and will assist SNEM in future planning.

2. Surveillance System

Some aspects of classic malaria eradication surveillance procedures are both inflexible and impractical in the context of the stated objectives of the current project: to contain the current resurgence of malaria transmission; and to develop within the GOE health services an infrastructure with the capacity to set priorities for long-term malaria control. Malaria surveillance should be based on the objectives of the program. Multiple, complementary data bases will be required. Considering the acute need to define and deal with an epidemic situation, available data and spot surveys will be required to set priorities, and data available outside the SNEM network should be actively sought. For the long-term stratification and program assessment of malaria, a thorough reevaluation of epidemiologic activities is necessary.

SNEM has basically two sources of surveillance data - Active Case Detection (ACD) and Passive Case Detection (PCD) which includes Activated Passive Care Detection (APCD) and the Voluntary Collaborators (VC). In addition, slides taken during epidemiological investigations assist in defining the malaria problem.

ACD is being used only in very focal situations and is being phased out; the project will not focus on this area of activity. In the light of present massive case loads, it makes good technical sense to scale down and redirect this work.

Passive Case Detection (PCD) carried out by GOE health institutions outside SNEM is very limited and SNEM derives little assistance from this area of surveillance. The project will be carrying out efforts to improve the relationships between the SNEM and these institutions. Training experiences, joint conferences and more joint health education activities are planned to integrate malaria and vector-borne disease control within the health structure.

Activated Passive Case Detection (APCD) describes the situation where a SNEM employee is assigned to a health institution to take blood slides from patients attending the institution for service. The Project will evaluate the usefulness of this system in the context of the epidemiological needs of the program.

The Voluntary Collaborator (VC) network is a major asset to malaria surveillance and therapy activities in Ecuador, and it is the principal health service which has been extended to the community level. The VC network depends on close supervision, a reliable system of providing supplies of materials and medications, and prompt collection of blood slides and return of laboratory results.

SNEM has experienced serious problems with each of these activities. Consideration should be given to identification and establishment of sentinel VC posts from which blood slides would be collected and supervision would be concentrated to assure a superior surveillance function. In addition, a number of established VC posts could be converted to medication centers, where blood slides would not be collected, but presumptive or curative therapy would be available. This conversion would make therapy more available, an essential element to controlling morbidity and mortality during the current resurgence of transmission. Furthermore, "sentinel" parasite surveillance should provide thoroughly adequate data for identifying areas of priority, while also decreasing the work load of available laboratories. Malaria is an illness recognized by most rural Ecuadoreans, and medication data without parasitologic confirmation can be used for program evaluation. The project will stress the improvement of epidemiology through provision of technical assistance, training and operational research.

Attention during the LOP will be paid to evaluating the proficiency of current laboratories and their location. Central laboratories need to be strengthened and their function of cross-check of peripheral laboratories emphasized in order to have a mechanism to confirm the accuracy of parasitologic data. Consideration is to be given to placing laboratories at mid-points between population centers, with maximal access to VC posts designated to collect blood smears.

For the long-term development of surveillance activities, emphasis must be placed on utilization of data derived from sources outside SNEM. PHC programs, including promotores and fixed health facilities, will be strengthened, and coordination in malaria diagnosis and therapy among all GOE health activities will be crucial. Malaria surveillance should not remain a responsibility solely of SNEM.

The designation of "Attack", "Consolidation", still applied by SNEM to the various areas of program activity, are outmoded in a malaria control effort. The operational areas could be designated simply as spraying or surveillance.

3. Chemotherapy

There are three instances when malaria drug therapy is indicated and will be provided. The first and most important in terms of both generating local data on malaria cases and treating suspected cases is drug chemotherapy provided by the approximately 6000 VCs attached to the SNEM organization and any cooperating public health facilities. Treatment with chloroquine is provided to all fever cases arriving at the VC post. Primaquine is only administered by SNEM employees after determining that the case is positive. Since all fevers are presumed to be malaria, the drug treatment is termed a presumptive treatment. Because of the special malaria risk to children under five and pregnant women, they are provided with an additional appropriate dosage of chloroquine adequate to ensure a rapid

reduction or elimination of the malaria parasites; this more comprehensive drug regimen is termed radical treatment. In addition to these two specific drug regimens provided by the health posts and SNEM employees, SNEM may organize a Mass Drug Administration (MDA) in carefully delimited special circumstances to reduce malaria transmission in areas (foci) where there has been continued high transmission but where spraying is not planned. In MDA all, or as nearly as possible all, residents of an area are provided with drugs.

The distribution and use of anti-malaria drugs in the VC system is technically sound and feasible. Chloroquine, the drug of choice, is cheap, effective and has few side effects. Chloroquine is used to suppress symptoms; primaquine (administered only by SNEM personnel) reduces the possibility of transmission as it acts on the gametocyte forms of the malaria parasite. For this reason the preferable regimen would include primaquine for all fever cases, with particular care taken in providing the appropriate treatment to children under five and pregnant women.

However, any effective use of large-scale drug distribution requires careful planning and execution. Full coverage of malarious areas with anti-malaria drugs in selected areas will be based on malaria rates, accessibility and cost considerations in relation to other less expensive measures. This is a rational and sound approach because of the threat of parasite resistance to chloroquine. Careful, frequent and continuing evaluations of drug effectiveness and parasite sensitivity to the drugs are planned. For these evaluations, SNEM will assign well-trained personnel for evaluation and sensitivity testing in all areas where drug distribution is used. Additional training of personnel for drug sensitivity testing is part of the project. External technical assistance will be used to develop and monitor a rational evaluation program, for operational research on alternative drugs, drug combinations and methods of distribution, and for a thorough reevaluation of total antimalaria drug use in the country, i.e. by public and private health facilities. The projected use of focal mass drug distribution and the conduct of essential field research is technically sound and is feasible within the constraints noted. The technical assistance required is available and is incorporated into the project design.

4. Evaluation of P. falciparum Drug Sensitivity

The available, though very limited data confirm that chloroquine resistant strains of P. falciparum are present in Ecuador. The priority issue facing malaria control is not the systematic documentation of the exact geographic prevalence of chloroquine resistance. Priority should be placed on determining the objectives of drug distribution in the overall malaria control strategy. The current strategy of radical cure of all infections is not functional, since the coverage of the SNEM program is low and antimalaria drugs are in short supply.

In large segments of malarious areas of Ecuador, and unfortunately in some areas with the most intense transmission, radical cure

of malaria infections is not feasible. The logistic barriers are similar to those encountered in some rural areas of Africa. A drug regimen is required which will assuredly, dramatically reduce parasite density in the patient, alleviate clinical illness and can be administered in a limited number of doses. In poorly accessible areas of Esmeraldas or the Oriente, radical cure of P. vivax with 14 days of primaquine is not realistic at this time. Asking patients to return or programming the health system to return to the patient with "radical" therapy is equally impractical in some areas. If single-dose therapy is to be advocated, then it must be determined what drug(s) are to be used, considering that the regimen should be effective against both P. vivax and P. falciparum.

In areas of Ecuador where patient access is greater, longer periods of therapy may be practical, if the manpower and financial investment to achieve radical cure is a program priority.

Quite apparently, the vast majority of malaria therapy occurs outside of SNEM programs. If this assumption is correct, it is critical to determine what therapy is actually occurring, using which drugs and at what dosages. If Fansidar or other alternative drugs are widely available and used, a GDE strategy based upon the use of other, less desirable drugs may have limited chances of success.

To define the efficacy of potential malaria therapy regimens in Ecuador, emphasis should be on the response of infected individuals to therapy with the potentially available drugs. Collection of such data should stress the use of available technologies by national staff, and the development of a drug surveillance mechanism which can be incorporated into ongoing malaria surveillance activities.

In this context, in vivo testing for drug response is the basic procedure to be utilized, with very limited in vitro testing to answer specific questions. Protocols have been developed and successfully implemented in AID-sponsored programs in Haiti and Africa, with CDC technical support, using simplified 7-day in vivo assessment for response to chloroquine, amodiaquine and Fansidar. Data generated by this in vivo approach is less precise than more prolonged in vivo or more technically sophisticated in vitro tests. Nonetheless, they can be collected quickly and can provide the basis for drug therapy recommendations, e.g., for defining the optimal "presumptive" therapy regimen.

Before final decisions are made on the major procurement of antimalarial drugs for the proposed project, an in vivo survey of 4-6 sites in the malarious areas of Ecuador should be conducted. Such a survey could be conducted in two months, and the results could contribute greatly to a rational decision on therapy (and, of course, on long-term project drug procurement). A protocol, as utilized in Africa, has been made available by CDC to SNEM's epidemiological personnel.

5. Intradomiciliary Spraying

There has been more experience in Ecuador with residual intradomiciliary spraying than with any other malaria control intervention. Such operations have, in the past, been reasonably well planned, organized and implemented when adequate funding was available. While evaluation of results has not always been complete or performed on a timely basis, good evaluation is within the capabilities of the program. Residual spraying is to be used selectively in the project with fenitrothion, malathion and DDT as the insecticides of choice. Recent field studies in Ecuador have demonstrated that intradomiciliary spraying with these insecticides is suitable for malaria control in Ecuador. The susceptibility tests for fenitrothion and malathion indicate all known vectors are susceptible. In areas of DDT application, the vectors have been determined to be susceptible to these insecticides. The use of this control measure is considered technically sound and feasible, provided that:

a. The behavior pattern of the vector will be such that intradomiciliary insecticide residues will interfere to a significant degree with the transmission of malaria;

b. Safe application and handling practices are employed with the insecticide so that there are no significant problems of pesticide toxicity to program personnel nor to recipient populations, as determined by carefully organized and effective monitoring; and,

c. There is frequent--preferably monthly--entomologic evaluation of the efficacy of the spraying and of the sensitivity of anopheline populations to the insecticide.

The determination and assurance of these qualifications are within the technical and administrative capabilities of the SNEM organization, but will require additional staff training, institution of operational research to develop alternative approaches and materials, and increased professional supervision. The project is designed to meet these requirements and to insure that a continually improved and epidemiologically sound spray operation is being implemented. SNEM will carefully monitor the mosquito population to identify the emergence of resistance to the insecticide in the vector or any significant alteration in its behavior patterns. The planned SNEM mechanism for this monitoring is considered technically sound and should detect early changes in vector behavior or response to insecticides. This SNEM mechanism is being strengthened by the addition of both technical assistance and training (see Section V, Financial Plan).

One of the priority operational research efforts the Project will support is a series of trials of alternative insecticides and their usefulness for acceptable control. Demonstration of the efficacy of new insecticides would permit SNEM to develop operational alternatives. Operational research is essential to determine behavior patterns of the anopheline mosquito vectors in the variety of ecologic situations throughout Ecuador and to determine any emerging or expanding patterns of mosquito resistance to fenitrothion and

DDT. Such research can be conducted by SNEM, with the assistance of A.I.D.'s contract senior advisor and PAHO advisors, and short term technical assistance. The project has specifically scheduled both training and technical assistance in mosquito resistance evaluation.

6. Larviciding

This method is appropriate for and is in fact used in Ecuador in urban, sub-urban and other selected situations to achieve reduction in vector malaria mosquito populations. Only petroleum products are being presently considered for this purpose, avoiding the use of insecticides which might induce resistance in the anopheline populations and negate the effectiveness of these compounds for use in intradomiciliary spraying. Provided this principle is followed, and that each larviciding project is evaluated for effectiveness, the measure is considered sound and feasible for application by SNEM. Most of the larviciding to date has been done in Guayaquil and Esmeraldas, but there are plans to carry out such activities in Milagro, Machala, Santa Rosa, Pasaje, Portoviejo, Chone, Bahia, and San Lorenzo. The conduct and evaluation of operational field studies on the effectiveness of various larvicidal methods are within the capacity of SNEM from both a technical and managerial point of view.

In the larviciding for Aedes aegypti, the product Abate is used. Abate is considered the insecticide of choice for reasons of both safety and cost-effectiveness.

7. Area Spraying (Adulticides)

The use of Ultra Low Volume (ULV) and fogging applications for control of adult vector mosquitos is sound and feasible if used specifically for control of focal problems, if suitable insecticides are used, and if the application equipment used is correctly adjusted and operated. ULV activities have been carried out in Milagro, Guayaquil, Machala, Pasaje, Salinas, Playas, Santa Rosa, Manta, San Lorenzo, La Libertad and El Triunfo. However, entomological evaluations have been minimal and much more needs to be done in ULV evaluation. This technique is used for rapid reduction of vector densities; there is a need for retraining of personnel in the correct use of the method. The project includes technical assistance and training in ULV spray operations as well as loan-financed procurement of ULV application equipment. Conducted as planned, this malaria control intervention can be selectively applied on a technically sound basis.

8. Source Reduction

Source reduction (environmental modification) methods are considered technically sound contributors to malaria control, particularly as they provide for a permanent reduction in mosquito breeding sources. The feasibility of inclusion of these measures in the malaria program demands specific efforts by the program to identify, assess and correct situations which are suitable for this type of intervention. SNEM has in the past carried out such work with the municipalities of Esmeraldas, Machala and La

Libertad, but in each case, activity has stopped when the specific joint project was completed. With increased training and retraining of personnel as planned during the project, it may be feasible to expand source reduction activities. The project plans to encourage community participation in minor source reduction actions; and to approach the Ministry of Defense for assistance in this type of activity. Source reduction is technically sound provided that SNEM personnel guide and give supervision to such efforts.

9. Biological Control

A number of biological control methodologies are being tested world-wide; they include the use of bacteria, viruses, and nematodes. Geneticists are also attempting to discover mechanisms for the control of mosquito reproduction. However, this project has no present plans to make operational application of any biological control except larvivorous fish and possibly BTI. The use of larvivorous fish appears to be an inexpensive, effective, and potentially community-based measure for reduction of mosquito populations in permanent breeding areas and rice paddies. It is a sound, time-tested measure and further exploitation of the method is feasible for SNEM. SNEM has had considerable experience in this methodology in the past. Work has been done with *Poecilia reticulatus* in Esmeraldas, Portoviejo and San Lorenzo--with mixed success, however. Additional fish breeding facilities, methods of distribution, and field studies evaluating the effectiveness in a variety of habitats are needed and will be considered in this project. It is considered feasible for SNEM to implement such biological control methods. Field research in additional biological methodologies is being considered within the project. SNEM is capable of doing these studies but will require limited technical assistance and training in planning and evaluating biological control activities.

10. Urban Malaria Transmission

Guayaquil, the most populous urban area in Ecuador, is located in a coastal area of high malaria transmission potential, with a high density of *Anopheles* breeding sites. The economic forces which have led to migration from other areas to Guayaquil have intensified the potential for urban malaria transmission. In 1983, 1031 malaria infections were documented in Guayaquil, a more than 4-fold increase from previous years. Actual infections were no doubt far more prevalent.

Traditionally, urban areas have not been included in SNEM program areas. In view of the huge population at risk, the Guayaquil malaria control effort should be included in plans for malaria control. Urban malaria control may involve special methods, including attacks on mosquito breeding sites, and may therefore require special technical resources and personnel. The project makes provision for technical assistance and training support for urban malaria control measures (see Section V, Financial Plan).

11. Other Vector-borne Diseases

The project will provide $206,000 in grant-funded support to technical assistance, training and operational research dealing with other vector-borne diseases in Ecuador (see Section V, Financial Plan). There are no plans to prepare and implement large-scale field operations for these diseases under this project. Other vector-borne diseases in Ecuador include leishmaniasis, onchocerciasis, yellow fever/dengue and Chagas' disease. The SNEM has already initiated a modest activity in surveillance of *Aedes aegypti*, the vector of yellow fever and dengue. The project's training, operational research and technical efforts are being made to establish, in coordination with PAHO and possibly other donors, a baseline of data and a cadre of trained personnel in this field for future program activity. This approach to developing baseline and training personnel for future program development is considered sound and scientifically correct.

12. Training

SNEM provides a variety of formal pre-service or in-service training experiences within Ecuador for its senior and mid-level staff. The spray operation field personnel are given in-service refresher training after each spray cycle. A portion of the in-service training is done on a ad-hoc basis at Zone Supervisor conferences or at similar meetings. The development of an organized, focussed effective training effort is a high priority activity in the project as this work area is in need of strengthening and expansion.

Under the A.I.D.-financed master technical assistance contract, the project plans to put approximately $900,000 into training support--approximately 30% of the grant funds being sought for the project. The training assistance is aimed primarily at developing malaria control skills, but training experiences are also being scheduled for other vector-borne diseases. The project plans to train up to 20 senior staff in vector borne diseases, the training to include basic vector disease knowledge, alternative control methodologies and operational research skills. In order to develop more awareness of the possibilities of vector-borne diseases in the general health services, five GOE/SNEM officers will be given an opportunity to obtain master's degree training in Public Health (MPH). Thirty-one observation tours within the Latin-American Region and the U.S. are scheduled to allow a more hands-on approach to required training. Special courses in entomology and epidemiology are being proposed along with four training experiences in various aspects of administration. In-country training in the detection of chloroquine-resistant malaria vectors is scheduled early in the project and will be continued over the LOP. Particular weight is attached to the need to provide augmented in-country training for the 6,000 Voluntary Collaborators.

The training provided by the project is considered directly in accord with SNEM's needs and is directly in support of both SNEM's and the Project's objectives. The training schedule proposed by the project are ambitous, but realistic over LOP.

13. Health Education

Health education, designed to increase the understanding, cooperation, and participation of the people in the program at the community level, is as important as the technical operations of vector control, case finding, and treatment. Because it is relatively difficult to measure results in this area, health education is often neglected in malaria programs around the world; Ecuador has been no exception. SNEM leadership, at the center and in the zones, recognizes the importance of health education and is attempting to strengthen that component of the program. As integration of malaria into the general health services proceeds, malaria education must become an important element of the overall health education program for both SNEM and general health service employees.

SNEM utilizes a variety of educational techniques such as participation in village organizations, as well as direct contact by malaria field workers to communicate program objectives, procedures, and schedules to the community. SNEM feels that these efforts have succeeded in creating villager acceptance, and to some extent understanding of the program. An intensive, systematic effort is to be undertaken during the project to study and change villagers' attitudes and practices through operational research, training of village volunteers and working with key community and government leaders, and applying innovative mass media techniques modeled after successful experiences elsewhere.

SNEM is handicapped by a shortage of trained health educators assigned to the program. The program is keyed to the concept that all SNEM employees should be health educators and that such activities are a part of every employee's job.

In the past, SNEM has managed to make significant progress in reducing malaria incidence with only marginal health education activities. Progress in reducing the present epidemic malaria situation, maintaining low levels, and finally eliminating malaria as a public health problem will require a greater health education effort than in the past.

For that reason, this project will provide the services of short-term consultants specializing in health education to improve in-country training, funds for operational research to study community knowledge, attitudes and practices in relation to malaria; and will support development of health education materials, including mass media (radio) campaigns. The plans to carry out this health education activity are modest, but will result in a considerable improvement in the management of health education functions within SNEM and increase community awareness of the program over the LOP.

14. Operational Research

Operational research, as opposed to basic research, constitutes those activities which are conducted to identify control problems, to determine operational priorities, or to define problem solution or effective

interventions. Operational research does not include epidemiologic surveillance and evaluation of operations. All operational research should be designed to generate knowledge and experience, on the basis of which control programs can be designed, conducted and/or improved. Over the LOP, grant-funded A.I.D. assistance will finance $535,000 in operational research under the master technical assistance contract (or subcontracts) and under PASA auspices. See Section V, Financial Plan, for a detailed listing of operational research proposals over the five years of the project. The list of proposals set forth in Section V does not exhaust the list of priority issues.

15. Long-Term Sustainability and Impact

If successfully executed, the project will have assisted SNEM to move substantially forward in its transition from a vertically organized program emphasizing total-coverage house-spraying and active case detection surveillance methods to an integrated program utilizing a selective mix of vector control measures and a better balance between active and passive case detection and treatment methods, for malaria, and also for other vector-borne diseases. Progressive reduction of malaria transmission by vector control and drug treatment for humans is expected to reduce the geographical area to be actively controlled, thereby reducing the administrative and financial costs of the program. Successful execution will depend on a number of key variables, including vector resistance to the OP and chlorinated hydrocarbon insecticides; epidemiologically accurate direction of spray operations; cooperation and participation of the general public and general health services staff; reduction in the incidence of P. falciparum malaria, especially in Esmeraldas; collaboration of municipal authorities; and expanded use of feasible alternative control measures which are the result of operational research, increased training and technical assistance inputs.

An important impact from the standpoint of government administration will be significant savings from the reduced requirement to import large quantities of expensive insecticides. A continued requirement of roughly $1 million in foreign exchange annually would appear to well within GOE capacity to support. The long-term impact on social and economic development will be substantial in terms of reduced morbidity (and infant mortality) and increased productivity.

The sustainability of the program is the more probable in view of the outcome of GOE's USAID-assisted effort to increase tax and import duty collections. Relying on efficiency of collection rather than rate increases, the effort is meeting with notable success which bodes well for GOE's future revenue generation.

The likelihood that the project can become self-sustaining on the basis of fee collection from beneficiaries is negligible. The concept of charging a fee for residential spraying is clearly visionary; that the rural householder would pay a fee for the privilege of having his household upset two or four times annually is not worth considering, even if the householder

fully understood the concept of preventive health services. The converse would assuredly be the norm: the householder would reject the application to his home of residual spraying, defeating the entire control effort.

The possibility of charging a fee for chemotherapy has also been considered and rejected as impracticable. The announced policy of the present GOE to provide free drug treatment of all kinds to pregnant women and small children makes the problem of charging all remaining recipients a fee an administrative mare's nest; the very collection of the fee and accounting for tablets that sell for the equivalent of 3 cents each would cost more than the value of the drug; and in any event, the value of drugs to be supplied under the program over its five-year course represents about 1% of program costs.

16. Summary

The project is judged to be technically feasible and sound. The project design provides appropriate and sufficient technical assistance and training and includes an operational research component which will enable the GOE to implement technically sound approaches to malaria control.

B. Administrative Feasibility Summary

To the extent that activities under this project represent a continuation of the kind of control efforts which have characterized SNEM's historic pattern of operations, SNEM has the capacity to administer such activities with dispatch. While the two-year record of sharply rising malaria incidence is attributable in part to serious flooding which hampered access to malarious areas and simultaneously augmented the malariogenic potential of these areas, it is equally true that Ecuador's economic crisis crippled SNEM at the very time when the need was greatest. Intradomiciliary spraying was terminated because SNEM lacked the funds to purchase imported insecticides.

This is not to say that SNEM is at this time ideally equipped to carry out the full program outlined in this document. In fact, the project is specifically designed to address SNEM's shortcomings. SNEM has major needs for training in control methodologies which provide alternatives to widespread intradomiciliary insecticide spraying, and which are more cost-effective. SNEM management has proved receptive to these concepts, and has participated in the planning of the training--management training included--which is detailed in Section V, Financial Plan. To restate, the project will address those areas of weakness which have prevented SNEM from carrying out the kind of program which SNEM's top leadership has recognized as necessary to long-term, cost-effective malaria control.

SNEM's historical role has been that of a completely vertical operation, divorced from the balance of the Ministry of Health, assigned responsibility for all things malarial--and, recently, for other vector-borne diseases. The degree of divorce from the other elements of MOH has been such that MOH hospitals have normally insisted that SNEM personnel take over malaria cases; conversely, Ecuadorean official malaria statistics ignore all malaria cases not confirmed by SNEM examination of blood smears.

This separation from the balance of the MOH had its inception in the old, jointly financed Servicio de Malaria created during the days of the U.S. Technical Cooperation Administration. The Servicio operated under its own rules, independent of both Ecuadorean and U.S. procurement, salary and management practices. That its personnel were considered step-children by the MOH when the Servicio de Malaria was finally turned over to GOE is hardly to be wondered at.

The still-rudimentary PHC system has had neither the training nor the drugs to provide even presumptive treatment to symptomatic malaria victims (although this aspect of the problem appears to be in process of resolution as this project paper is being drafted). Moreover, the recent reorganization of the MOH, removing SNEM from the Coastal Subsecretariat jurisdiction and placing the organization directly under the General Subsecretariat for Health should facilitate SNEM's ability to administer the project and secure the vital cooperation from and coordination with other elements in the MOH.

It is abundantly clear that SNEM's understaffed and underemployed Education unit (within an otherwise well-staffed Epidemiology Department) requires immediate attention--an issue to which the AID-financed contract Malaria Advisor will have to address himself.

More critical is the present weakness in the central Field Operations Division; the positions of Chief and Assistant Chief are now vacant. The Operations Chief is in fact designated as Deputy Director of SNEM. There can be no delay in filling this position.

SNEM's present headquarters facilities--and, to the extent observed, those at the zone level--are at least adequate; and SNEM has already offered to provide office space for the AID-supplied contract malaria advisor. Warehousing space at central and zonal levels appears to be adequate, but may in some cases be substandard at the sector level.

SNEM's capacity for keeping its vehicle fleet in operation is very good indeed. In a country which turns a new car into an item to be surplused in three to five years, SNEM is still operating vehicles dating back to the 1960's. But, however commendable the effort, the cost in repairs and down-time is clearly excessive, and incompatible with the requirements of this project. For this reason, $1,500,000 in AID loan funds are budgeted for substantial augmentation of SNEM's transportation. The acquisition of a modern vehicle fleet poses the maintenance operation with a problem: lack of experience on any vehicle less than ten years old or of American origin. This fact has been taken into consideration; on-site training in the maintenance of the vehicles to be procured under this project will be a required element in the call for bids.

An area of critical importance to the success of this project is that of labor peace. SNEM is perhaps unique among the world's malaria control operations in that some 98% of SNEM's staff--including even first-line supervisors--owe their job security to the Código de Trabajo, or Labor Code, rather than to the Ley de Servicio Civil. Not only the field spraymen, but also their supervisors, and indeed the entire staff below the top professional

level, have opted for the security of a long-term union contract rather than that provided by gazetted civil service status. Negotiations are now in train for a new labor agreement--coincidentally, for five years--which could result in restrictive agreements impeding administrative flexibility in assigning new tasks or personnel transfers. There is also the possibility of augmented labor costs, which would require an equivalent increase in GOE inputs to the project.

The fact that a large portion of the training proposed under this contract will go to members of this unpredictable entity whose loyalties lie with the union rather than their employing organization is not necessarily a cause for alarm; the market for their acquired skills will in any event be SNEM.

C. Project Economic Analysis Summary

This economic analysis appraises the malaria control project in terms of whether it is worthwhile from an economic stand point.

The benefits of this project to Ecuador are 2.93 times its costs. Available alternative methodologies of malaria control that could possibly produce comparable benefits would be far more expensive, and methodologies to produce comparable benefits at lower costs are not yet available. The project is therefore considered cost-effective.

Benefits vs. Costs

The estimates set forth below (and detailed in Annex K) are based on projections of cases of malaria, on presumptive and radical drug treatment costs, on hospitalization costs, and on income losses, with and without the project. As such they represent the best judgement of the malaria specialists consulted and are indicative of orders of magnitude; they do not pretend to precision. However, the implicit rate of return on investment and the benefit-cost ratio are obviously high.

Without the proposed malaria program, malaria cases from 1985 to 1989 would be expected to reach over 5.8 million. With the program, the aggregate number would be about 260,000 and by the end of the project, the case load of perhaps 15,000 would be sufficiently low that malaria would not constitute a serious public health problem. The net value of benefits from the program (avoided treatment costs and wages not foregone) in the order of $126 million are more than triple the costs ($40.2 million). The per capita cost of the project (among the population at malaria risk) is about $1.64 per year over LOP; the project cost per case of malaria avoided is about $7.20. No other available anti-malaria methodology approaches this measure of cost-effectiveness.

In addition to economically quantifiable benefits, the project will produce a number of benefits, economic and social, to which no monetary value can be assigned:

1. Support to GOE efforts to colonize the thinly populated provinces of the Oriente.

2. Increase in the amount of produce harvested.

3. Expansion in agricultural acreage in what are now perennially malarious areas.

4. Strengthening of the general health delivery system.

5. Decrease in the incidence of other diseases (since malaria is frequently the precursor of other diseases).

Sensitivity analyses to test the effects on the project's Economic Rate of Return (ERR) of possible cost overruns and benefit shortfalls demonstrate that miscalculations of either factor by as much as 50%, or of both factors by as much as 40%, would still leave the project with an ERR of over 50 percent.

D. Financial Analysis

This project provides assistance to support the GOE Malaria Control Program. As shown in Table IV-2, the entire program over the next five years is estimated to cost $40,168,000.

The SNEM budget over the period is the equivalent of $29,948,000--excluding whatever amount may still be budgeted for malaria chemotherapy provided by the health promotores (who have only very recently been accorded the right to provide drug treatment to clinically diagnosed victims of malaria). With the exception of the foreign exchange required to purchase DDT -- $2,898,000 equivalent of the $7,661,000 equivalent which SNEM has budgeted for supplies and equipment -- all costs to be supported by the GOE are local costs.

The pledge of one other donor is known at this time: PAHO, which will continue to provide the services of one resident advisor, and the part-time services of a regional advisor (who is also resident in Ecuador). PAHO also supports the costs of a limited number of training courses. PAHO's contribution over the period will be $720,000 equivalent.

The A.I.D. project inputs will include $3,000,000 in grant-funded services, and $6,500,000 in loan-funded commodities, for a total of $9,500,000, all in foreign exchange costs. This represents approximately 23.6% of the total costs of the entire program over the next five years. Thus, the A.I.D. inputs will support and thereby make effective a GOE malaria control budget over three times as great.

The three tables on the following pages summarize project costs by fiscal years and funding source; project costs by expense category, source and kind of funding; and A.I.D. funding by expense category, divided between

grant and loan funds, by fiscal year and in total. Project costs are defined as subobligations or binding commitments such as PIOs, purchase orders or contracts.

With respect to loan-funded commodity purchases, inflation has been estimated at 10% annually. A contingency factor of 5% has been applied to all commodity costs. For grant-funded items of expenditure, less subject to inflation than commodity purchases, the inflation factor is built into the estimated expenditures.

Sucres, where shown, are expressed as dollar equivalents at the exchange rate of U.S. $1.00 = 100 sucres.

TABLE No. IV-1

SUMMARY OF PROJECT COSTS 1/ BY EXPENSE CATEGORY AND FUND SOURCE

($000 and $000 equivalent)

Expense Category	Life of Project Funding			
	AID		GOE 2/	PAHO
	Grant	Loan		
1. Technical Assistance				
a. Short term	$ 355	-	-	-
b. Long term	1,010	-	-	500
Subtotal	1,365	-	-	500
2. Training				
a. In-country	449	-	-	-
b. External	460	-	-	100
Subtotal	900	-	-	-
3. Operational Research	535	-	-	-
4. Evaluation	200	-	-	-
5. Commodities				
a. Transport	-	1,500	-	-
b. Sprayers, ULV, etc.	-	350	-	-
c. Insecticides	-	2,823	2,898 3/	-
d. Training/ Research Equip.	-	300	-	-
e. Drugs	-	400	-	-
f. Office Supp./Equip.	-	120	-	-
g. Other	-	160	-	120
Subtotal	-	5,653	2,898	120

Expense Category	Life of Project Funding AID Grant	AID Loan	GOE[2]	PAHO
6. Other Costs				
a. Salaries	-	-	20,758	-
b. Contract services	-	-	1,191	-
c. Supplies, materials	-	-	4,763[3]	-
d. Capital equipment	-	-	130	-
e. Other [3]	-	-	208[4]	-
Subtotal	-	-	27,050	-
TOTAL	3,000	5,653	29,948	720
Inflation (10%)[5]	-	565	-	-
Contingency (5%)	-	282	-	-
GRAND TOTAL	3,000	6,500	29,948	720

1/ AID dollar costs are defined as anticipated subobligations or firm commitments of funding.

2/ Expressed in dollar equivalents at exchange rate of US $1.00 = 100 sucres.

3/ Of $7,661,000 equivalent for operating supplies and materials, $2,898,000 equivalent covers the program's extensive requirements for DDT, all of which are to be met by GOE. This is a foreign exchange cost.

4/ Of which $198,000 equivalent is for vaccination campaigns against vector-borne diseases other than malaria.

5/ Inflation factor is already built into grant-funded items of expenditure.

TABLE No. IV-2

SUMMARY OF PROJECT COSTS 1/ BY
FISCAL YEAR AND FUNDING SOURCE

(in $000 or equivalent)

Funding Source	U.S. Fiscal Year					
	1985	1986	1987	1988	1989	TOTAL
AID Grant Funds	350	555	625	710	760	3,000
AID Loan Funds	2,260	1,590	955	1,040	655	6,500
GOE 2/	4,550	5,000	6,250	6,433	7,715	29,948
PAHO	112	126	142	160	180	720
TOTAL	7,272	7,271	7,972	8,343	9,310	40,168

1/ A.I.D. dollar costs are defined as anticipated subobligations or commitments of funding.

2/ Expressed in dollar equivalents at exchange rate of US$1.00 = 100 sucres

TABLE No. IV-3

SUMMARY OF AID FUNDING BY EXPENSE CATEGORY AND FISCAL YEAR

Expense Category	1985		1986		1987		1988		1989		TOTAL	
	Grant	Loan	Grant	Loan	Grant	Loan	Grant	Loan	Grant	Loan	Grant	Loan
1. Technical Assistance												
a. Short-term	97	-	45	-	33	-	102	-	78	-	355	-
b. Long-term	128	-	215	-	227	-	218	-	222	-	1,010	-
Subtotal	225	-	260	-	260	-	320	-	300	-	1,365	-
2. Training												
a. In-country	5	-	80	-	90	-	110	-	155	-	440	-
b. External	60	-	115	-	105	-	85	-	95	-	460	-
Subtotal	65	-	195	-	195	-	195	-	250	-	900	-
3. Operational Research	60	-	50	-	120	-	145	-	160	-	535	-
4. Evaluation	-	-	50	-	50	-	50	-	50	-	200	-
5. Commodities												
a. Transport	-	800	-	460	-	-	-	150	-	90	-	1,500
b. Spray equipment	-	200	-	50	-	50	-	25	-	25	-	350
c. O.P. Insecticides	-	754	-	623	-	571	-	570	-	305	-	2,823
d. Training/Research Eq.	-	-	-	75	-	75	-	75	-	75	-	300
e. Drugs	-	100	-	100	-	100	-	50	-	50	-	400
f. Office Supp./Eq.	-	50	-	50	-	10	-	10	-	-	-	120
g. Lab. Supplies	-	60	-	25	-	25	-	25	-	25	-	160
Subtotal	-	1,964	-	1,383	-	831	-	905	-	570	-	5,653
Inflation and Contingency	-	296	-	207	-	124	-	135	-	85	-	847
GRAND TOTAL	350	2,260	555	1,590	625	955	710	1,040	760	655	3,000	6,500
LOAN	-	2,260	-	1,590	-	955	-	1,040	-	655	-	6,500

E. Social Soundness Analysis

This analysis is keyed to three basic factors:

1. The ability of the program to distribute benefits equitably;

2. The range of cultural diversity in Ecuador;

3. The social acceptance of the techniques used in malaria control.

The program will provide direct and immediate benefits to all inhabitants of the coastal provinces of the country and in the more densely populated areas of Napo, in the form of vector control measures, case detection and treatment--designed to reach all affected persons in these areas in order to interrupt malaria transmission. Because spraying is conducted on a house-to-house basis, the program reaches a segment of the population missed by many social sector programs; in fact, the malaria spray team is often the first representative of the central government seen by many rural citizens--other than the military or the tax office.

In the four provinces of the eastern amazonic region, services will, by reasons of geography, almost total lack of communications and cost-efficiency, be limited in most areas to treatment of clinically diagnosed malaria cases by the voluntary collaborators with very limited focal spraying in the main population centers. The effect of such an effort is to prevent malaria-caused death and to limit the duration of illness, although its impact on disease incidence is minimal.

The Primary Health Care system, hitherto vertically compartmentalized from the malaria control service, is only now being accorded the right to dispense chemotherapeutic drugs (specifically, chloroquine); PHC's system of 1,200 health promotores will be added to the more than 6,000 voluntary collaborators serving under the malaria program as such.

The health education programs which form an important element in the project will enable these remote communities to understand control measures, to take steps to improve malaria care and to reduce local sources of malaria infection.

Thus, the program will benefit the entire malarious portion of the country, with benefits concentrated in rural areas. It will reduce malaria-related mortality and morbidity--to the population at large, but in particular, to pregnant women and to small children, upon whom the burden of malaria mortality falls most heavily.

The regional and cultural diversity to be found in Ecuador--and, in particular, in rural Ecuador--have been taken into account in program design as well as program administration. The belief in many elements of Ecuadorean society that certain diseases are evidence of supernatural displeasure does not appear to apply to malaria; and while there may be a less than full

understanding of the cause of malaria, there is general acceptance that it is curable by "western" (as against traditional) medical treatment. Medical missionaries in coastal areas as well as in the Oriente report full acceptance by local healers and witch doctors of drug treatment of malaria--including, in particular, their own infections. There appears to be no conflict with local belief; to the contrary, most people seek drug relief from the symptoms of malaria--although their choice of curative drug may not be the best.

Additionally, SNEM's zonal structure lends itself to local acceptance. Spray crews, surveillance workers and supervisors are all recruited from the areas where they work, and hence understand local customs.

The most serious social constraint confronting the program may be reluctance by villagers to allow their houses to be sprayed. In the earlier period of malaria eradication, acceptance of household spraying was high. This was due, at least in part, to the ability of the insecticide to destroy pests, especially cockroaches and bedbugs. The connection between malaria and spraying was frequently not understood by the populace. When insect resistance to DDT increased and insects remained after spraying, people's enthusiasm for spraying declined. Other factors which contribute to resistance to spraying include: the odor of some insecticides; the interruption of social and religious events; general nuisance; wall discoloration; and the belief that the insecticide is dangerous.

Related to the social acceptance of household spraying is the place malaria holds in the health belief system. If people perceive malaria to be a serious threat, they will be more apt to take steps to work with the malaria control program. In some areas, malaria is viewed as just such a threat while in others, it is not. Even when malaria is a serious concern of the population, they may not associate malaria with mosquitoes. The health education component of the program is intended to promote community understanding, cooperation, and participation, and will place greater emphasis on efforts to inform people about the cause of malaria and how the program's activities will eliminate the disease.

Nevertheless, a continuing review of social acceptance during the implementation of the new project is essential. Along with the annual program evaluations, special studies are planned to examine problems as they may arise, but, more particularly, to optimize the results of the health education component of the program and to bring about a greater measure of community self-help effort in controlling malaria. Such studies will investigate the reasons for social resistance and possible courses of remedial action. The SNEM has in the past shown itself to be sensitive to the social requirements of the population and has undertaken educational efforts through the village social and political structure to avoid potential problems. These efforts will be augmented under the proposed project at the field level as well as in the planned training courses. Present SNEM staffing indicates that outside assistance, particularly in the field of communications techniques using mass media, will be needed for the research function.

The identification of beneficiaries and the project's benefit incidence show that the major limiting factor will be the extent of the

program's operation. The program itself does not restrict participation on the basis of education, income, occupation, age, or sex. Rather, any person with a fever has the ability to become a direct beneficiary.

Given the social setting and the current plan, the malaria control program appears socially sound. The major problem area remains household spraying. Social acceptance to spraying exists and will continue, but the enthusiasm among the householders has abated as DDT has lost the effectiveness as a killer of household pests which won household spraying its initial acceptance. Still effective in killing malaria vectors which rest on sprayed interior surfaces, DDT remains the spray material of choice in most parts of Ecuador, in view of its cost advantages over any alternative insecticide. This is especially the case since official objections to the use of DDT, based on a misconception of its risks when used solely as a residual insecticide for public health purposes, have now been withdrawn. Fenitrothion spray, introduced two years ago into the province of Esmeraldas, retains its acceptability, despite the inconvenience of four spray cycles annually (vs. only two for DDT). Subsequent introduction of malathion, effective at least during LOP against household pests as well as the anopheline vector of malaria, may for that reason raise no additional problems of acceptance, despite considerations of odor.

If a malaria immunization inoculation were available, many of the social acceptance issues would be reduced since inoculations are generally well received. The only reasonable approach to the problem of social resistance is constant monitoring of the situation; research of resistance instances; and a program flexible enough to incorporate research findings.

F. Environmental Concerns

The IEE has been approved with a negative determination by the LAC Environmental Officer. An Initial Environmental Examination (IEE) is provided as Annex M. The insecticides to be used in the Ecuador Malaria Control Program are those commonly used in other malaria programs around the world. Numerous environmental studies and assessments have already been undertaken for these chlorinated hydrocarbons and organophosphorus insecticides, and all have concluded that these compounds have a favorable risk-benefit impact on the environment. In view of these studies and the fact that Ecuador has not experienced any health problems in its spray operations due to the safeguards built into the program of monitoring cholinesterase levels in personnel, adequate supervision, regular and refresher training, and proper storage and distribution practices, the Mission has concluded that no further environmental analysis is required and recommends a negative determination. If new chemical, biological, or physical malaria control methodologies are introduced into the program after the approval of this project, the environmental impact will be reviewed, and, if necessary, environmental studies or assessments will be carried out.

At the PID review for this project in AID/W, the Environmental Officer asked for a clarification on the effect of the proposed spray

operation on the shellfish industry. The three medical officers on the PP Team who went to the coastal areas where such shellfish are present, made a special point of inquiring as to the effect of the program on this industry. Both Government and private enterprise parties were asked about this question. The answer was that no problems had been encountered to date on this question and that it was foreseen that no problem would arise in the future if SNEM's operational program is executed as planned. (See Annex O for report on field trip by Col. Ignacio Hernández, US Medical Corps, attached to U.S. Embassy, Quito).

V. A.I.D. FINANCIAL PLAN

The A.I.D. inputs into the proposed malaria control project will include $3,000,000 in grant-funded services and $6,500,000 in loan-funded commodities for a total of $9,500,000, all in foreign exchange costs. Initial funding is to be authorized in FY-1985. The A.I.D. grant will help finance long and short-term technical assistance ($1,365,000); in-country and external training ($900,000); operational research ($535,000) and evaluation ($200,000). The A.I.D. loan will finance transport ($1,500,000); insecticides ($2,823,000); spray equipment ($350,000), anti-malaria drugs ($400,000); and miscellaneous supplies and equipment ($580.000). The balance of the A.I.D. loan covers a 10% provision for LOP inflation and a 5% contingency allowance.

AID inputs represent approximately 23.6% of the total costs of the program over the next five years. Apart from $720,000 in technical services and training to be contributed by PAHO, the balance of the project, including all local costs, is provided by GOE--$29,948,000 equivalent, or about 74.5% of the $40,168,000 total cost of the project.

A.I.D. funds are allocated heavily in the first two years of the project, and in particular, the first year, FY-1985. During FY-1985, A.I.D. will provide a total of $2,610,000--$350,000 in grant-funded technical assistance, training and operational research, and $2,260,000 in loan-financed commodities, principal among which are transport equipment ($800,000), insecticides ($754,000), and spray equipment ($200,000).

This is, in fact, the minimum necessary to initiate this project, consistent with the short and long-term technical assistance, the tranining and the planned operational research planned. Replacement vehicles and supplies needed for field activities are scheduled to arrive as early as possible in 1985-- after the arrival of A.I.D.'s long-term malaria advisor. The skyrocketing malaria incidence figures make it imperative that field operations be initiated without delay.

In subsequent years, planned activities in each year reflect supply requirements and fund availabilities to achieve project goals. In the second project year, it is planned to procure most of the balance of vehicles required for the field operations, with smaller quantities in the fourth and fifth years. Insecticides will be procured at approximately level rates in project years two, three and four, tapering off in the final year. Drug procurement, starting at $100,000 per year, will taper off to $50,000 in each of the last two years as malaria incidence and transmission is expected to decline.

Throughout project implementation adequate funding is required to monitor insecticide and drug effectiveness throughout the country; to provide the wide range of training and operational research guidance needed to convert SNEM to an organization capable of epidemiologically focused malaria control; and to assist in project evaluation at appointed times.

The following tables (V-1 and V-2) spell out, year by year and item by item, the elements of proposed A.I.D. grant and loan funding. Subtables V-1, a-d provide for each year the specific costed provisions for technical assistance, operational research, training and evaluation.

Subtables V-2, a-e summarize annual costed requirements for organophosphorus insecticides, itemized initial transport requirements and initial 1985 requirements for spray equipment.

TABLE V-1

A. SUMMARY OF PROPOSED A.I.D. GRANT FUNDING
(U.S. $000)

		FY1985	FY1986	FY1987	FY1988	FY1989	TOTAL
I.	Technical Assistance	225	260	260	320	300	1,365
II.	Operational Research	60	50	120	145	160	535
III.	Training	65	195	195	195	250	900
IV.	Evaluation	-	50	50	50	50	200
		350	555	625	710	760	3,000

SUMMARY OF TECHNICAL ASSISTANCE, FY 1985-89

FY 1985	Cost	
a. Master contract		
1. Senior Technical advisor (salary allowances, costs) 6 mo.	$100,000	
2. Bilingual secretary (6 mo.) driver (6 mo.), books, supplies, equipment	9,000	
3. Purchase of vehicle; local travel	16,000	
4. One RT, to US and return and per diem for consultation at AID/W and CDC	3,000	
5. Short term consultants		
a. Insecticide resistance, 2 mo.	30,000	
b. Training consultant, 1 mo.	15,000	
c. Epidemologist for study of surveillance system, 1.5 mo.	25,000	
d. Sociologist for knowledge-attitude-practice (KAP) assessment, 1 mo.	15,000	
		213,000
b. PASA		
1. Drug sensitivity, 1 mo.	10,000	
2. Testing of insecticide at CDC	2,000	
		12,000
TOTAL COSTS FY 1985		225,000
FY 1986		
a. Master contract		
1. Senior Technical Advisor (salary, allowance, costs, R&R)	190,000	
2. Staff, office supplies, equipm.	20,000	
3. Local travel, vehicle maintenance	5,000	
4. Consultants		
a. Operational specialist	7,500	
b. Training consultant	15,000	
c. Epidemologist	15,000	
d. Sociologist	7,500	
TOTAL COSTS FY 1986		260,000

FY 1987

a. Master contract		
1. Senior technical advisor (salary, allowances, costs, HL)	$200,000	
2. Staff, office supplies equipment	22,000	
3. Local travel, vehicle maintenance	5,000	
5. Consultants		
a. Drug sensitivity/operations spec.	15,000	
b. Training consultant	8,000	
c. Sociologist (KAP) local	5,000	
6. Attendance at international conference for Senior Technical Advisor	3,000	
		258,000
b. PASA		
1. Testing of insecticide at CDC	2,000	
		2,000
TOTAL COSTS FY 1987		260,000

FY 1988

a. Master contract		
1. Senior technical advisor (Salary, allowance, costs, R&R	190,000	
2. Staff, office supplies, equipment	20,000	
3. Local travel, vehicle maintenance	5,000	
4. Attendance at international conference for Senior Technical Advisor	3,000	
5. Consultants		
a. Training consultant	30,000	
b. Epidemologist/Entomologist	15,000	
c. Other Vector-Born Disease Specialist	30,000	
d. Operational specialist	15,000	
e. Sociologist (KAP)-local	10,000	
		318,000
b. PASA		
1. Testing of insecticide at CDC	2,000	
		2,000
TOTAL COSTS FY 1988		320,000

FY 1989

a. Master contract		
1. Senior Technical Advisor (Salary, allowances, costs) $190,000		
2. Staff, office supplies, equipment severance pay	27,000	
3. Local travel, vehicle maintenance	5,000	
4. Consultants		
a. Drug resistance, insecticide resistance	15,000	
b. Training consultant	30,000	
c. Operational specialist	15,000	
d. Other VBD specialist	15,000	
		297,000
b. PASA		
1. Testing of insecticides at CDC	3,000	
		3,000
TOTAL COSTS FY 1989	300,000	
Total costs, Technical Assistance, LOP	$1,365,000	
Long Term 1,010,000		
Short Term 355,000		

2. OPERATIONAL RESEARCH PROPOSALS, FY 1985-89

Activity	Mechanism	Est. Cost
FY 1985		
a. Master contract		
1. Drug sensitivity testing and evaluation of laboratory diagnostic services	Contractor's staff or sub-contract	$ 30,000
2. Baseline KAP surveys concerning malaria in priority transmission areas; drug usage, including use and effectiveness of native drugs	Local (possibly university) contract or, possibly, SNEM/MOH Health Education mechanism	15,000
3. Baseline prevalence studies of transmission and disease impact of onchocerciasis, Rio Cayapa area	Local contract and establishment of research center on north coast	15,000
TOTAL FY 1985		$ 60,000
FY 1986		
a. Master contract		
1. Vector ecology study insecticide testing	Pilot studies performed by SNEM and/or contract with local institution	$ 20,000
2. Extended KAP survey in remainder of country to assist in formulating health education modules	Extend local contractor used in FY 1985	10,000
b. PASA		
1. Epidemology studies to define strategy of stratification; survey to develop computer-based data analysis for stratification	CDC	20,000
TOTAL FY 1986		$ 50,000

FY 1987

a. Master contract		
1. Vector assestment; insecticide usage at different application densities	Contractor's staff of sub-contract	$ 30,000
2. Sociological study to define and evaluate interventions in the field of health education	Local contract	20,000
3. Study of potential for implementation of elements of malaria control within national health service system	Local contract	15,000
4. Onchocerciasis research; studies of prevalence; socio-economic factors and their impact on disease transmission, Rio Santiago Basin	Three year contract (at an estimated $25,000 per year) with local institution	25,000
B. PASA		
1. Epidemology/stratification of malarious areas; continued development of computer-based analysis	Three year PASA (at $20,000 per year) to work with SNEM; contract with local firm or institution (at $10,000 per year) to work on computer program	30,000
TOTAL FY 1987		$ 120,000

FY 1988

a. Master contract		
1. Studies of urban malaria	Local two-year contract at $15,000 per year	15,000
2. Study of health education system to define the most effective interventions for vector-borne diseases	Local contract (with possibly PASA association)	15,000
3. Onchocerciasis research	Second year of loal contract	25,000
4. Leishmaniasis research: Basic prevalence studies, determination of types of parasites found in coastal and amazonic regions	Two-year contract at $15,000 per year with local institution	15,000
5. Chagas disease research: Basic prevalence studies	Two year contract at $10,000 per year, with local institutions	10,000
b. PASA		
1. Epidemology/stratification PASA	Second year of mixed PASA/local contract	30,000
2. Vector ecology studies with emphasis on integrated control of vectors of malaria leishmaniasis, chagas disease, onchocerciasis	Two year PASA at $35,000 per year	35,000
TOTAL FY 1988		$ 145,000

FY 1989

a.	Master contract		
	1. Urban malaria study	Final year of local two year contract	$ 15,000
	2. Health education study	Local contract	30,000
	3. Onchocerciasis research: Completion of baseline studies to define control strategies	Final year of local three-year contract	25,000
	4. Leishmaniasis research: vectoral study; determination of breeding cycle	Final year of local two year contract	15,000
	5. Chagas'disease research: vectoral study; determination of breeding cycle	Final year of local two year contract	10,000
b.	PASA		
	1. Epidemiology/stratification PASA	Final year of mixed PASA/local contract	30,000
	2. Vector ecology study: integrated control of vectors of malaria, leishmaniasis, Chagas disease and onchocerciasis	Final year of two year PASA	35,000
	TOTAL FY 1988		$ 160,000
	Total costs, Operational research LOP		535,000
		Master contract	355,000
		PASA	180,000

3. SUMMARY OF TRAINING/RETRAINING PROPOSALS (GRANT)

PROJECT ACTIVITY	FIELD OPERATIONS VECTOR CONTROL	FIELD OPERATIONS SURV. EPIDEMIOLOGY	ADMINISTRATIVE MANAGEMENT
FY 1985			
	1. 6-wk.course at USC 5 participants cost:$16,000	1. Malaria Course at Mexico 1 participant cost: $6,400	1. Three week training course in hands-on vehicle maintenance - Contract with successful bidder of project vehicles (in-country), Sept. 1985. Cost: $4,600
	2. Field Observation in Region-3 wks. 3 participants cost: $15,000	2. Training in Drug sensitivity (in-vivo, in-vitro) 3 participants cost: $4,000 + equipment, consultation costs in-country for 3 weeks for $3,700 TOTAL -$8,000	
FY 1985 training costs			$50,000
Costs of administration under Master Contract			15,000
TOTAL FY 1985 COSTS			65,000
FY 1986			
	1. 6-wk course at USC 5 participants cost: $17,000	1. Epi. short course at Mexico 3 participants cost:$7,000	1. Short course at school of PH (Finance) 1 participant cost: $5,000
	2. Field observations in Region-3 wks. 3 participants cost: $15,000 (Guatemala, Mexico)	2. MPH-Mexico 1 participant cost: $20,000	
	3. Observation of mosquito abatement districts-US-2 wks 3 participants cost: $6,000	3. Six month course in Entomology (Panama/Brazil) 2 participants cost: $20,000	

PROJECT ACTIVITY	FIELD OPERATIONS VECTOR CONTROL	FIELD OPERATIONS SURV. EPIDEMIOLOGY	ADMINISTRATIVE MANAGEMENT	
		4. 2-10 day courses in country for sector chiefs in Entomology and Epidemiology 40 participants (contract) cost: $60,000		
FY 1986 Training Costs				150,000
Cost of Administration under Master Contract				45,000
TOTAL FY 1986 COSTS				195,000
FY 1987				
	1. 6-wk course at USC 5 participants cost: $18,000	1. 3-1 week courses for training of trainers for Evaluation Auxiliaries 40 participants (contract to Univ.) Cost: $25,000		
	2. Field observation in region-3 wks. 3 participants cost: $16,000 (Guatemala, Mexico)	2. MPH -Mexico 2 participants cost: $40,000		
	3. Field observation at US Mosquito abatement districts -2 wks. 3 participants cost: $7,000	3. 20-2 day courses for voluntary collaborators 1,000 participants cost: $44,000		
FY 1987 Training costs				150,000
Costs of Administration under Master Contract				45,000
TOTAL FY 1987 TRAINING COSTS 195,000				
FY 1988				
	1. 6-wk course at USC 5 participants cost: $20,000	1. 40-2 day courses, Voluntary Collaborators - 2,000 participants (zone) Cost: $85,000		
	2. Field Observation in Region - 3 wks. 3 participants cost: $15,000	2. MPH Mexico 1 participant cost: $20,000		

PROJECT ACTIVITY	FIELD OPERATIONS VECTOR CONTROL	FIELD OPERATIONS SURV. EPIDEMIOLOGY	ADMINISTRATIVE MANAGEMENT	
	3. Two week study tour to Puerto Rico on Dengue Surveillance, CDC. 5 participants cost: $10,000			
FY 1988 Total				$150,000
Costs of Administration under Master Contract				45,000
TOTAL FY 1988 COSTS				195,000
FY 1989				
	1. 2-Refresher Training courses in-country in Vector Control for Zone Supervisors and Sector Chiefs. 5 days 50 participants Contract with Univ./CDC Cost: $20,000	1. 40-2 day courses for vol.collab. 2000 participants (zone) cost: $85,000	1. Short course in Health Education Mexico or Venezuela. 2 participants cost: $10,000	
	2. Two week study tour to Puerto Rico for Dengue Surveillance, CDC 5 participants cost: $10,000	2. MPH -Mexico 1 participant cost: $20,000	2. Funds for national director to attend International Conference. cost: $5,000	
	3. Two week study tour to Brazil or Venezuela. Chagas Disease and other Vector Borne Dis. 2 participants cost: $6,000	3. Study tour for National Director/and Epidemiologist - 3 weeks 2 participants cost: $15,000		
	4. Study tour for laboratory chiefs for new technology 3 weeks 2 participants cost: $9,000			

PROJECT ACTIVITY	FIELD OPERATIONS VECTOR CONTROL	FIELD OPERATIONS SURV. EPIDEMIOLOGY	ADMINISTRATIVE MANAGEMENT	
5.	2- Training Courses in-country on other vector borne diseases for zone chiefs sector personnel. 5 days participants - 40 Contract with Univ./CDC cost: $20,000			
FY 1989 Training Costs				$200,000
Costs of Administration under Master Contract				50,000
TOTAL FY 1989 Costs				250,000
Training Costs, LOP			700,000	
Costs of Administration under Master Contract			200,000	
Total Training Costs			900,000	

4. Evaluation

An annual program review will be carried out by SNEM with the assistance of representatives of the various donors. All evaluations will be coordinated with the Mission's evaluation officer. The U.S. consultants provided for this review will be grant funded; their services will not be covered by the grant funded master technical services/operational research/training contract. These evaluations will take place for approximately three weeks during the July-August or the February-March period. The first such formative evaluation will be held in 1986 during July-August period. Grant funding proposals include $50,000 to cover travel, per diem and consultant salaries for each of the last four years of the project. There are two Project Evaluation Summary (PES) reviews scheduled for the project.

TABLE V-2

B. SUMMARY OF PROPOSED A.I.D. LOAN FUNDING
(U.S. $000)

		FY1985	FY1986	FY1987	FY1988	FY1989	TOTAL
I.	Insecticides*	754	623	571	570	305	2,823
II.	Transport	800	460	-	150	90	1,500
III.	Spray Equipment	200	50	50	25	25	350
IV.	Laboratory Supplies	60	25	25	25	25	160
V.	Health Education and Volunteer Collaborator Training/supplies		75	75	75	75	300
VI.	Anti-Malaria Drugs	100	100	100	50	50	400
VII.	Office Supplies/ Equipment	50	50	10	10	-	120
	SUB-TOTAL	1,964	1,383	831	905	570	5,653
	INFLATION (10%)	197	138	83	90	57	565
	CONTINGENCY (5%)	99	69	41	45	28	282
	GRAND TOTAL	2,260	1,590	955	1,040	655	6,500
	LOAN	2,260	1,590	955	1,040	655	6,500

* Cost of O.P. insecticides/Kg: Malathion - $2.50 (86), $2.75 (87), $3.00 (88), $3.30 (89)
Fenitrothion-$$5.00 (85), CIF Ecuador.

1/ Costs of insecticide per year are for 2nd cycle of the year indicated and 1st cycle of following year, to allow for procurement pipeline.

2/ Other commodities include 15% shipping.

ECUADOR

MALARIA PROGRAM

1. SUMMARY OF ARRIVAL SCHEDULES FOR

O.P. INSECTICIDES OVER LIFE OF PROJECT

YEAR	MONTH	QUANTITIY IN KILOS FENITROTHION, 40%	MALATHION, 50%
1985	April	96,700	
	September		108,000
1986	April		108,000
	September		111,000
1987	April		111,000
	September		80,000
1988	April		80,000
	September		50,000
1989	April		50,000
	September		84,000

1/ Data Source - SNEM

ECUADOR

MALARIA PROGRAM

SUMMARY OF PROJECTED COSTS OF ORGANOPHOSPHORUS INSECTICIDES PROCURED UNDER PROJECT

Year	No. of houses to be sprayed with Fenitrothion (Twice/year)	No. of houses to be sprayed with Malathion (4 times/year	Quantity of insecticides (Kg.) Fenitrothion 40%	Malathion 50%	Price CIF ($US/Kg.)	Cost per Year ($ U.S.) ($ U.S.)
1985	48,379		96,[illegible] 4/		$5.00	$483,790 1/
1986		60,014		216,050	2.50	540,125
1987		60,694		222,098	2.75	610,770
1988		44,387		160,000	3.00	480,000
1989		51,069 3/		184,000	3.30	607,200 2/
TOTAL						2,721,885

1/ Fenitrothion in the amount of 100,000 Kg. is included in the program funded under the Ecuador Emergency Fund. Should this amount fail to arrive, an equivalent amount would be required under Malaria Project Assistance.

2/ In 1989, additional support is provided for the focal spraying of 25,000 houses in 1990.

3/ In 1988, the number of houses to be sprayed is reduced to approximately 70%, and in 1989 to approximately 40% of the originated number. However, see Footnote 2.

4/ Data Source - SNEM

ECUADOR

MALARIA CONTROL PROGRAM

ESTIMATION OF TRANSPORT REQUIREMENTS

FOR FY-1985 PROCUREMENT

TRANSPORT DESCRIPTION	NO. OF UNITS	UNIT VALUE IN US$	TOTAL COST (US$)
Truck, 5 Ton, 2 WD	2	22,500	45,000
Pick-up, 1/2 Ton, 4 WD	30	11,000	330,000
Jeep, CJ-7, 4 WD	10	11,000	110,000
Station Wagon, 4 WD	4	12,000	48,000
Motorcycles, 125 cc	60	900	54,000
Outboard motor, 40 HP	34	1,500	51,000
Outboard motor, 25 HP	25	1,200	30,000
Boat, alum., 16 ft.	30	1,000	30,000
			698,000
	15% shipping		102,000
			800,000

Note: All vehicles have gasoline engines,
6 cylinders, color forest green
15" wheels, standard width rims
4 speed stick shift with compound low gear
6 ply tires (not 6 ply rating tires) with tubes
Outboard motors should have sealed, waterproof electronic ignition or should not have solid-state ignition.

4. ESTIMATION OF TRANSPORT REQUIREMENT FOR FY-1986

TRANSPORT DESCRIPTION	NO. OF UNITS	UNIT VALUE IN US$	TOTAL COST (US$)
Spare parts, vehicle tools		Misc.	110,000
Pick-ups, 4 WD	7	14,000	98,000
Station Wagon, 4 WD (or equivalent	1	15,000	15,000
Jeep, CJ-7, 4 WD	7	14,000	98,000
Boat, alum., 16 ft	20	1,000	20,000
Outboard motors, 25 HP	25	1,400	35,000
Outboard motors, 40 HP	15	1,600	24,000
			400,000
	15% shipping		60,000
			460,000
	$ Cost		460,000

Note: All vehicles gasoline operated,
color forest green, stick shift
15" wheels, standard width rims
4 speed stick shift with compound low gear
6 ply tires (not 6 ply rating tires)
All tires with tubes
Outboard motors should have sealed, waterproof electronic ignition or should not have solid-state ignition.

5. ESTIMATES OF SPRAYING EQUIPMENT FOR FY-1985 PROCUREMENT

DESCRIPTION	NO. OF UNITS	COST PER UNIT	TOTAL
1. Pump, hand compression, 3 gallon, Hudson X-per marked for 10 liters	400	$80.00	$32,000
2. ULV, Londonaire type truck-mounted	8	8,000.00	64,000
3. Microgen, portable	15	400.00	6,000
4. Sprayer, Hudson X-pert spare parts, 6,000 nozzle tips, 8002 HSS.	misc.	NA	49,000
5. Helmets, wide-brim, light metal or plastic.	500	20.00	10,000
6. Gloves, rubber Heavy duty, 12"	1,000 pr.	5.00	5,000
7. Mask, paper, disposable	32,000	.25	8,000
			174,000
	15% shipping		26,000
			200,000

VI. PROJECT IMPLEMENTATION

A. Host Country Arrangements

The Project Agreement will be signed by the Minister of Finance, the Minister of Health (MOH), and the Director of SNEM. Resources will be provided on a non-reimbursable basis to SNEM. A full delegation of authority for Project implementation for the Director of SNEM will be provided in the Project Agreement. One exception will be procurements requiring GOE-provided foreign exchange which by law must be undertaken by MOH (a central government entity) on behalf of SNEM. This arrangement will only be applicable to the purchase of counterpart-financed pesticides.

B. A.I.D. Arrangements

Project management responsibility will rest with the Mission's Office of Health and Population (O/HP), which will be assisted by the Controller's Office, the Executive Office and the Office of Development & Resources. A Senior Malaria Advisor with at least five years of operational experience in malaria control will be provided under a master contract with a qualified American firm or institution (see below). He will serve as technical advisor to SNEM over the LOP, and will be located in SNEM's Guayaquil headquarters. The contract malaria specialist will serve as project liaison officer with day-to-day contact with SNEM. He will work closely with the PAHO advisor(s) and with long and short-term consultants to insure that the Project is implemented in a timely manner. He will also work closely with the USAID O/HP to insure complementary implementation and close coordination with other Mission assisted health activities.

1. Disbursement Procedures

Most of the A.I.D.-provided funds, grant and loan, will be used for procurement of goods and services requiring dollar payment, to be undertaken through the procurement procedures and facilities of USAID, the Regional Contract Office or AID/W, as appropriate. A relatively minor element in the program to be financed by A.I.D. funds under the master contract will result in sucre expenditures, and these can best be handled through the procedures of the contractor. Examples of such sucre expenditures are the salaries of the bilingual secretary and the chauffeur of the long-term senior advisor; gasoline and service for his vehicle; his in-country air transportation; and normal office supplies and equipment, operational research activities, training supplies, etc. Such expenditures may be met from an advance funding authorization which may not exceed the requirements for the ensuing three months, and for the use of which the contractor must account to the USAID controller.

2. Procurement Procedures

a. Technical Assistance

This project will finance a total of 79 person-months of technical assistance consisting of a long-term advisor to the SNEM for five years or 54 person-months (expected April 1985) and 25 person-months of short-term technical assistance.

Technical assistance will be provided under

i. A master contract negotiated by the Mission in accordance with competitive AID procedures, with a capable U.S. firm or institution:

(a) A senior malaria advisor with at least five years of operational experience in malaria control. He will serve as principal A.I.D. technical advisor to SNEM over the LOP, and will be located in SNEM's Guayaquil headquarters. He will work closely with the PAHO advisor(s) and with short-term consultants to insure and monitor Project implementation. He will also serve as liaison officer with the USAID O/HP, working closely to insure complementary implementation and close coordination with other Mission-assisted health activities.

(b) The technical consultants required to provide essential specialized technical assistance, guidance for programmed activities in operational research, and in-country training of SNEM staff.

(c) Scheduled long and short-term training for SNEM's senior and mid-range operational, technical and managerial personnel.

ii. In addition, a PASA will be negotiated with the Centers for Disease Control (CDC) under which will be provided:

(a) Systematic insecticide testing over the LOP.

(b) Drug sensitivity testing at the outset of the project, to assure that drug procurement under the project is in keeping with actual needs.

(c) Epidemiology studies to define the strategy of stratification and to develop computer-based data analysis for stratification.

(d) Vector ecology studies with emphasis on integrated control of the vectors of malaria, onchocerciasis, leishmaniasis and Chagas' disease.

As mentioned previously, PAHO will also be providing a limited amount of technical assistance to the SNEM during the life of the A.I.D. project. The senior malaria specialist provided under the master contract will work closely with the local PAHO office to insure that the PAHO and A.I.D. technical services are complementary.

b. Commodities

Aside from insecticides, which constitute the largest category of commodities to be procured under the project, there are a limited number of other commodities required under the project. These include: malaria control vehicles, motorcycles, boats; ULV fogging machines and sprayers; training, administrative, health education and research equipment; anti-malaria drugs; supplies and equipment for the operational research and laboratory activities; and anti-malaria drugs.

To ensure that insecticides are procured in a timely and efficient manner throughout the project, the Mission will handle all insecticide procurement with assistance from SER/COM, AID/Washington, in accordance with A.I.D. policies and procedures for the direct competitive procurement of insecticides for malaria control programs. Through the RCO, the Mission will also procure directly the malaria control vehicles, boats, motorcycles and ULV machines. U.S. manufacturers produce the ULV machines, sprayers and vehicles which are required for this project. The RCO will issue an IFB for the vehicles and machines and select one or more suppliers on the basis of competitive procurement procedures to provide these items as units or separately.

SNEM, with prior A.I.D. review and approval, will procure from the advance fund (see Subsection 1 (b), Disbursements, above) all the local equipment and supplies for the A.I.D.-financed operational research activities and for training under the master contract. SNEM may also procure, on a reimbursable basis, any locally available equipment and supplies required for PASA-supported operational research activities.

c. Operational Research

There are a number of operational research activities proposed for this project. Those mutually agreed research activities which can be directly carried out by SNEM will be supported by the project. Where appropriate, local contracts with host country institutions will be entered into by the master contractor and/or by the U.S. Agency which will act under the PASA, in consultation with SNEM, to carry out specific operational research activities. This will insure that A.I.D. procedures are followed in announcing, awarding and evaluating the projects. In addition, every approved operational research project should have PAHO approval for technical soundness prior to contract signature.

3. Project Monitoring

USAID monitoring responsibilities will be shared by the Health and Population (O/HP) office (with respect to the performance of the Ministry of Health and SNEM) and the USAID Development Resources Office. The O/HP is currently staffed by three U.S. health professionals (two under contract) and is capable of the required over-all project monitoring responsibilities. The responsible USAID Project Manager will be the Chief of the Office of Health and Population.

In addition, the senior malaria specialist will be the responsible project liaison officer with day-to-day contact with SNEM. He will work closely with the PAHO technical team, and with the PASA-supplied specialists who will direct and support elements of the operational research program. He will supervise the long and short term consultants financed under the master contract to ensure that the provisions of the Project Agreement and PILs are met.

The Mission's Evaluation Officer will be kept informed of the over-all monitoring activities and will take a leadership role in the scheduling and implementation of the project's evaluation.

Once project disbursements begin, the SNEM will prepare quarterly reports on progress and problems of the project. At the field level, the SNEM will call periodic meetings of the national headquarters and zone chiefs to review project progress. USAID representatives, including the project malaria specialist, will attend these meetings along with the PAHO advisors.

C. Implementation Schedule

Project activities are programmed to take place over the period FY1985-1989. It is expected that the project agreement will be signed in early CY1985. The Project Assistance Completion Date is January 30, 1990. The proposed implementation schedule is presented in Table VI-1.

Immediately upon signing the Project Agreement, A.I.D. will initiate procurement of (1) 96 metric tons of fenitrothion, 40% wdp. for the second cycle of spraying in CY1985; (2) 400 Hudson sprayers, ULV and safety equipment; (3) 46 vehicles including trucks, CJ-7s and pick-ups; 60 motorcycles; 69 outboard motors; and 30 16-foot boats; (4) anti-malaria drugs; and (5) limited laboratory and office equipment. The insecticides must arrive in Guayaquil, Ecuador no later than June 1, 1985 to allow for off-loading and inland transportation of the insecticides to the zones. All vehicles should arrive as soon as possible after June 1, but no later than August 1, 1985.

Prior to signature of the Project Agreement, PIO/C's will be prepared and will be signed at the time of the Project Agreement. Preparation of these PIO/C's will require short-term TDY assistance from SER/COM in mid January, 1985.

The scope of the work for the master contract is essentially set forth in this document and should be completed immediately. This contract will be awarded to a qualified 8-A (minority) firm.

The long-term senior advisor under the master contract is expected to arrive in country by May 1, 1985. He will be allowed 3 days in AID/Washington to confer with the ST/H Malariologist on the project prior to arrival in Ecuador.

The PASA-assisted in-country training for chloroquine-resistance testing methodologies should begin on a priority basis. Therefore, in the event PASA negotiations cannot be completed by May, 1985, separate short-term TA firm CDC will be required to carry out this study.

Over the Life of Project (LOP) a total of 25 person months (PM) of short-term technical assistance is provided through grant funding: 6.5 PM FY85; 3 PM in FY86; 2.5 PM in FY87; 8 PM in FY88; and 5 PM in FY89. (See Part V, Financial Plan.) This technical assistance covers a wide range of skills including operations, training, research, entomology and epidemiology.

As the Project is heavily weighted towards training and operational research to increase and improve SNEM's technical and operational skills, comprehensive programs in both areas have been scheduled over LOP. The training component includes formal master's level training in Mexico or Puerto Rico, 20 6-week courses in Vector Control, 35 observation courses in the region and the US; training in vehicle maintenance and support for in-country training of 5,000 voluntary collaborators and 124 SNEM mid-level staff. The training element will provide 40.5 person years (PY) of training which is distributed as follows: 1.1 PY in 1985; 4.1 PY in 1986; 8.1 PY in 1987; 12.7 PY in 1988; and 14.5 PY in 1989. (See Part V, Financial Plan). The operational research includes social, operational and technical activities in malaria as well as other vector-borne diseases. It is envisaged that a share of the operational research will be contracted to local institutions for periods of two to three years. All contracts will be based on an approved protocol. The first contract announcements for FY1985 will be issued by June 1, 1985. The funding for operational research is estimated at $60,000 (FY85); $50,000 (FY86); $120,000 (FY87); $145,000 (FY88); and $160,000 (FY89) for a LOP total of $535,000. (See Part V, Financial Plan.)

Evaluations for the Project are to be performed annually with the first evaluation to be carried out in July or August of 1986. This evaluation is expected to span 10-14 days with the primary purposes of insuring that Project support and materials from A.I.D., GOE and PAHO are flowing properly and that training and operational research are being carried out; and reviewing the status of the malaria epidemic along the North coast. The evaluations in 1987, 1988 and 1989 will be joint GOE/PAHO/AID activated with clear terms of reference. Representatives of AID/W, ST/H will participate in all evaluations.

A Plan of Operations will be prepared by the GOE/SNEM for the period U.S. FY1985-FY1989 which will be approved by the GOE by January 1, 1985. Each year a specific Plan of Action will be submitted by October 1 which outlines the following year's planned activity in detail.

FY = Oct 1-Sept. 30

Chart No. VI-1

Oct. 1984

PROPOSED IMPLEMENTATION SCHEDULE

ACTIVITY	FY1985	FY1986	FY1987	FY1988	FY1989	FY1990 PACD Sept.30
1. PROJECT AGREEMENT SIGNED						
2. TECHNICAL ASSISTANCE						
a. Long term			HL			
b. Short term						
1. Parasitological	RESTS				RESTS	
2. Operational		ULV	ULV	OPER VBD	OPER VBD	
3. Epidemiological	SVS		SVS			
4. Training	CON		CON	CON	CON	
5. Social	KAP	KAP	KAP	KAP		
6. Entomology	RESTS					
3. TRAINING						
a. Long term		MPH-1	MPH-2	MPH-1		
b. Short term course	RES	USC	FIL HPT USC ENTO USC		USC	
c. Observation	SEG		US/REGION US/REGION	US/REGION	P.RICO CONF PR-BRAZIL	
d. Voluntary Collaboration			VOL. COLLAB.			
e. In-country		S.C.-EPI	HA			
4. OPERATIONAL RESEARCH						
a. Health Education						
b. Parasitology				H ED.		
c. Entomology	RESTS					
d. Social		VECTOR		EPI J.M.	EPI	
e. Other Vector-borne diseases	KAP VBD	KAP	KAP VBD ONCHO LYMPH CHAGAS			
f. Epidemiology		EPI	EPI TB			
g. Public Health						
5. COMMODITY PROCUREMENT	ORDER ETA	ORDER ETA	ORDER ETA	ORDER ET.	ORDER ETA	
6. EVALUATION		JOINT GOE/MOH/ AID	PES(AID) / JOINT	JOINT	PES(AID)	

TERMS AND ABBREVIATIONS CHART NO. VI-1

HL	Home leader
RESIS	Resistance
ULV	Ultra low volume
SYS	Systems development
CON	Contract
KAP	Knowledge, attitude, practices (social)
MPH	Master's degree
FIN	Finance
EPT	Epidemiology
USC	University of South Carolina
ENTO	Entomology
REG	Region
VOL COLLAB	Voluntary Collaborators
P.RICO	Puerto Rico
CONF	Conference
VBD	Vector borne disease
PH	Public health
ETA	Estimated time of arrival
ORDER	Order
PES	Project Evaluation Summary
JOINT	Joint Review
ONCHO	Onchocerciasis
LEISH	Leishmaniasis
CHAGAS	Chagas disease

D. Evaluation Plan

In addition to the normal monitoring of the project by the long-term Malaria Specialist and the USAID Project Officer, a series of Project Evaluation Summary (PES) and joint GOE/PAHO/AID Reviews will be held over the life of the project. The evaluations will concentrate on three major areas: epidemiology; cost and effectiveness of the anti-malaria measures; and management of the program.

The first evaluation is scheduled for July-August of 1986 and will focus on the start-up inputs to the project in technical assistance, operational research and training, and their relationship to the three major subject areas listed above. This evaluation will provide project course corrections, identify problem areas which are impeding the progress of the program and provide recommendations for improvement.

The first PES will be carried out in 1987 and serve as the mid-term evaluation. This PES will be carried out by A.I.D., SNEM and PAHO, but basically it will be an A.I.D. document. Consultant services for this activity are provided in the Project Grant Funding. It is planned that the AID/W, ST/H Malariologist will participate directly in this activity.

The 1988 and 1989 evaluations are joint A.I.D./SNEM/PAHO reviews of the program. These evaluations are scheduled for the February-March period and will take approximately three weeks. Terms of reference will be provided for these reviews which are developed by SNEM with the assistance of PAHO and A.I.D. Notification to the concerned agencies which will take part in these reviews will take place at least four months ahead of time together with identification of the expected consultant in-puts from each agency.

The final PES will be performed in CY1990 prior to June 1, 1990. The evaluation is basically an A.I.D. documentation activity, but assistance from PAHO is expected. The services of the A.I.D./W, ST/H Malariologist are expected to be utilized in the preparation of this document.

In addition to measuring progress achieved against the specific yearly output indicators for the project, the evaluations will assess and provide recommendations concerning specific aspects of SNEM which may include but not be limited to the following:

1. Staffing and administrative procedures at the national, zone and sector levels;

2. Laboratory services, including a review of the number of laboratories established, number of blood films collected and examined, number of qualified microscopists, number of films examined per microscopist, time lag between blood film collection and receipt and examination by the laboratory, and cross-checking operations;

3. Volunteer collaborator and health institution surveillance operations, including a review of the number of blood films collected, fever cases treated, drugs administered, and positive cases given radical treatment;

4. Condition and maintenance of vehicles, spray equipment, and other program equipment;

5. Operational research progress and achievements;

6. treatment of positive cases by month;

7. tion of insecticides and anti-malarial drugs, including estimate ual requirements, beginning stocks, new receipts, actual use, and ending stocks;

8. Spray operations, including percent of coverage and efficiency, entomological studies and results, and resistance problems;

9. Larvicide and other vector source management methods in the urban areas;

10. Training of SNEM program personnel, including officers at the national headquarters, zone and sector levels, malaria control personnel, and spray personnel;

11. Health education and community participation programs;

12. Insecticide handling techniques and safety measures.

13. The degree to which SNEM has succeeded in securing and putting to full use the collaboration and/or cooperation of other elements in the MOH.

The evaluations will be conducted on the basis of field trips, interviews with personnel at the national, zone and sector levels of the SNEM, and review of secondary source information in the form of administrative and technical reports available from SNEM provincial and urban authorities, health facilities, and at PAHO and USAID/Ecuador offices in Quito.

Approximately US $200,000 in grant funds are available from the project for the described evaluations for the 1986-1990 period.

VII. CONDITIONS, COVENANTS, AND NEGOTIATING STATUS

A. Conditions and Covenants

In addition to the standard conditions and covenants and in order to ensure timely implementation of the Project, the Mission recommends that the Project Authorization include the following covenants:

1. Condition Precedent to Disbursement

Prior to any disbursement, or to the issuance by A.I.D. documentation pursuant to which disbursment may be made, the GOE will, except as A.I.D. may otherwise agree in writing, cause the National Malaria Eridication and Vector Control Service ("SNEM") to recruit, identify and employ personnel for the position of Chief of Operations and Assistant Chief of Operations in SNEM.

2. Covenants

a. The Borrower/Grantee shall cause SNEM to prepare, in form and substance satisfactory to A.I.D., by December 1 of each project year, beginning in 1985, an annual plan detailing safety measures and procedures to be employed in the application of all insecticides used in the program.

b. The Borrower/Grantee shall cause SNEM to prepare, in form and substance satisfactory to A.I.D. by November 1 of each project year, beginning in 1986, an annual program evaluation plan outlining criteria and benchmarks for each program component to be assessed during the annual program review.

c. The Borrower/Grantee shall make every reasonable effort to ensure that each participant trained overseas under this Project works in malaria control activities in Ecuador for not less than three times the length of time of his or her training program.

d. The Borrower/Grantee shall take appropriate safety measures for the use of insecticides financed under this program, including the provision of safety equipment to insecticide handlers, training of handlers and supervisory personnel in the risks associated with the insecticides, and instruction in proper procedures for safe handling. The Grantee shall also maintain rigid control over the quality of insecticides procured for the program to ensure that they meet PAHO and A.I.D. technical requirements.

e. The Borrower/Grantee shall provide, or cause SNEM to provide, to A.I.D., in form and substance satisfactory to A.I.D., by December 1 of each project year, beginning in 1985, a certified copy of the approved SNEM budget for the following calendar year.

B. Negotiating Status

This Project has been jointly developed with representatives of the Government of Ecuador. Enthusiasm for the Project is high among technical personnel, and the Project is a high priority of the GOE at the highest levels. The above Covenants have been discussed with and agreed to by the Government of Ecuador. During Project Agreement negotiations, USAID/Ecuador will incorporate into the Agreement appropriate language to cover these terms and conditions.

VIII. WAIVERS

A. Sole Source Waiver for Procurement of Spray Pumps

As described in this Project Paper (PP), a large number of spray pumps will be procured for the project with loan funds at a cost of $231,000. These pumps are required for the field operations to apply residual insecticides.

A sole source waiver is required to purchase these spray pumps from the H.D. Hudson Manufacturing Company, 500 North Michigan Ave, Chicago, Illinois 60611. The reason for this sole source waiver is that all SNEM's field spray pumps are from this source and to purchase pumps from another source would complicate the program's standardization schedule, increase costs and require a large amount of retraining.

H.D. Hudson pumps are in standard use worldwide in malaria control programs. For over thirty years, this Company has furnished thousands of pumps and spare parts for those pumps. The quality of the Hudson pump is unmatched for the difficult field operations in malaria control programs. In addition, the H.D. Hudson Company provides these pumps at a special discount rate to A.I.D.

Therefore, a sole source waiver is requested for up to $231,000 for the purchase of these spray pumps in accordance with Chapter 12 of Handbook I., Supplement B.

B. Source and Origin Waiver for Procurement of Motorbikes.

As described in Part V of this Project Paper, sixty (60) small motorbikes (125cc) will be procured for the project with loan funds, at an estimated total cost of $54,000. These vehicles are an essential component of SNEM's supervisory system for reaching the many difficult-to-access rural areas where the malaria program must operate. The 125cc motorbike required is not manufactured in the U.S. In accordance with AID HB 1B, procurement of commodities from Code 899 sources and of Code 899 origins under AID financed projects requires a waiver. Under HB 1B Chapter 5B4A(2), a waiver may be granted for project goods if "the commodity is not available from countries included in the authorized geographic code".

USAID has concluded that motorbikes requested under this waiver are required to carry out project activities. They are the most reliable, cost effective, and viable option considering the project sites, conditions and needs. The U.S. does not presently manufacture such motorbikes; therefore the commodity is not available from the U.S. and the criteria to permit purchase of vehicles of Code 899 source and origin are satisfied.

C. Sole Source, Source/Origin and Transportation Waiver for Procurement of Certain Antimalarial Drugs from UNICEF.

Ecuador is in the midst of a serious epidemic of malaria, as described in the Project Paper. Two of the antimalarial drugs required for treatment are primaquine and amodiaquine. Neither the child dosage of primaqune (7mg.base), nor amodiaquine are manufactured in the U.S. These drugs are available from UNICEF, and have been procured in the past from UNICEF by the GOE with satisfactory results. HB IB, Chapter 4c3d stipulates that, in addition to the general requirements for a source/origin waiver, the procurement of non-U.S. source pharmaceuticals may be approved only when (1) the pharmaceutical products is essential to the project, (2) the delivered price from the U.S. is at least 50% more than from another surce, and (3) information is available to attest to the safety, efficacy and quality of the product. None of the proposed pharmaceuticals involve known violations of U.S. patents; the Mission is also satisfied that UNICEF's procedures assure that suppliers meet acceptable manufacturing and quality control standards.

Because UNICEF procures pharmaceuticals from 899 countries and ships from Denmark, an 899 country, a source/origin and transportation waiver to Code 899 is required, since the authorized geographic code for the loan funds of this prject is currently 921. A waiver of the authorized geographic code is justified in accordance with HB IB, Chapter 5B4a(7), for "such other circumstances as are determined to be critical to the success of project objectives". These criteria are met as discussed above. USAID therefore recommends that such a waiver be included in the Project Authorization.

D. A.I.D. Financed Participant Travel

Chapter 15 of the A.I.D. Handbook 10 requires that the international travel of A.I.D. financed participants be paid by the host country, the participant, or other sponsor unless waived by the USAID Director in the case of USAID funded programs.

As described in Part V, Financial Plan, grant funded training is envisaged under the project. USAID/Ecuador considers that A.I.D. funding of international travel costs is justified based on the overall substantial Host Country contributions planned for the project, and current foreign exchange difficulties of the GOE. Accordingly, the USAID Director, in approving this Project Paper waives the requirement of Host Country funding of participant travel under the Project. This Project Paper serves as the required notification.

LOGICAL FRAMEWORK

Project Title and Number: Malaria Control, 518-0049

Life of Project: FY1985-FY1989
PACD Date : September 1990
Date Prepared : November 1984

Narrative Summary	Objectively Verifiable	Means of Verification	Important Assumptions
Program or Sector Goal: The broader objective to which this project contributes: (A-1) To reduce morbidity and mortality from endemic diseases through the establishment of a responsive, efficient and effective national health system	Measure of goal achievement: - Measurable reductions in morbidity and mortality from endemic diseases which are directly attributable to specific health interventions. - Increased utilization of the national health services delivery system by the general public.	Evaluation of statistics from the Institute of Census and Statistics, Ministry of Health and other health organizations	- Sustained economic growth to support national health services. - Continued GOE commitment to supporting its health services. - Continued support by PAHO. - Absence of unusual natural disaster.

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Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Project Purpose (B-1) (Upper level purpose) Control the incidence malaria.	a. To control the present endemic of malaria by 1987. b. To reduce malaria incidence to an annual parasite incidence of 1.6 case/1000 or less by 1989. c. To reduce P.falciparum malaria to a point where it represents no more than 10% of the total yearly caseload of malaria by 1989.	SNEM surveillance records, case records of public and private hospitals, health posts and centers, validated by: annual multi-donor assessments, AID mid-term and EOP evaluations, and continuous monitoring by long and short term advisors and consultants.	1. Continuing GOE priority given to anti-malarial activities. 2. Adequate GOE budgetary support.
(lower level) To improve the effectiveness of insecticide spray operations; institutionalize effective surveillance; introduce alternative malaria control activities which minimize the need for house spraying with insecticides; initiate vector control research for the diseases of leishmaniasis, Chagas Disease and onchocerciasis; continue Ae.agypti control program.	1. SNEM fully and properly staffed and effectively operating to maintain continuing malaria surveillance and control. 2. Increased local involvement and cooperation with other GOE institutions. 3. 6,000 Volunteer Collaborators trained and in place. 4. Inter-Ministerial Malaria Council functioning. 5. Four vector control and/or other auxiliary or substitute methods for house spraying tested, and, where applicable, implemented. 6. Active program in Ae.aegypti surveillance.	Same as above, plus SNEM annual reports.	Research within Ecuador and world-wide will define appropriate alternative methodologies to provide viable operational methods for control of malaria. Major malaria epidemic does not occur.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Project Outputs (C-1) 1. House spraying with residual insecticides targeted and stratified to provide coverage where and when needed so that total insecticide spraying is reduced.	Reduction in the house spraying targets in the 4 x yearly and 2 x yearly spray areas and increase in focal spray areas as follows: Area / 1985 / EOP 4 x / 48,379 / 16,000 2 x / 260,491 / 130,000 Focal / - / 25,000	1. SNEM annual report. 2. Annual multi-donor assessment of operations. 3. Mid-term and EOP AID evaluations. 4. On-going monitoring by long and short-term advisors.	1. Continued availability of residual insecticides effective against the vector. 2. Implementation capacities exist for alternative control methodologies. 3. Household acceptance of insecticide spraying will improve through health education and community involvement.
2. Functioning, effective and continuous epidemiological, parasitological, and entomological surveillance system.	1. All blood slides are examined and reported by SNEM within 7 days of collection. 2. All slides from malaria volunteers are examined by SNEM and reported to the VC within 10 days. 3. Resistance tests on A.albimanus and A.punctimacula adults completed each year in 4 or more SNEM zones. 4. Minimum of 35 resistance tests completed each year against other Anopheles species and other candidate insecticides. 5. Minimum of 3 intensive field investigations for parasite resistance to drugs each year. 6. Minimum of 6 research studies in progress to improve existing and/or evaluate new control methods of vector control. (continued)	Same as above.	1. Available trained staff. 2. Malaria education improved in public and private sectors. 3. MOH actively participates.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
	(continued) 7. Existing zonal laboratory capacity increased from 7 to 10 by EOP. 8. Micro computer and data storage and retrieval systems in place with 2 trained operators by end of 1987.		
3. Effective vector control program in place in pilot areas to replace house spraying.	1. Operational implementation of at least 2 projects to test feasibility of replacement of house-spraying with alternative control methods in representative areas by EOP. 2. Five research projects to test various methods of vector control under Ecuadorian ecological conditions completed by EOP. 3. Continuing vector census systems installed in each region.	Same as above.	Suitable methodology available which can be adapted to Ecuadorean conditions.
4. Effective presumptive, prophylactic, and radical drug treatment systems in place and responsive to surveillance data	1. Increase in Annual Blood Examination Rate (ABER) to 10% by EOP. 2. Projects initiated in chloroquine resistance problems during EOP. 3. Radical treatment initiated within maximum of 14 days after blood sampling.	Same as above.	Anti-malaria drugs are available which continue to be effective against existing parasites.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
5.Malaria education and information program in place and serving all levels of SNEM, MOH promoters, educators and potential beneficiaries.	1.Three annual workshops completed and publicized. 2.Appropriate information materials designed (by end of second year), printed and distributed to all malarious areas by end of third year. 3.Appropriate educational presentations initiated in 80 malarious areas. 4.Sociological KAP research instituted in SNEM program; completed by end of project. 5.Twelve or more annual media placements (in Spanish and/or local language) for informing and educating the public	Same as above.	Technical and creative skill locally exist for design and production of IEC materials.
6.Revised, intensified and continuing training programs for staffs of SNEM and other relevant institutions.	1.Three annual training workshops covering all phases of malaria control completed by EOP. 2.Component on social marketing (i.e. social, cultural and behavioral skills necessary to induce changes in behavior) included in annual workshops and all SNEM training courses. 3.U.S. short-term training of operational and entomological personnel in vector control as applied to malaria control: 5 per year for 20 by EOP. 4.Out of country, observational training of SNEM personnel: 30 by EOP. 5.Up to two MPH courses per year for 5 by EOP.	Same as above.	1.Necessary Cabinet-level support available. 2.Appropriate candidates can be identified and cleared. 3.Suitable courses on malaria control will be available in the Latin America Region.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
	(continued) 6. Initiation of special courses in vector control, for headquarters, zone and sector personnel: 6 courses by EOP. 7. Training for 5000 volunteer collaborators over life of project.		
7. Effective program planning, management, and evaluation.	1. Yearly Plan of Action prepared and approved. 2. Existing Plan of Operations is revised in 1984 and Plan of Operations for 1985-1989 prepared by end of 1984. 3. Evaluations completed in 1986, 1987 and 1988. 4. AID annual and final EOP evaluations completed. 5. Indicators for outputs 1 through 6 achieved in timely, effective manner.	Same as above.	GOE priority for malaria control continues.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Project Inputs (D-1)			
Government of Ecuador (GOE)	GOE	GOE	GOE
1.Provision of salaries and other local currency costs for operations.	1.GOE budgets GOE $29.9 million (sucre equivalent) and funds delivered to SNEM as required.	1.Annual GOE/MOH budget, and budget/fund availability.	Adequate political and executive support for the malaria control program.
2.Foreign exchange sufficient to import insecticide (DDT) to meet operational plans.	2.Approved Plan of Operations exists over LOP.	2.Staffing lists.	Adequate funds for SNEM operations over LOP.
3.Full complement of administration and technical personnel and field spraymant.through in-kind	3.SNEM vacancies reduced to below 5% by EOP and key vacancies (zonal and central managerial staff) reduced to near zero by 1986).	3.Field visitations.	Adequate personnel staffing for SNEM.
4.MOH primary health care facilities available for initial blood samples and presumptive treatment as well as education activities.	4.MOH health facilities taking slides and distributing pills.	4.Provision of support for SNEM in national planning documents.	Adequate facilities for SNEM through in-kind support of GOE health institutions.
USAID	USAID (1000's) GRANT / LOAN	USAID	USAID
1.Training	1. 900	1.Trained SNEM staff	Availability of adequate funds.
2.Operational research	2. 535	2.OR project documentation	
3.Planning, management and evaluation	3. 200	3.Effective management information system and improved operations. Annual evaluation.	
4.Technical assistance	4. 1,365	4.Consultations occur as scheduled . Monitor on-board.	
5.Laboratory supplies	5. 160	5.Lab capacities exist.	
6.Transport/spraying eqt.	6. 1,850	6.NA	
7.Insecticides	7. 2,823	7.PIO/C's - SNEM reports	
8.Other commodities	8. 820	8.Receiving reports.	
9.Contingencies/inflation	9. 847	9.Same as 8.	
TOTAL	$ 3,000 / $ 6,500		
Pan American Health Organization (PAHO)	PAHO	PAHO	PAHO
1.Seven person years of advisors/consultants and limited commodity support and training support. (1-full time plus 1/2 time Regional Advisor)	1.Advisors/consultants and Commodities/training $720,000	Presence of PAHO advisors and PAHO documentation, both in Ecuador and PAHO/Washington.	PAHO budget projections are realized.

PID APPROVAL CABLE

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TAGS:
SUBJECT: GUIDANCE CABLE: ECUADOR MALARIA CONTROL PID (518-0149)

1. THE DAEC REVIEWED AND APPROVED THE SUBJECT PID ON AUGUST 31, 1984. FOLLOWING ARE THE MAJOR ISSUES DISCUSSED AND GUIDANCE FOR PP DEVELOPMENT.

2. THE PRIMARY PURPOSE OF THE PROJECT IS MALARIA CONTROL. HOWEVER, THE PID ALSO MENTIONS SOME ACTIVITIES CONCERNED WITH OTHER VECTOR BORNE DISEASES, SUCH AS YELLOW FEVER, LEISHMANIASIS, ONCHOCERCIASIS, AND CHAGAS. THE PP SHOULD CLARIFY THAT THESE ACTIVITIES ARE "OPERATIONS RESEARCH TO CONTROL THESE DISEASES" AND SOME TRAINING ACTIVITIES, AS WAS EXPLAINED TO THE DAEC. THE NATURE OF THESE OPERATIONS RESEARCH AND TRAINING ACTIVITIES SHOULD BE ELABORATED. SUPPORTIVE DATA AND COMMENTARY SHOULD BE INCLUDED IN THE PP TO EXPLAIN A) THE INCIDENCE AND LOCATION OF THESE OTHER VECTOR BORNE DISEASES, B) THE SERIOUSNESS OF THEIR EFFECTS, C) THEIR RELATIONSHIP TO MALARIA CONTROL, AND D) WHY THESE VECTOR BORNE DISEASES WERE INCLUDED OVER OTHERS.

3. THE PROBLEM OF GOE'S ABILITY TO MEET ITS FINANCIAL COMMITTMENT DURING THE LIFE OF THE PROJECT AND ITS COMMITTMENT TO CONTINUE FUNDING MALARIA CONTROL AFTER THE PROJECT WERE OF SERIOUS CONCERN TO THE DAEC. THE MISSION SHOULD CONSIDER THE FOLLOWING POINTS AND QUESTIONS IN DESIGNING THE PP TO HELP INSURE GOE FINANCIAL INPUTS DURING THE PROJECT.

-- A) THE GOE CONTRIBUTION IN BOTH LOCAL AND FOREIGN CURRENCY SHOULD BE EXAMINED CAREFULLY REGARDING THE EXTENT TO WHICH THERE ARE PROBLEMS IN FOREIGN EXCHANGE AVAILABILITY DUE TO DEVALUATION OF THE SUCRE OR GOVERNMENT AUSTERITY. IS THE GOE CONTRIBUTION PRIMARILY IN LOCAL CURRENCY FOR SALARIES? DOES THE PROPORTION OF FOREIGN CURRENCY INCREASE OVER THE LOP AS THE GOE'S TOTAL COMMITMENT INCREASES?

--- B) THE MISSION SHOULD DEVELOP APPROPRIATE SOLUTIONS,

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SUCH AS EXAMINING THE POSSIBILITY OF DESIGNING THE CPS OR OTHER MECHANISMS TO GUARANTEE THE AVAILABILITY OF FOREIGN CURRENCY FOR THE LOP. FOR EXAMPLE, THE GOE MIGHT BE REQUIRED TO SET ASIDE FOREIGN CURRENCIES IN A SEPERATE ACCOUNT AND/OR INCLUDE MALARIA CONTROL FUNDS AS A SEPERATE LINE ITEM IN THE NATIONAL BUDGET.

THE SECOND ASPECT OF THIS PROBLEM INVOLVES THE RECURRENT COSTS OF MALARIA CONTROL AFTER THE PROJECT ENDS. MALARIA CONTROL MUST BE RECOGNIZED AND TREATED AS A CONSTANT AND ON-GOING PROBLEM. WITHOUT GOE COMMITTMENT AND FINANCIAL SUPPORT AFTER THE LOP, THE INCIDENCE OF MALARIA AND ITS RELATED PROBLEMS WILL ONLY ONCE AGAIN INCREASE. WHAT CAN THE MISSION DO TO HELP INSURE CONTINUED GOE COMMITMENT?

4. DETERMINING APPROPRIATE CONTROL INTERVENTIONS WILL BE DETERMINED AT LEAST PARTLY BY WHAT DRUG AND CHEMICAL RESISTANCES EXIST IN DIFFERENT PARTS OF THE COUNTRY. THE MISSION SHOULD INCLUDE IN THE PP A THOROUGH DESCRIPTION OF WHAT CONTROL METHODS WILL BE USED AND WHERE. THE PP SHOULD ALSO EXPLAIN THE REASONS FOR THOSE DECISIONS AND INCLUDE SUPPORTING DATA.

5. THE MISSION SHOULD DEVELOP A PLAN TO EVALUATE THE COST EFFECTIVENESS OF VARIOUS MALARIA CONTROL METHODS. TO DATE, APPROXIMATELY 6 OR 7 ECONOMIC ANALYSES OF MALARIA PROJECTS HAVE BEEN COMPLETED FOR AID SUPPORTED ACTIVITIES IN OTHER COUNTRIES. THESE SHOULD BE REVIEWED FOR POSSIBLE INFORMATION ON COST-EFFECTIVE CONTROL MEASURES AND DESIGN METHODS THAT WON'T SACRIFICE THE TECHNICAL EFFICACY OF THE PROJECT.

6. CONCERN FOR POSSIBLE DAMAGE TO THE SHRIMP FISHING INDUSTRY LOCATED IN COASTAL AREAS AND TARGETED FOR MALARIA CONTROL INSECTICIDE SPRAYING WAS EXPRESSED AT THE DAEC. CONCERN FOR THIS ISSUE SHOULD BE CONSIDERED AT THE DESIGN STAGE AND DISCUSSED IN THE PP, PERHAPS WITH A REVIEW OF THE TOTAL CYCLE AND CHAIN OF PESTICIDES IN ECUADOR.

7. THE IMPLEMENTATION PLAN FOR THE PP SHOULD STATE IN DETAIL HOW MALARIA CONTROL, TRAINING, INSECTICIDE PROCUREMENT, AND SPRAYING ACTIVITIES WILL BE EFFECTED IN A TIMELY MANNER. SHULTZ

Best Available Document

MINISTERIO DE FINANZAS
SUBSECRETARIA DE CREDITO PUBLICO

Oficio No. DCRP-84- 1717

Quito, a 15 NOV. 1984

Señor Arq.
Orlando Llenza
DIRECTOR DE LA MISION AID
Ciudad.-

Estimado señor Director:

Tomando en cuenta el recrudecimiento del problema malárico en el país y considerando que en la actualidad más de cinco millones de habitantes corren el riesgo de contraer esa enfermedad, el Gobierno Nacional considera al control de la malaria como uno de los objetivos básicos dentro del sector de la salud.

Para controlar este mal endémico como factor determinante para la ejecución de programas de desarrollo de los sectores agrícola, pecuario, minero e industrial en las áreas tropicales y subtropicales del país, es necesario financiar las siguientes actividades:

a).- Asesoría técnica en malaria a largo plazo, además de varias asesorías cortas.

b).- Desarrollo de investigaciones aplicadas para el diseño de métodos de vigilancia y control.

c).- Capacitación de recursos humanos en actividades relacionadas con la vigilancia y control de malaria.

d).- Compra de equipo, medicamentos e insecticidas para actividades de control a nivel de campo.

Con estos antecedentes, el Ministerio de Finanzas y Crédito Público, a nombre del Gobierno de la República del Ecuador, se permite solicitar a la Agencia Internacional para el Desarrollo se considere la concesión de un préstamo por un monto de US$6'500.000, el mismo que debería contener condiciones especiales en cuanto a la forma de pago, tasa de interés, período de gracia y que, además contemplaría un fondo no reembolsable de US$3'000.000.

Por su parte el Gobierno del Ecuador, de acuerdo al trámite usual en estos casos asignaría una contrapartida por un valor aproximado de US$10'000.000 para financiar los costos de salarios, suministros, insecticidas y equipos de laboratorio y oficina.

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MINISTERIO DE FINANZAS
SUBSECRETARIA DE CREDITO PUBLICO

Oficio No. DCRP-84- 1717

Quito, a 15 NOV. 1984

Dados la trascendencia y alcance del proyecto, nos comprometemos a seguir apoyando con suficientes recursos presupuestarios el desarrollo y buena marcha del proyecto, así como para asegurar la provisión de las divisas necesarias para la compra a largo plazo de los insumos indispensables, como es el caso de los insecticidas.

Por la favorable atención que el señor Director se digne dispensar a este proyecto prioritario del Gobierno del Ecuador, me anticipo en agradecerle.

Atentamente,
DIOS, PATRIA Y LIBERTAD

Econ. Francisco Swett,
MINISTRO DE FINANZAS Y CREDITO PUBLICO

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DRAFT PROJECT AUTHORIZATION

Name of Country:	Ecuador
Name of Project:	Malaria Control Project
Number of Project:	518-0049
Number of Loan:	518-

1. Pursuant to Section 104 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Malaria Control Project for Ecuador involving planned obligations of not to exceed Six Million Five Hundred Thousand United States Dollars ($6,500,000) in loan funds ("Loan") and Three Million United States Dollars ($3,000,000) in grant funds ("Grant") over a five (5) year period from the date of authorization, subject to the availability of funds in accordance with the A.I.D. OYB/allotment process, to help in financing foreign exchange and local currency costs for the project. The planned life of the project is five (5) years from the date of initial obligation.

2. The project ("Project") consists of assistance to Ecuador to reduce morbidity and mortality caused by endemic diseases. The major purpose of the project is to control malaria nation-wide to a level where it is no longer a public health problem and to develop institutional capacities to maintain that level of control.

3. The Project Agreement, which may be negotiated and executed by the officer to whom such authority is delegated in accordance with A.I.D. regulations and Delegations of Authority, shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate.

a. Interest Rate and Terms of Repayment

The Government of Ecuador (GOE) shall repay the Loan to A.I.D. in U.S. Dollars within twenty-five (25) years from the date of first disbursement of the Loan, including a grace period of not to exceed ten (10) years. The Government of Ecuador shall pay to A.I.D. in U.S. Dollars interest from the date of first disbursement of the Loan at the rate of (i) two percent (2%) per annum during the first ten (10) years, and (ii) three percent (3%) per annum thereafter, on the outstanding disbursed balance of the Loan and on any due and unpaid interest accrued thereon.

b. Source and Origin of Commodities, Nationality of Services (Loan)

Commodities financed by A.I.D. under the Loan shall have their source and origin in Ecuador or in countries included in A.I.D. Geographic Code 941, except as A.I.D. may otherwise agree in writing. Except for ocean shipping, the suppliers of commodities or services financed under the Loan shall have Ecuador or countries included in A.I.D. Geographic Code 941 as their place of nationality, except as A.I.D. may otherwise agree in writing. Ocean shipping financed by A.I.D. under the Loan shall be financed only on flag vessels of Ecuador or countries included in A.I.D. Geographic Code 941, except as A.I.D. may otherwise agree in writing.

c. Source and Origin of Commodities, Nationality of Services (Grant)

Commodities financed by A.I.D. under the Grant shall have their source and origin in Ecuador or in the United States, except as A.I.D. may otherwise agree in writing. Except for ocean shipping, the suppliers of commodities or services financed under the Grant shall have Ecuador or the United States as their place of nationality, except as A.I.D. may otherwise agree in writing. Ocean shipping financed by A.I.D. under the Grant shall be financed only on flag vessels of the United States, except as A.I.D. may otherwise agree in writing.

d. Special Covenants

The GOE shall covenant that, unless otherwise agrees in writing, it will:

(1) cause SNEM to prepare, in form and substance satisfactory to A.I.D., by December 1 of each project year, beginning in 1985, an annual plan detailing safety measures and procedures to be employed in the application of all insecticides used in the program.

(2) cause SNEM to prepare, in form and substance satisfactory to A.I.D., by November 1 of each project year, beginning in 1986, an annual program evaluation plan outlining criteria and benchmarks for each project component to be assessed during the annual program review.

(3) make every reasonable effort to ensure that each [illegible] trained overseas under this Project works in malaria control activities in Ecuador for not less than three times the length of time [illegible] his or her training program.

(4) take appropriate safety measures for the use of insecticides financed under this program, including the provision of safety equipment to insecticide handlers, training of handlers and supervisory personnel in the risks associated with insecticides, and instruction in proper procedures for safe handling.

e. Waiver

(1) Hand compression spray pumps ("Hudson sprayers") having an approximate value of $231,000 may be purchased from a single source on a negotiated price basis.

COUNTRY CHECKLIST

A. GENERAL CRITERIA FOR COUNTRY ELIGIBILITY

1. FAA Sec. 481; FY 1984 Continuing Resolution. Has it been determined or certified to the Congress by the President that the Government of the recipient country has failed to take adequate measures or steps to prevent narcotic and psychotropic drugs or other controlled substances (as listed in the schedules in section 202 of the Comprehensive Drug Abuse and Prevention Control Act of 1971) which are cultivated, produced or processed illicitly, in whole or in part, in such country or transported through such country, from being sold illegally within the jurisdiction of such country to United States Government personnel or their dependents, or from entering the United States unlawfully?

   It has not been so determined. The GOE has an active narcotics program with USG support.

2. FAA Sec. 620(c). If assistance is to a government, is the government liable as debtor or unconditional guarantor of any debt to a U.S. citizen for goods or services furnished or ordered where (a) such citizen has exhausted available legal remedies and (b) the debt is not denied or contested by such government?

   No such case is known.

3.	FAA Sec. 620(e)(1). If assistance is to a government, has it (including government agencies or subdivisions) taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking steps to discharge its obligations toward such citizens or entities?	No.
4.	FAA Sec. 532(c), 620(a), 620(f), 620D; FY 1982 Appropriation Act Secs. 512 and 513. Is recipient country a communist country? Will assistance be provided to Angola, Cambodia, Cuba, Laos, Vietnam, Syria, Libya, Iraq, or South Yemen? Will assistance be provided to Afghanistan or Mozambique without a waiver?	No.
5.	ISDCA of 1981 Secs. 724, 727 and 730. For specific restrictions on assistance to Nicaragua, see Sec. 724 of the ISDCA of 1981. For specific restrictions on assistance to El Salvador, see Secs. 727 and 730 of the ISDCA of 1981.	N/A
6.	FAA Sec. 620(j). Has the country permitted, or failed to take adequate measures to prevent, the damage or destruction by mob action of U.S. property?	No.
7.	FAA Sec. 620(l). Has the country failed to enter into an agreement with OPIC?	Yes.

8. FAA Sec. 620(o); Fishermen's Protective Act of 1967, as amended, Sec. 5. (a) Has the country seized, or imposed any penalty or sanction against, any U.S. fishing activities in international waters?	Yes, taken into account by the Administrator at the time of approval of Agency OYB.
(b) If so, has any deduction required by the Fishermen's Protective Act been made?	N/A
9. FAA Sec. 620(q); FY 1982 Appropriation Act Sec. 517. (a) Has the government of the recipient country been in default for more than six months on interest or principal of any AID loan to the country?	No.
(b) Has the country been in default for more than one year on interest or principal on any U.S. loan under a program for which the appropriation bill appropriates funds?	No.
10. FAA Sec. 620(s). If contemplated assistance is development loan or from Economic Support Fund, has the Administrator taken into account the amount of foreign exchange or other resources which the country has spent on military equipment? (Reference may be made to the annual "Taking into Consideration" memo: "Yes, taken into account by the Administrator at time of approval of Agency OYB." This approval by the Administrator of the Operational Year Budget can be the basis for an affirmative answer during the fiscal year unless significant changes in circumstances occur.)	Yes, taken into account by the Administrator at the time of approval of Agency OYB.

11. FAA Sec. 620(t). Has the country severed diplomatic relations with the United States? If so, have they been resumed and have new bilateral assistance agreements been negotiated and entered into since such resumption?	No.
12. FAA Sec. 620(u). What is the payment status of the country's U.N. obligations? If the country is in arrears, were such arrearages taken into account by the AID Administrator in determining the current AID Operational Year Budget? (Reference may be made to the Taking Into Consideration memo.)	Payment status is current.
13. FAA Sec. 620A; FY 1982 Appropriation Act Sec 520. Has the country aided or abetted, by granting sanctuary from prosecution to, any individual or group which has committed an act of international terrorism? Has the country aided or abetted, by granting sanctuary from prosecution to, any individual or group which has committed a war crime?	No.
14. FAA Sec. 666. Does the country object, on the basis of race, religion, national origin or sex, to the presence of any officer or employee of the U.S. who is present in such country to carry out economic development programs under the FAA?	No.
15. FAA Sec. 669, 670. Has the country, after August 3, 1977, delivered or received nuclear enrichment or reprocessing equipment, materials, or technology, without specified arrangements or safeguards?	No.

Has it transferred a nuclear explosive device to a non-nuclear weapon state, or if such a state, either received or detonated a nuclear explosive device, after August 3, 1977? (FAA Sec. 620E permits a special waiver of Sec. 669 for Pakistan.)	
16. ISDCA of 1981 Sec. 720. Was the country represented at the Meeting of Ministers of Foreign Affairs and Heads of Delegations of the Non-Aligned Countries to the 36th General Session of the U.N. of Sept. 25 and 28, 1981, and failed to disassociate itself from the communique issued? If so, has the President taken it into account? (Reference may be made to the Taking into Consideration memo.)	Yes. Yes. Yes, taken into account by the Administrator at the time of approval of Agency OYB.
17. ISDCA of 1981 Sec. 721. See special requirements for assistance to Haiti.	N/A.
18. FY 1984 Continuing Resolution. Has the recipient country been determined by the President to have engaged in a consistent pattern of opposition to the foreign policy of the United States?	No such determination has been issued.

FUNDING SOURCE CRITERIA FOR COUNTRY ELIGIBILITY

1. Development Assistance Country Criteria

a. FAA Sec. 116. Has the Department of State determined that this government has engaged in a consistent pattern of gross violations of internationally recognized human rights? If so, can it be demonstrated that contemplated assistance will directly benefit the needy?	The Department of State has not determined that Ecuador is a violator of human rights.

2. Economic Support Fund Country Criteria

a. FAA Sec. 502B. Has it been determined that the country has engaged in a consistent pattern of gross violations of internationally recognized human rights? If so, can the country made such significant improvements in its human rights record that furnishing such assistance is in the national interest? N/A

b. ISDCA of 1981, Sec. 725(b). If ESF is to be furnished to Argentina, has the President certified that (1) the Govt. of Argentina has made significant progress in human rights; and (2) that the provision of such assistance is in the national interests of the U.S.? N/A

c. ISDCA of 1981, Sec. 726(b). If ESF assistance is to be furnished to Chile, has the President certified that (1) the Govt. of Chile has made significant progress in human rights; (b) it is in the national interest of the U.S.; and (3) the Govt. of Chile is not aiding international terrorism and has taken steps to bring to justice those indicted in connection with the murder of Orlando Letelier? N/A

PROJECT CHECKLIST

A. GENERAL CRITERIA FOR PROJECT

1. FY 1982 Appropriation Act Sec. 523; FAA Sec. 634A; Sec. 653(b).

   (a) Describe how authorizing and appropriations committees of Senate and House have been or will be notified concerning the project; (b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than $1 million over that amount)?

   A Congresional Notification will be submitted.

2. FAA Sec. 611(a)(1). Prior to obligation in excess of $100,000, will there be (a) engineering, financial or other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?

   Yes.

3. FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?

   This is not required for the Project.

4. FAA Sec. 611(b); FY 1982 Appropriation Act Sec. 501. If for water or water-related land resource construction, has project met the standards and criteria as set forth in the Principles and Standards for Planning Water and Related Land Resources, dated October 25, 1973?

   N/A

5. FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed $1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project?	N/A.
6. FAA Sec. 209. Is project susceptible to execution as part of regional or multilateral project? If so, why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.	The Project is a joint bilateral/multilateral effort, which will be supported by A.I.D., PAHO, and COE.
7. FAA Sec. 601(a). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; and (c) encourage development and use of cooperatives, and credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.	The Project will impact positively, although indirectly, on (a), (b), and (e).

8. FAA Sec. 601(b). Information and conclusions on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).	Through the reduction of the incidence of malaria, the labor force will be made more productive and foreign investment encouraged, for this and health reasons.
9. FAA Sec. 612(b), 636(h); FY 1982 Appropriation Act Sec. 507. Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized in lieu of dollars.	About 75% of the total project costs will be provided by the GOE
10. FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?	No.
11. FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?	Yes.
12. FY 1982 Appropriation Act. Sec. 521. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity?	N/A.

13. FAA 118(c) and (d). Does the project comply with the environmental procedures set forth in AID Regulation 16? Does the project or program take into consideration the problem of the destruction of tropical forests?	Yes. See IEE.
14. FAA 121(d). If a Sahel project, has a determination been made that the host government has an adequate system for accounting for and controlling receipt and expenditure of project funds (dollars or local currency generated therefrom)?	N/A

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FAA Sec. 102(b), 111, 113, 281(a). Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions; (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries?

(a) Community education and mobilization activities are an integral part of the Project.

(b) The Project will strengthen the institutional capability of the GOE to execute an effective national malaria control program.

(c) The Project will assist the GOE in its efforts to improve the health status of Ecuadoreans.

(d) N/A.

(e) The Project will strengthen the GOE capability to work toward cooperative control efforts with other signatories of the Andean Pact (Colombia and Peru).

b. FAA Sec. 103, 103A, 104, 105, 106. Does the project fit the criteria for the type of funds (functional account) being used?	The Project falls under Health account. It fits the criteria for this type of funds since it is designed to reduce incidence of malaria in the country and therefore it will impact on the health status of the population.
c. FAA Sec. 107. Is emphasis on use of appropriate technology (relatively smaller, cost-saving, labor-using technologies that are generally most appropriate for the small farms, small businesses, and small incomes of the poor)?	N/A.
d. FAA Sec. 110(a). Will the recipient country provide at least 25% of the cost of the program, project, or activity with respect to which the assistance is to be furnished (or is the latter cost-sharing requirement being waived for a "relatively least developed" country)?	The GOE will provide about 75% of the Project total costs.
e. FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to Congress been made, and efforts for other financing, or is the recipient country "relatively least developed"? (M.O. 1232.1 defined a capital project as the construction, expansion, equipping or alteration of a physical facility or facilities financed by AID dollar assistance of not less than $100,000, including related advisory, managerial and training services, and not undertaken as part of a project of a predominantly technical assistance character.	The Project does not involve the use of grant funds for capital assistance.

f. FAA Sec. 122(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth?	Yes.
g. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intelectual resources to encourage institutional development; and supports civil education and training in skills required for effective participation in governmental processes essential to self-government.	In the PP, malaria has been identified as a disease which impacts negatively on the social and economic development of individuals. Some 7.5 percent of the labor force in Ecuador's malarious areas -- nearly two thirds of the country -- will suffer from malaria in 1984. The Project will support human resources development through adequate training at every organizational level of SNEM; and will strengthen SNEM management systems and technical capacity.
2. Development Assistance Project Criteria (Loans Only)	
a. FAA Sec. 122(b). Information and conclusion on capacity of the country to repay the loan, at a reasonable rate of interest.	N/A.
b. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete with U.S. enterprises, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan?	N/A.
c. ISDCA of 1981, Sec. 724(c) and (d). If for Nicaragua, does the loan agreement require that the funds be used to the maximum extent possible for the private sector? Does the project provide for monitoring under FAA Sec. 624(g)?	N/A

3. Economic Support Fund Project Criteria

a. FAA Sec. 531(a). Will this assistance promote economic or political stability? To the extent possible, does it reflect the policy directions of FAA Section 102?	N/A
b. FAA Sec. 531(c). Will assistance under this chapter be used for military, or paramilitary activities?	N/A
c. FAA Sec. 534. Will ESF funds be used to finance the construction of the operation or maintenance of, or the supplying of fuel for, a nuclear facility? If so, has the President certified that such use of funds is indispensable to nonproliferation objectives?	N/A
d. FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made?	N/A

STANDARD ITEM LIST

A. Procurement

1.	FAA Sec. 602. Are there arrangements to permit U.S. small business to participate equitably in the furnishing of commodities and services financed?	Yes.
2.	FAA Sec. 604(a). Will all procurement be from the U.S. except as otherwise determined by the President or under delegation from him?	Yes.
3.	FAA Sec. 604(d). If the cooperating country discriminates against marine insurance companies authorized to do business in the U.S., will commodities be insured in the United States against marine risk with such a company?	N/A.
4.	FAA Sec. 604(e); ISDCA of 1980 Sec. 705(a). If off-shore procurement of agricultural commodity or product is to be financed, is there provision against such procurement when the domestic price of such commodity is less than parity? (Exception where commodity financed could not resonably be procured in U.S.)	N/A.
5.	FAA Sec. 604(g). Will construction or engineering services be procured from firms of countries otherwise elegible under Code 941, but which have attained a competitive capability in international markets in one of these areas?	N/A.

6.	FAA Sec. 603. Is the shipping excluded from compliance with requirement in section 901(b) of the Merchant Marine Act of 1936, as amended, that at least 50 per cent of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners, and tankers) financed shall be transported on privately owned U.S. flag commercial vessels to the extent that such vessels are available at fair and reasonable rates.?	Yes.
7.	FAA Sec. 621. If technical assistance is financed, will such assistance be furnished by private enterprise on a contract basis to the fullest extent practicable? If the facilities of other Federal agencies will be utilized, are they particularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs?	Yes. Yes.
8.	International Air Transport. Fair Competitive Practices Act, 1974. If air transportation of persons or property is financed on grant basis, will U.S. carriers be used to the extent such service is available?	Yes.
9.	FY 1982 Appropriation Act Sec. 504. If the U.S. Government is a party to a contract for procurement, does the contract contain a provision authorizing termination of such contract for the convenience of the United States?	Yes.

B. Construction

1. FAA Sec. 601(d). If capital (e.g., construction) project, will U.S. engineering and professional services to be used?	N/A.
2. FAA Sec. 611(c). If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable?	N/A.
3. FAA Sec. 620(k). If for construction of productive enterprise, will aggregate value of assistance to be furnished by the U.S. not exceed $100 million (except for productive enterprises in Egypt that were described in the CP)?	N/A.

C. Other Restrictions

1. FAA Sec. 122(b). If development loan, is interest rate at least 2% per annum during grace period and at least 3% per annum thereafter?	Yes.
2. FAA Sec. 301(d). If fund is established solely by U.S. contributions and administered by an intenational organization, does Comptroller General have audit rights?	N/A.
3. FAA Sec. 620(n). Do arrangements exist to insure that United States foreign aid is not used in a manner which, contrary to the best interests of the United States, promotes or assists the foreign aid projects or activities of the Communist-bloc countries?	Yes.
4. Will arrangements preclude use of financing:	

a. FAA Sec. 104(f); FY 1982 Appropriation Act. Sec. 525: (1) To pay for performance of abortions as a method of family planning or to motivate or coerce persons to practice abortions; (2) to pay for performance of involuntary sterilization as method of family planning, or to coerce or provide financial incentive to any person to undergo sterilization; (3) to pay for any biomedical research which relates, in whole or part, to methods or the performance of abortions or involuntary sterilizations as a means of family planning; (4) to lobby for abortion?	(1) Yes. (2) Yes. (3) Yes. (4) Yes.
b. FAA Sec. 620(g). To compensate owners for expropriated nationalized property?	N/A.
c. FAA Sec. 660. To provide training or advice or provide any financial support for police, prisons, or other law enforcement forces, except for narcotics programs?	Yes.
d. FAA Sec. 662. For CIA activities?	Yes.
e. FAA Sec. 636(i). For purchase, sale, long-term lease, exchange or guaranty of the sale of motor vehicles manufactured outside U.S., unless a waiver is obtained?	Yes.
f. FY 1982 Appropriation Act, Sec. 503. To pay pensions, annuities, retirement pay, or adjusted service compensation for military personnel?	Yes.

g. FY 1982 Appropriation Act, Sec. 505. To pay U.N. assessments arrearages or dues?	Yes.
h. FY 1982 Appropriation Act, Sec. 506. To carry out provisions of FAA section 209(d) (Transfer of FAA funds to multilateral organizations for lending)?	Yes.
i. FY 1982 Appropriation Act, Sec. 510. To finance the export of nuclear equipment, fuel, or technology or to train foreign nationals in nuclear fields?	Yes.
j. FY 1982 Appropriation Act, Sec. 511. Will assistance be provided for the purpose of aiding the efforts of the government of such country to repress the legitimate rights of the population of such country contrary to the Universal Declaration of Human Rights.?	Yes.
k. FY 1982 Appropriation Act, Sec. 515. To be used for publicity or propaganda purposes within U.S. not authorized by Congress?	Yes.

CERTIFICATION PURSUANT TO 611(e) OF THE

FOREIGN ASSISTANCE ACT OF 1961, AS AMENDED

I, Orlando Llenza, the principal officer of the Agency for International Development in Ecuador, having taken into account, among other factors, the maintenance and utilization of projects in Ecuador previously financed or assisted by the United States, do hereby certify that, in my judgement, Ecuador has both the financial capability and human resources capability to effectively maintain and utilize the Project: MALARIA CONTROL.

Orlando Llenza
Mission Director, USAID/Ecuador

Date: November 16, 1984

SUPPLEMENTARY TECHNICAL INFORMATION

1. Plasmodium falciparum:

Plasmodium falciparum is the most malignant of the four species of human malaria. The virulence of P. falciparum depends upon the rapidity with which the parasites can reproduce in the human red blood cells, perhaps by a factor of 10 every 48 hours. Individuals who have had limited prior P. falciparum infections (e.g., young children, immigrants or visitors from areas without falciparum malaria transmission) can sustain overwhelming infections of their red cells within 7-10 days of their initial symptoms.

Epidemiologically, P. falciparum transmission in Latin American coastal areas has been highly variable from year to year. Generally, however, P. vivax constitutes the majority of the transmission, P. vivax produces considerable illness but rarely results in death. To compound the problem, P. falciparum is the only species of malaria which has developed resistance to the principal antimalarial drugs: chloroquine, amodiaquine, and quinine. Consequently, effective drug therapy of P. falciparum infections in Latin America South of the Panama Canal, where chloroquine resistance occurs, requires information on the drug susceptibility of local strains.

Abrupt increases in the incidence of P. falciparum infections pose a critical problem for public health programs. In addition to rapid and effective vector control to inhibit transmission, effective antimalaria drug therapy must be made available to all exposed populations to decrease malaria-related fatalities.

Resistance of P. falciparum to chloroquine has been recognized in South America since 1959. Rumors of chloroquine resistance in Ecuador were frequent during the early 1970's, yet P. falciparum infections were not very prevalent during that period and the threat of resistance was not a major operational issue. Beginning in 1976, a limited number of tests for chloroquine resistance were conducted in provinces bordering on Colombia, which has extensive drug resistance. Testing has conformed to World Health Organization (and PAHO) recommended procedures, emphasizing the use of in vitro tests. The in vitro methods require technical expertise and basic laboratory facilities including electricity, microscopy, and incubators. As noted by SNEM and PAHO staff, these technical requirements have greatly limited the development of representative chloroquine testing data. A review of the basic in vitro testing available showed that it has been conducted very adequately.

Data collected to date (Table G-1) demonstrate 30 in vitro resistant P. falciparum isolates in the Province of Esmeraldas during the period 1976-1983. Very little in vivo testing has been conducted, according to SNEM staff, due to greater reliance on in vitro methods and the difficulty of conducting the recommended 28 day in vivo follow up.

TABLE G-1

Response of P. falciparum to Chloroquine

AREA	Date of test	Test Method: In Vitro				Test Method: In Vivo		
		Susceptible		Resistant		Susceptible	Resistant	
		No. of cases	Inhibition Total (Mol.)	No. of cases	Inhibition Total (Mol.)	No. of cases	No. of cases	Grade
PROVINCE OF NAPO	1976	-	-	-	-	0	10	I
							2	II
	1977	5	*	1	2.5	-	-	-
PROVINCE OF ESMERALDAS	1977	1	*	1	2.5	-	-	-
	1979	2	0.75	3	2.0	23	8	I
		2	1.0	1	3.0	-	-	-
		7	1.25	-	-	-	-	-
	1980	3	0.5	2	1.5	-	-	-
		6	0.75	2	2.0	-	-	-
		1	1.0	4	3.0	-	-	-
	1981	3	1.0	2	1.5	-	-	-
				1	2.0	-	-	-
	1983	3	0.75	1	1.5	-	-	-
		3	1.0	2	2.0	-	-	-
				1	3.0	-	-	-

There are no data on chloroquine response of P. falciparum from other areas of Ecuador, yet it can be inferred with some confidence that resistance occurs to some degree in all areas of the country with P. falciparum transmission. In Guayaquil, many patients have been seen who had either a failure of clinical response (they remained ill) or persistent or recurrent parasitemia following chloroquine therapy. Additionally, in Tumbes Province, Peru, on the Ecuador frontier, chloroquine-resistant P. falciparum infections have been documented, some in persons reportedly infected in Ecuador. In general, there is an assumption, as yet undocumented, that chloroquine resistance affects all malarious areas of Ecuador. There are no data on the prevalence of resistance, the intensity of resistance (an estimate of whether resistant infections retain any response to therapy), or the efficacy of alternative antimalarial drugs, principally amodiaquine and Fansidar.

The general uncertainty concerning the efficacy of chloroquine for P. falciparum infections and the limited provision by SNEM and other health services of malaria therapy (it is probable that fewer than 10% of symtomatic infections are treated by GOE programs) have resulted in great variation in malaria therapy practices.

SNEM recommendations for "presumptive" therapy are for a single dose of chloroquine (approximately 10 mg. base per kilo of body weight) plus a single dose of 45 mg. of primaquine. In some areas, specially those with presumed chloroquine resistance, amodiaquine (Camoquine) is used instead of chloroquine. Amodiaquine (a compound chemically related to chloroquine) is recommended by SNEM, based upon observations from other countries with chloroquine resistance that amodiaquine is somewhat more effective for therapy. Primaquine is advocated as a drug which will kill P. falciparum gametocytes in order to limit transmission. Several problems have occurred with this "presumptive" regimen. The principal problem has been the lack of antimalarial drugs, which undermines the PCD system since ill persons will rapidly seek alternative therapy sources (to the extent available). Due to the great limitations in laboratory services, the lag time between slide submission and return of microscopic examination results has in some areas exceeded several weeks. Furthermore, due to the volume of malaria cases, medicators have not been able to return to deliver "radical" cures. Consequently, "presumptive" therapy has in practice been the only therapy for a sizeable proportion of persons using SNEM facilities.

SNEM policy for "radical cure" (as opposed to practice in most cases) requires that P. vivax infections receive a full 3-day course of chloroquine (25mg/kg base) and 14 days of primaquine (15 mg base/day). P. falciparum infections are to be treated with three tablets of Fansidar (a combination of pyrimethamine and sulfadoxine) and three days of primaquine for adults. In practice, an undetermined but very small percentage of patients actually receives radical cure. Both Fansidar and primaquine are in very short supply to SNEM.

On the local commercial market, antimalarial drugs are extremely plentiful. No import data are available, yet it is reported that Fansidar can be obtained in most areas of Ecuador and is used extensively for

auto-presumptive therapy. Consequently, a situation has potentially developed in which A substantial proportion of symptomatic malaria infections, both P.vivax (which remains exquisitely sensitive to chloroquine) and P. falciparum are being treated with the antimalaria drug which would ideally be reserved for chloroquine-resistant P. falciparum infections, and which has little or no effect on P. vivax infections.

2. Malaria Surveillance System

Malaria case detection in Ecuador has conformed to the standard surveillance methods utilized in other malaria programs in the Americas. These detection methods derive from the strategies of malaria eradication, and may be of limited efficiency when malaria programs have either restricted resources or program objectives other than eradication.

Passive case detection (PCD), through the network of voluntary collaborators (VC) is the principal malaria surveillance activity. More than 6,000 VC posts have been established in Ecuador. A patient who feels that he has malaria must seek out the VC in his community; a blood smear is taken along with identifying data, and a "presumptive" dose of antimalarial drug is given to the patient. The effectiveness of this system as a surveillance method depends entirely on the utilization of VC posts by patients with malaria, as opposed to seeking therapy from other sources, such as local shops, healers, or private physicians. In addition, since VC's are not paid by SNEM, there may be considerable variation in the community utilization of their VC, depending on various social and human interaction factors, which SNEM officials cannot control directly.

Voluntary collaborators are nominated by their communities, and are generally literate young adults--often women from respected families. SNEM trains each VC in methods for taking blood smears, calculation of doses of presumptive drug therapy, and proper collection of identifying data for each patient. It is the responsibility of a SNEM medicator or field supervisor to provide equipment to the VC, and to collect the blood smears and accompanying information on a periodic basis.

Blood slides taken by VC's are collected by SNEM auxiliaries or medicators and deposited at a SNEM laboratory, of which there are approximately 35 in the country. There is a well-established set of forms used for data collection and analysis. Voluntary collaborators record the name, age, sex, and place of residence for each patient, in addition to the therapy administered. The laboratories receive the slides and forms, on which the microscopic examination results are recorded. A copy of the laboratory results is forwarded to the Central Epidemiology Department for tabulation and analysis. Slides are, in theory, read at a provincial lab and the results of bloodsmears with malaria parasites are returned by the medicator to the community for "radical cure" therapy of the patients. Delays of greater than seven days in the return of slide interpretation precludes prompt radical therapy, and therefore accomplishment of the second objective of the PCD system: effective, prompt therapy of patients to limit illness and transmission.

Active Case Detection (ACD) is an auxiliary malaria case detection method, in which SNEM personnel search for fever cases or suspected malaria infections in the community. Blood slides are taken from suspect cases and "presumptive" therapy is given. In theory, ACD should complement PCD surveillance particularly in identifying malaria infections which do not present at VC posts. Additionally, ACD can identify infections when the prevalence is very low, and the efficiency of PCD is quite marginal. Of greatest importance, however, is the considerable manpower required by SNEM to conduct ACD, and, in consequence, its low cost-effectiveness.

Additional surveillance data come from reports of malaria cases detected by both public and private sector health services (hospitals, health centers, and dispensaries). There is considerable variation in the extent to which health services report to SNEM; with the general lack of laboratory services, some hospitals depend upon SNEM for slide diagnosis, whereas others rely completely on clinical diagnosis of malaria.

During the period 1982-84, the surveillance of malaria cases in Ecuador has been taxed beyond its capacities. It is probable that the VC network functioned adequately during the 1970's when malaria transmission was at low levels. With the resurgence of transmission, however, several glaring problems have been noted by SNEM staff:

a. Supervisory staff, required for adequate PCD surveillance, have been insufficient, leading to inadequate collection, supervision and validation of PCD data. Furthermore, as major shifts in population have occurred, particularly to less accessible areas of Esmeraldas and Napo Provinces, it is clear that PCD surveillance has not been able to keep abreast of population expansion.

While some ACD has continued, particularly in the Oriente, there has been a purposeful reduction in such surveillance. This has been necessitated by the great resurgence of transmission, which has overtaxed the surveillance system. Reduction of ACD is a logical action when manpower is limited.

b. Laboratory services are even more heavily over-taxed. Functional labs generally appear to be struggling to contend with patients appearing at SNEM and health service posts; great backlogs of referred blood slides have accumulated due to insufficient facilities. In the areas of highest transmission, Esmeraldas and Napo, the vast majority of probable malaria infections are being treated without blood slides being taken, since health providers know that timely laboratory diagnosis is impossible. This creates many potential problems. Surveillance deteriorates and more importantly, data are not comparable from year to year or between geographical areas. In addition, with the problem of drug resistance, presumptive therapy of infections without microscopic confirmation creates the possibility of inadequate therapy of P. falciparum infections (see Annex G for a map showing the location of SNEM laboratories).

c. The standard procedure of cross-checking of laboratory proficency, in which central laboratories check all parasite-positive and 10% of

negative slides read by peripheral laboratories, no longer functions in Ecuador. Consequently, the accuracy of the limited microscopic operations cannot be ascertained.

The malaria surveillance data during 1982-83 have been summarized well by Dr. Francisco Vasquez Balda and his staff in the Department of Epidemiology (ref. "Informe Anual del Departamento de Epidemiologia, 1983"). Some of the data are classified according to whether they pertain to areas of "attack" or "consolidation"1/. During this period the number of blood slides examined nationally has averaged about 7-8% of the population at risk. As noted previously, the lack of uniformity in PCD surveillance has been an increasing problem, and consequently this percentage of blood smears represents a fairly high coverage in those areas accessible to functioning laboratories. In excess of 75-80% of all positive blood smears are derived from PCD. The 1982-84 record of surveillance (Tables G-2, G-3, and G-4), show a marked increase in all parameters, and most impressively in the reported P. falciparum infections. There is no doubt that Ecuador is currently experiencing a major resurgence of malaria, and most importantly, of P. falciparum infections. This resurgence is occurring in all previous areas; data suggest that northern coastal areas and Napo have the most intense problems, yet with the deficits in case detection, geographical variations in malaria transmission intensity have not been clearly identified. Such determinations may be made by parasitological and serological surveys.

In addition, the use of malariometric surveys in specific areas may be used to determine the effectiveness of SNEM's control interventions

Training or refresher training in the basic tasks for malaria surveillance and in newer methods of control has been deficient in recent years. Field staff, particularly at the supervisory level, need continued upgrading of their technical knowledge and administrative skills to be maximally effective. Great priority will be given to systematic training of malaria staff at all levels in the AID-supported project--both didactic, formal training and intensive, in-country field experiences.

3. Operational Research Topics

In the Ecuador malaria control program, it is clear that new approaches must be undertaken, building on past experiences but not being limited by those experiences. It is possible to list many operational research topics which could be pursued productively. The following are, however, among the priority issues which need to be addressed. The list is neither definitive nor exhaustive.

1/ These are operational classifications based upon eradication strategies and are of no relevance to current issues, particularly considering the big increase in transmission and limited insecticide spraying.

Table G-2

ECUADOR

MALARIA SURVEILLANCE RESULTS

1982 - 1984

Year	1982				1983				1984			
Source	ACD[1]	PCD[1]	INV.[1]	TOTAL	ACD	PCD	INV.	TOTAL	ACD	PCD	INV.	TOTAL
Blood Slides	93,494	229,931	61,367	384,792	82,496	317,767	52,804	453,067	24,327	225,916	15,632	265,875
Positives	952	12,577	1,104	14,633	2,624	44,800	4,182	51,606	1,221	46,718	1,087	49,026
Plasmodium falciparum	250	2,550	326	3,126	1,007	13,199	2,309	16,515	923	9,489	476	10,888
(% TOTAL)	(26)	(20)	(30)	(21)	(38)	(29)	(55)	(32)	(76)	(20)	(44)	(22)

1 ACD - Active Case Detection
PCD - Passive Case Detection
INV - Special Investigations

1984: Through July

EVOLUCION DE LA INCIDENCIA MALARICA A NIVEL PROVINCIAL

Período: 1974-1983

PROVINCIAS	POBLACION ESTIMADA AÑO 1983	AÑO 1974			AÑO 1975			AÑO 1976		
		TOTAL CASOS	INFEC. P.FALC.	IPA	TOTAL CASOS	INFEC. P.FALC.	IPA	TOTAL CASOS	INFEC. P.FALC.	IPA
AZUAY	22.806	3	-	0.2	1	-	0.1	4	-	0.2
BOLIVAR	32.260	9	1	0.4	3	-	0.1	3	-	0.1
CAÑAR	29.772	28	-	1.4	9	-	0.4	7	-	0.3
CARCHI	15.777	-	-	-	2	2	0.2	10	-	0.9
COTOPAXI	30.507	19	2	0.9	5	-	0.2	3	1	0.1
CHIMBORAZO	17.062	5	-	0.4	0	-	-	-	-	-
EL ORO	342.914	37	-	0.2	56	1	0.2	85	2	0.4
ESMERALDAS	301.979	2.004	774	10.1	2.914	973	14.2	4.032	999	19.1
GUAYAS	2'215.294	414	45	0.3	399	54	0.3	1.377	445	0.9
IMBABURA	16.735	11	1	1.0	16	-	1.4	27	19	2.3
LOJA	175.759	55	0	0.5	53	1	0.4	55	1	0.4
LOS RIOS	501. 729	358	43	0.8	207	54	0.6	330	56	1.1
MANABI	992.632	608	108	0.9	712	105	1.1	1.101	190	0.3
MORONA SANTIAGO	62.737	88	-	2.1	133	-	3.1	590	-	8.8
NAPO	113.821	1.450	17	19.0	1.562	7	20.1	2.907	199	36.3
PASTAZA	13.049	141	-	16.3	65	-	7.3	131	-	14.2
PICHINCHA	[illegible].953	353	12	2.8	404	38	3.1	433	33	3.2
[illegible]	[illegible].471	8	0	0.3	14	-	0.4	9	-	0.3
[illegible]	[illegible]	5.451	1.203	1.6	6.552	1.236	1.9	10.974	1.945	3.0

Sección [illegible] SNEM

Table G-3

EVOLUCION DE LA INCIDENCIA MALARICA A NIVEL PROVINCIAL

Periodo: 1977-1983

PROVINCIAS	POBLACION AÑO 1983	AÑO 1977			AÑO 1978			AÑO 1979			AÑO 1980			AÑO 1981		AÑO 1982			AÑO 1983		
		TOTAL CASOS	INFEC. FALCIP.	IPA	TOTAL CASOS	INFEC. FALCIP.	IPA	TOTAL CASOS	INFEC. FALCIP.	IPA	TOTAL CASOS	INFEC. FALCIP.	IPA	TOTAL CASOS	INFEC. FALCIP.	TOTAL CASOS	INFEC. FALCIP.	IPA	TOTAL CASOS	INFEC. FALCIP.	IPA
AZUAY	22.806	79	1	4.[illegible]	128	-	6.1	151	-	6.8	14	-	0.6	44	-	16	-	0.7	37	-	1.6
BOLIVAR	32.260	8	-	0.3	28	-	0.7	25	4	0.6	43	7	1.9	16	1	52	3	1.7	112	5	3.5
CAÑAR	29.272	8	-	0.3	1	-	0.04	2	-	0.08	[illegible]	-	[illegible]	3	-	27	-	2.4	1.048	255	35.2
CARCHI	15.777	5	-	0.4	13	1	1.0	11	2	0.7	8	2	0.5	4	-	30	-	1.9	54		3.4
COTOPAXI	30.507	27	-	1.5	24	-	1.2	27	1	1.3	58	3	2.8	65	2	72	12	2.5	493	22	16.2
CHIMBORAZO	17.062	1	-	0.06	1	-	0.06	0	-	-	0	-	0.	2	-	81	-	4.8	191	2	11.2
EL ORO	342.914	351	21	1.2	592	6	2.1	486	5	1.5	169	-	0.5	583	-	341	-	0.9	3.243	31	9.5
ESMERALDAS	301.979	5.015	1.504	22.1	4.707	1.563	20.7	4.596	2.[illegible]	17.2	5.340	2.291	19.2	7.835	2.334	2 6.938	2.326	22.7	19.479	11.441	64.5
GUAYAS	2'215.294	1.088	452	0.6	648	279	0.4	448	228	0.2	474	189	0.2	710	119	1.703	191	0.8	4.768	531	2.2
IMBABURA	16.735	41	-	2.4	41	2	2.3	25	3	1.1	7	2	0.3	45	2	54	2	3.1	146	2	8.7
LOJA	175.759	106	1	0.6	105	2	0.6	123	1	0.6	100	-	0.5	59	1	26	1	0.1	428	5	2.4
LOS RIOS	501.729	706	213	1.6	510	36	1.2	412	111	0.8	576	58	1.1	866	71	1.727	258	3.1	7.578	810	15.1
MANABI	992.632	983	206	1.1	918	268	1.0	689	75	0.7	1.206	239	1.2	1.770	291	2.410	235	2.2	9.985	3.166	10.1
MORONA SANTIAGO	62.737	392		7.5	462	-	8.9	264	-	4.6	29		0.5	22	1	15	-	0.2	77	1	1.2
NAPO	113.821	2.054	186	31.8	1.037	24	15.9	510	9	6.9	385	4	4.5	497	8	475	19	4.1	2.943	75	25.9
PASTAZA	13.049	75		7.4	102	-	9.1	71	-	5.3	58	2	5.3	17	-	6	-	0.4	47	-	3.6
PICHINCHA	192.933	330	27	2.4	490	22	3.5	360	33	2.0	271	38	1.5	496	47	649	79	3.3	951	147	4.9
ZAMORA CHINCHIPE	48.471	6	1	0.2	8	-	0.3	7	-	0.2	7	-	0.2	1		1	-	0.02	26	2	0.5
TOTALES:	5'126.237	11.275	2.612	2.8	9.815	2.205	2.4	8.207	2.648	1.7	8.748	2.755	1.8	12.745	3.427	14.633	3.126	2.7	51.606	16.515	10.1

TABLE 4-4

a. Malaria-related research

(1) Socio-cultural studies of malaria

- Knowledge, attitudes, practices (KAP) related to malaria, stratified by geographic, cultural, racial variables.

- Survey of KAP among health workers related to malaria and therapy.

- Quantification of migration among areas of differing malaria transmission levels.

- Identification of factors which influence the effectiveness of volunteer collaborators in particular cultural or racial settings.

(2) Epidemiology and surveillance

- Determination of efficacy of malaria case surveillance using case definitions not including microscopic examination of blood smears.

- Stratification: definition of epidemiologic variables which will produce a useful prioritization of malarious areas according to malaria endemicity and control potential.

- Computer-based data management to enable rapid and precise analysis of epidemiologic data.

(3) Drug therapy

- Mapping of Ecuador for in-vivo response to chloroquine administered at 25 mg/kg of body weight.

- Evaluation of alternative drugs, amodiaquine and Fansidar, on a limited basis in areas of documented chloroquine resistance.

- Evaluation of the current use patterns of antimalarial drugs in representative communities of Ecuador.

- Collaborative trials and data sharing with malaria control programs in Peru and Colombia to define regional drug resistance patterns.

- Survey of Black communities for chloroquine pruritus.

(4) Development of profile of urban malaria in Ecuador

- Define KAP; identify immigration patterns into and within Guayaquil.

- Assess current urban vector control activities as to effectiveness.

(5) Field trials of new insecticides, including larvicides

- Testing new insecticides in pilot situations to determine residual and operational characteristics.

- Use of new larvicides.

(6) Alternative methods of malaria and vector-borne disease control

- Exploratory use of biological control methodology.

- Increasing use of source reduction and water management techniques.

- Promotion of individual physical barrier methods such as bed nets.

b. Research related to other vector-borne diseases

(1) Leishmaniasis

- Establishment of field studies to determine the incidence and geographical distribution of Leishmania in Ecuador, the vector species and life cycles, breeding sites, biting habits, density and infection rates.

- Establishment of a study to determine the effect of SNEM's intradomiciliary insecticide spray program (for malaria control purposes) on incidence of leishmaniasis.

(2) Chagas' Disease

- Continuation of the present SNEM study to determine the incidence of vector infection by T. cruzi.

- Continuation of the serological survey of the population in contact with the vector to determine the morbidity of Chagas'.

- Establishment of a study to determine the effect on Chagas' vector of insecticide spraying of SNEM malaria control program.

(3) Onchocerciasis

- Establishment of a study to determine the geographical distribution, abundance, habitat, breeding sites and taxonomy of the black fly species on the major onchocercal focus (Rio Santiago Basin) in the Province of Esmeraldas.

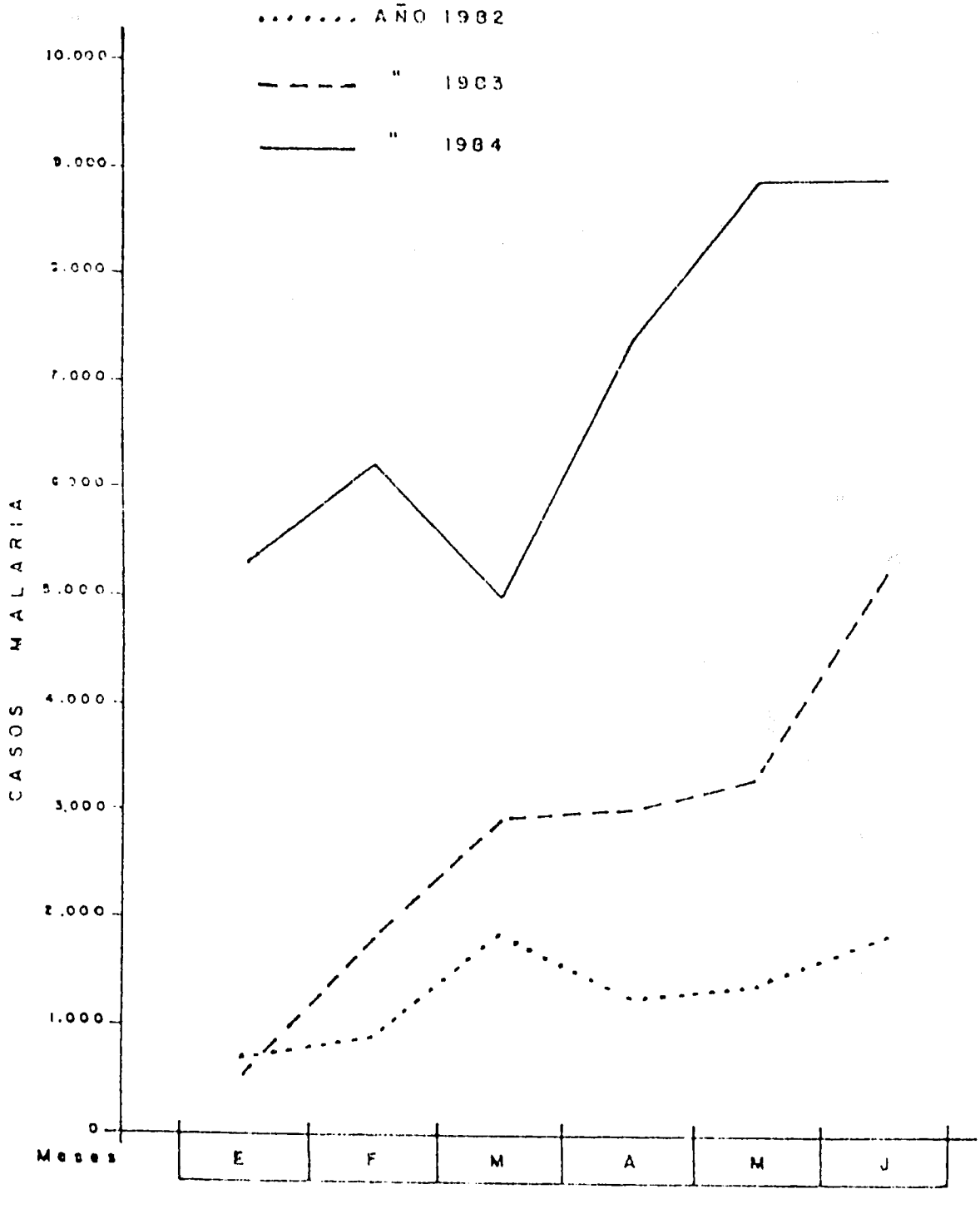
- Investigation to determine the biting densities and transmission potential of all black fly species.

TABLE G-5

SNEM
Ecuador

Dpto. EPIDEMIOLOGIA

INCIDENCIA MALARICA: PRIMER SEMESTRE
AÑOS 1982 - 83 - 84

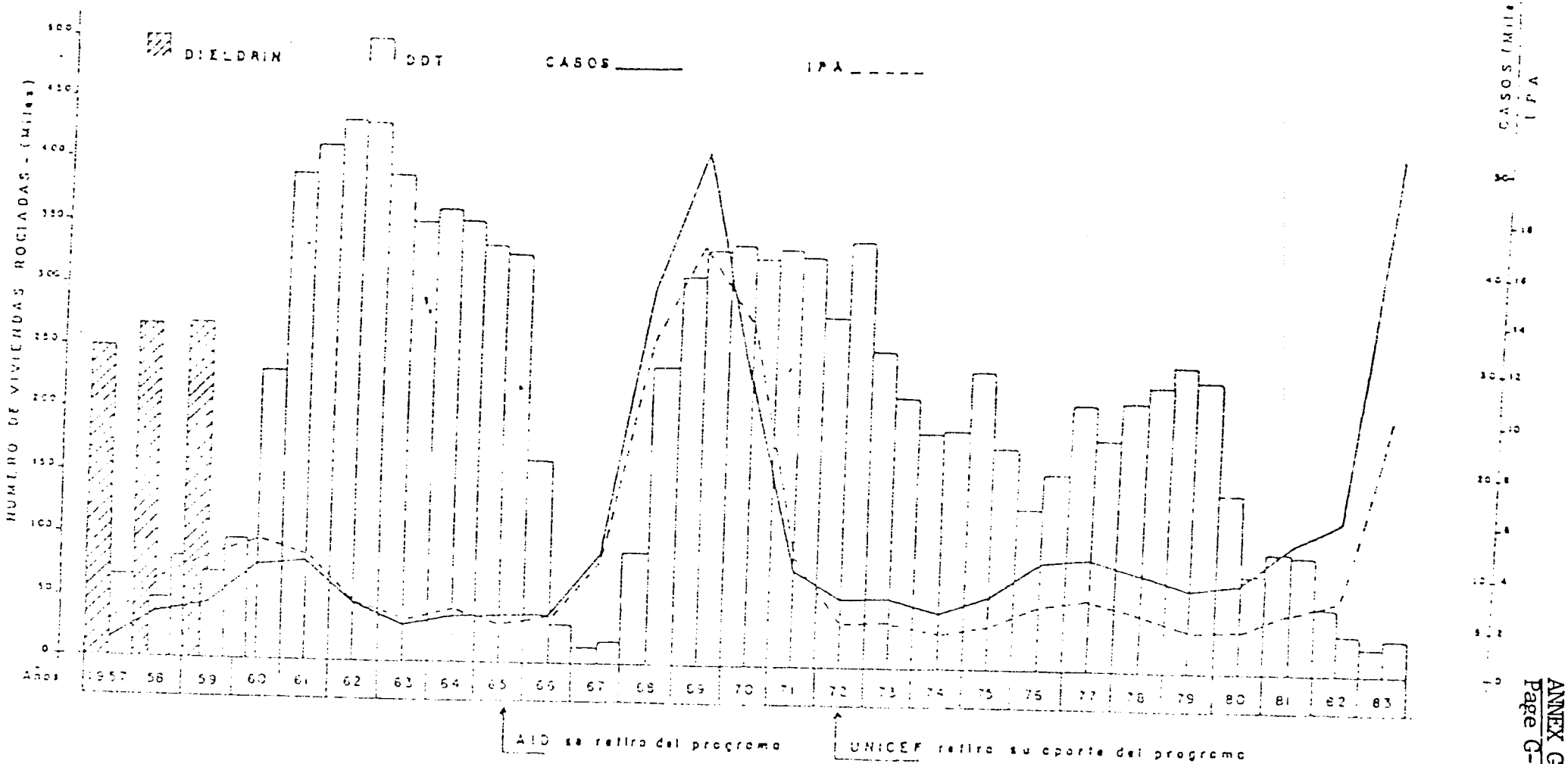


Dr. F.V.B/G. de C.

TABLE G-6

SNEM
Ecuador

NUMERO DE VIVIENDAS ROCIADAS CON DIELDRIN Y CON DDT,
CASOS DE MALARIA E INCIDENCIA PARASITARIA ANUAL (IPA)



SNEM
ECUADOR

PROGRAMACION DE LAS OPERACIONES DE ROCIADO DOMICILIAR

Periodo: Junio - Diciembre de 1984

PROVINCIAS DEL AREA MALARICA.	INFORMACION BASICA AÑO 1982			INFORMACION BRIGADA LOCAL		PROGRAMA DE ROCIADO DOMICILIAR Periodo: Junio - Diciembre de 1984					
	POBLACION ESTIMADA	CASAS EXIST.	LOCALIDADES EXIST.	LOCALID. POSIT. AÑO 1982 Número	%	LOCALIDADES BRIGADA Nº	%	CASAS A ROCIAR Nº	%	INSECTICIDA KILOS 100 75%	KILOS PENITROTION
Azuay	22.806	6.369	159	17	10.3	-	-	-	-	-	-
Bolivar	32.260	6.451	98	21	21.4	3	3.0	118	1.8	75	-
Cañar	29.772	8.442	124	30	24.2	72	58.1	7.184	85.1	4.602	-
Carchi	15.777	3.155	76	16	21.9	-	-	-	-	-	-
Cotopaxi	30.507	6.101	64	22	34.4	13	20.3	2.177	35.7	1.395	-
Chimborazo	17.062	4.843	140	23	14.5	6	4.3	1.355	27.4	850	-
El Oro	342.914	75.173	522	175	33.5	81	15.9	13.974	26.9	12.755	-
Esmeraldas	301.972	60.395	654	442	67.6	621	94.9	46.423	76.9	-	44.599
Guayas	2.215.394	446.192	2.553	415	16.3	657*	25.8	74.520*	16.8	45.200	-
Imbabura	16.735	3.347	96	28	28.6	-	-	-	-	-	-
Loja	175.759	35.151	888	100	11.3	65	7.3	3.000	8.5	2.725	-
Los Rios	501.729	100.345	1.738	430	27.6	286	16.5	23.180	23.1	14.854	-
Manabi	990.632	204.708	1.967	893	46.8	288	15.1	48.015	23.5	31.756	-
Morona Santiago	62.737	13.942	362	34	9.4	110	30.4	2.929	21.2	2.029	-
Napo	113.821	25.294	391	199	50.9	280	71.6	20.276	80.2	13.849	-
Pastaza	13.049	2.900	166	20	12.1	72	43.4	1.025	35.3	710	-
Pichincha	192.933	42.874	293	128	43.7	44	15.0	15.091	35.2	9.676	-
Zamora Chinchipe	46.471	10.771	200	6	3.0	-	-	-	-	-	-
TOTAL:	5.126.237	1.056.345	10.480	3.068	29.3	2.598	24.8	265.465	25.1	143.516	44.599

TABLE G-7

TABLE G-8

ECUADOR

PROGRAMA DE MALARIA

DISTRIBUCION DE LAS BRIGADAS DE ROCIAMIENTO SEGUN SUS MEDIOS DE MOVILIZACION

ZONA	ROCIAMIENTOS CON: DDT	FOSFORADOS	TRANSPORTE MOTORIZADO Terrestre	Fluvial	A PIE	MONTADA
I. Santo Domingo	7	-	4	1	-	2
II. Puyo	10	-	4	4	1	1
III. Guayas	26	-	16	4	6	-
IV. Loja	2	-	-	-	-	2
V. Los Ríos	12	-	6	6	-	-
VI. Manabí	11	8	8	1	4	6
VII. Esmeraldas	-	36	1	17	2	16
TOTAL	68	44	39	33	13	27

Table C-9

SERVICIO NACIONAL DE ERRADICACION DE LA MALARIA

DISTRIBUCION DE MEDIOS DE TRANSPORTE TERRESTRE, ACTUALMENTE EN SERVICIO (JULIO 1984)

SEDE	CAMION (MODELO / AÑO	CAMIONETA PICK - UP (MODELO / AÑO							TOTAL	JEEP (MODELO / AÑO						TOTAL
	68	68	76	77	78	80	81	82		64	67	68	72	76	82	
OFICINA CENTRAL	1	1	1				1		3					4		4
ZONA: I	1							1	1			1		2		3
II					1			2	3	1						1
III				6		2			8	1	2		2	1		6
IV		1			2				3				2			2
V				6					6					1		1
VI				4			2		6				1			1
VII					1	1		1	3			1			1	2
TOTAL:	2	2	1	16	4	3	3	4	33	2	2	2	5	8	1	20

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SERVICIO NACIONAL DE ERRADICACION DE LA MALARIA

DISTRIBUCION DE OTROS MEDIOS DE TRANSPORTE

ZONAS	MOTOCICLETAS (125cc)	MOTOR (25)	(FB) (40)	(HP) (50)	BOTES ALUMINIO (16 pies)	CANOAS	MULARES
I	9	-	-	-	-	-	16
II	3	3	-	4	5	7	9
III	17	4	-	1	4	-	8
IV	5	-	-	-		-	19
V	12	2	-	-	3	-	10
VI	11	1	-	-	-	-	50
VII	5	1	1	1	2	4	49
TOTAL :	62	11	1	6	14	11	161

"D"

CONDICIONES:

	BUENAS	REGULARES	MALAS	TOTAL
Motocicletas	-	42	20	62
Motores (FB)	-	10	8	18
Botes de Aluminio	-	-	14	14
Canoas	-	11	-	11
Mulares	-	98	63	161

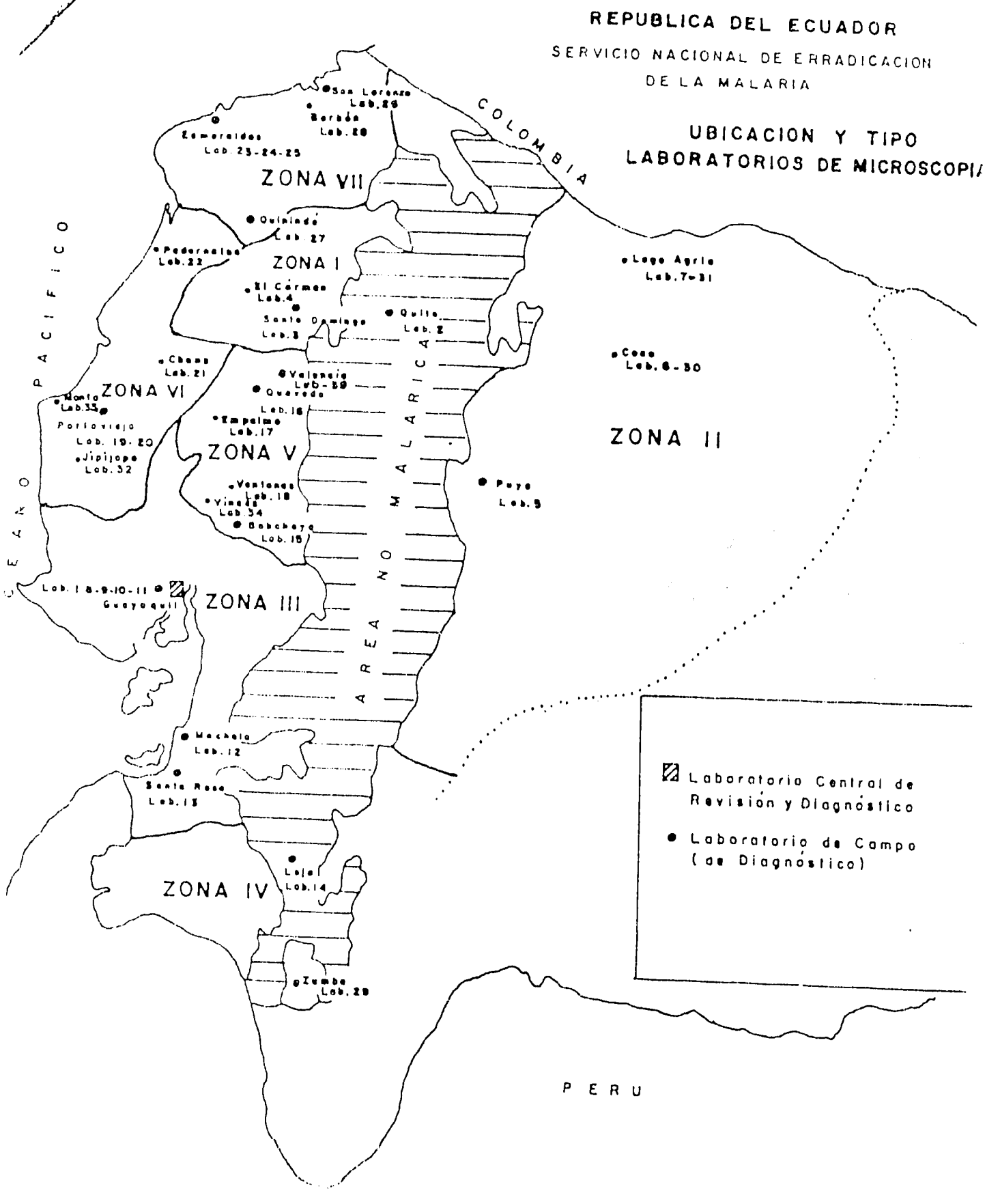
Table G-10

DISTRIBUCION DE LOS LABORATORIOS DEL SNEM CON PERSONAL DE MICROSCOPISTAS A NIVEL CENTRAL Y ZONAL (JULIO 1984)

DEPENDENCIA	PERSONAL	LOCALIDAD	UBICACION	N.º LAB.
Lab. Central	1 Jefe			
"	1 Quimico			
"	4 Microscopist.	Guayaquil	Oficinas Centrales SNEM	1
"	2 Auxiliares			
ZONA I	1 Microscopist.	Quito	Instituto Nacional Higiene	2
"	1 "	Sto. Domingo	Jefatura Zona I SNEM	3
"	1 "	El Carmén	Distrito SNEM	4
ZONA II	2 Microscopist.	Puyo	Jefatura Zona II SNEM	5
"	2 "	Coca	Distrito SNEM	6-30
"	3 "	Lago Agrio	Distrito SNEM	7-31
ZONA III	3 Microscopist.	Guayaquil	Jefatura Zona III SNEM	8
"	1 "	"	Hospital Luis Vernaza	9
"	1 "	"	Hospital Guayaquil	10
"	1 "	"	Centro de Salud N.º 3	11
"	1 "	Machala	Distrito SNEM	12
"	1 "	Sta. Rosa	Hospital María de Lourdes	13
ONA IV	2 Microscopist.	Loja	Jefatura Zona IV SNEM	14
"	1 "	Zumba		29
ZONA V	1 Microscopist.	Babahoyo	Hospital Martín Icaza	15
"	2 "	Quevedo	Hospital General (INH)	16
"	1 "	El Empalme	Centro Salud-Hospital	17
"	1 "	Ventanas	Centro Salud-Hospital	18
"	1 "	Vinces		19
"	1 "	Valencia		35
ZONA VI	3 Microscopist.	Portoviejo	Jefatura Zona VI SNEM	19
"	1 "	"	Instituto Nacional Higiene	20
"	1 "	Chone	Laborat. Hospital General	21
"	1 "	Pedernales	Distrito SNEM	22
"	1 "	Jipijapa		32
"	1 "	Manta		33
ZONA VII	1 Microcopist.	Esmeraldas	Instituto Nacional Higiene	23
"	1 "	"	Lab. Hospital D. Torres	24
"	1 "	"	Jefatura Zona VII SNEM	25
"	1 "	San Lorenzo	Distrito SNEM	26
"	1 "	Quinindé	Distriro SNEM	27
"	1 "	Borbón	Centro Salud Hospital	28

Resumen : 1 Jefe Laboratorios de Microscopía
1 Quimico
4 Microscopistas Revisoras
41 Microscopistas de Zona

Table G-11



Dib. Gladys de Coral.

TABLE G-12

DISTRIBUCION GEOGRAFICA DE LOS ANOFELINOS EN EL ECUADOR

An. apicimacula Diar y Kab, 1906	Costa
An. eiseni Coquillet, 1902	Costa
An. intermedius (Peryassú, 1908)	Oriente
An. mattogrosensis Lutz y Neiva, 1911	Costa
An. mediopunctatus (Theobald, 1903)	Costa
An. neomaculipapus Curry, 1931	Costa
An. pseudopunctipennis Theobald, 1901	Costa-Sierra
An. punctimacula Dyar y Knab 1906	Costa
An. tibiamaculatus (Neiva, 1906)	Oriente
An squamifemur Antunes, 1937	Costa
An. vargasy Gabaldon-Cova García, Lopez 1941	Oriente
An. lutzi Cruz, 1901	Oriente
An. albimanus Wiedeman, 1820	Costa
An. aquasalis Curry, 1932	Costa
An. argyritarsis Robineau-Desvoidy, 1827	Costa
An. benarrochi Galbaldon-Cova García Lopez 1941	Oriente
An. darlingi Root, 1926	Oriente
An. noroestensis Galvaoy Lane, 1937	Oriente
An. nuñeztovari Gabaldón, 1940	Oriente
An. oswaldoi Peryassú, 1922	Oriente
An. rangeli Gabaldón, Cova-García-López, 1940	Oriente
An. triannulatus Neiva y Pinto, 1922	Costa
An. bambusicolus Kmp, 1937	Oriente
An. boliviensis Theobald, 1905	Oriente
An. Cruzii Dyar y Knab	Oriente
An. neivai Howard, Dyar y Knab	Costa-Oriente
An. kompi, Edwars, 1930	
An gomezdelatorrei Levi-Castillo 1955	Sierra

TABLE G-13

PRUEBAS DE SUSCEPTIBILIDAD REALIZADAS EN LA ZONA VII DE ESMERALDAS DEL SNEM

FECHA	LOCALIDAD	SECTOR	ESPECIE	INSECTICIDA CONCENTRACION	% MORTALIDAD	RESULTADOS R	VR	S
II-82	La Propicia	2	A. albimanus	D.D.T. 4.0%	100 %			X
II-82	La Propicia	2	A. albimanus	D.D.T. 4.0%	74.7%	X		
II-82	La Propicia	2	A. albimanus	D.D.T. 4.0%	79.5%	X		
V-82	La Propicia	2	A. punctimacula	D.D.T. 4.0%	91.7%		X	
VI-82	La Palma	2	A. punctimacula	D.D.T. 4.0%	80 %	X		
VI-82	La Palma	2	A. punctimacula	D.D.T. 4.0%	100 %			X
VI-82	Lagarto	2	A. albimanus	D.D.T. 4.0%	98 %			X
X-82	Tacusa	2	A. albimanus	D.D.T. 4.0%	95 %		X	
X-82	Tacusa	2	A. albimanus	D.D.T. 4.0%	96 %		X	
XII-82	Carret.Quininde.Esm.	2	A. punctimacula	D.D.T. 4.0%	62.6%	X		
XII-82	Hacienda Rio Blanco	3	A. punctimacula	D.D.T. 4.0%	51.7%	X		
XII-82	Hacienda Rio Blanco	3	A. punctimacula	D.D.T. 4.0%	75 %	X		
XII-82	Santa Rosa	3	A. punctimacula	D.D.T. 4.0%	57.7%	X		
XII-82	Santa Rosa	3	A. punctimacula	D.D.T. 4.0%	66.3%	X		
III-82	Chumunde	2	A. punctimacula	D.D.T. 4.0%	62.6%	X		
III-82	Las Guantas	2	A. albimanus	D.D.T. 4.0%	92 %		X	
III-82	Las Guantas	2	A. albimanus	D.D.T. 4.0%	94.6%		X	
III-82	Mutile	2	A. albimanus	D.D.T. 4.0%	89 %		X	
IX-82	Salima	4	A. albimanus	D.D.T. 4.0%	98.6%			X
IX-82	Salima	4	A. albimanus	D.D.T. 4.0%	100 %			X
IX-82	Boca del Sucio	4	A. punctimacula	D.D.T. 4.0%	91.1%		X	
IX-82	Boca del Sucio	4	A. punctimacula	D.D.T. 4.0%	96 %		X	
X-82	Tonchigue	2	A. albimanus	D.D.T. 4.0%	99 %			X
X-82	La Propicia	2	A. albimanus	D.D.T. 4.0%	95 %		X	
X-83	La Propicia	2	A. albimanus	D.D.T. 4.0%	96 %		X	
I-84	Atacames	2	A. punctimacula	Fenitrothion 1%	100 %			X
I-84	Atacames	2	A. albimanus	Fenitrothion 1%	100 %			X
I-84	Atacames	2	A. albimanus	Fenitrothion 1%	100 %			X
I-84	La Propicia	2	A. albimanus	Fenitrothion 1%	100 %			X
II-84	Atacames	2	A. albimanus	D.D.T. 4.0%	93 %		X	
II-84	Atacames	2	A. albimanus	D.D.T. 4.0%	94 %		X	

FECHA	LOCALIDAD	SECTOR	ESPECIE	INSECTICIDA CONCENTRACION	% MORTALIDAD	RESULTADOS R	VR	S
III-84	San Jose	2	A. albimanus	D.D.T. 4.0%	99 %			X
IV-84	Timbre	2	A. albimanus	Fenitrothion 1%	100 %			X
IV-84	La Tola	1	A. albimanus	D.D.T. 4.0%	97.3%			X
VI-84	Timbre	2	A. albimanus	Fenitrothion 1%	100 %			X

Resultados: R. Resistencia - 80% Mortalidad
V.R. Verif. Reguerida - 80-97% Mortalidad
S. Susceptible - 98-100% Mortalidad

NOTA: Las pruebas con D.D.T. se efectuaron a una hora de exposición
Las pruebas con FENITROTHION se efectuaron a dos (2) horas de exposición.

No. PRUEBAS	ESPECIE	NOMBRE DE LOCALIDAD	CANTON	PROVINCIA	CONCENTRACION DEL INSECTICIDA	No. DE MOSQUITOS USADOS.	PORCENT DE MORT
1	A. albimanus	HDA.ROSA ELVIRA	IAGUACHI	GUAYAS	D.D.T 4.0%	100	76%
2	A. albimanus	" " "	"	"	"	100	100%
3	A. albimanus	" " "	"	"	"	98	98%
1	A. punctimacula	" " "	"	"	"	100	100%
1	A. albimanus	SANTA LUCIA	DAULE	"	"	100	94%
2	A. albimanus	" "	"	"	"	100	92%
3	A. albimanus	" "	"	"	"	100	93%
4	A. albimanus	" "	"	"	"	100	98%
5.	A. albimanus	" "	"	"	"	100	100%
1	A. albimanus	BABAHOYO	BABAHOYO	LOS RIOS	"	100	92%
2	A. albimanus	" "	"	"	"	100	97%
1	A. punctimacula	" "	"	"	"	75	65%
2	A. punctimacula	" "	"	"	"	100	100%
1	A. albimanus	LAGARTO	ESMERALDAS	ESMERALDAS	"	100	98%
1	A. punctimacula	LA PALMA	"	"	"	80	80%
2	A. punctimacula	" "	"	"	"	100	100%
3	A. punctimacula	LA PROPICIA	"	"	"	80	92%

NO. RUMBAS	ESPECIE	NOMBRE DE LOCALIDAD	CANTON	PROVINCIA	CONCENTRACION DE INSECTICIDA	Nº DE MOSQUITOS USADOS.	PORCENTAJ DE MORTAL
1	A. punctimacula	CHUMUNDE	ESMERALDAS	ESMERALDAS	D.D.T. 4.0%	75	62.4%
1	A. albimanus	LAS GUANTAS	"	"	"	75	92%
2	A.aalbimanus	" "	"	"	"	75	94.4%
3	A. albimanus	" "	"	"	"	75	(a)
-	A. punctimacula	BABAHOYO	BABAHOYO	LOS RIOS	"	80	100%
.	A. albimanus	"	"	"	"	100	93%
2	A. albimanus	"	"	"	"	100	99%
2	A. punctimacula	"	"	"	"	75	94.4%
3	A. punctimacula	"	"	"	"	100	99%
	A. albimanus	EL EMPALME	EL EMPALME	GUAYAS	"	100	98%
	A. punctimacula	" "	"	"	"	75	92%
	A. punctimacula	" "	"	"	"	75	92%
	A. albimanus	QUEVEDO	QUEVEDO	LOS RIOS	"	100	100%
	A. punctimacula	" "	"	"	"	100	99.2%
	A. albimanus	SALIMA	MUISNE	ESMERALDAS	"	75	99%
	A. albimanus	"	"	"	"	75	100%
	A. punctimacula	BOCANA DEL SUCIO	"	"	"	100	93%
	A. punctimacula	" "	"	"	"	80	96.2%
	A. punctimacula	QUEVEDO	QUEVEDO	LOS RIOS	"	45	87%
	A. punctimacula	EMPALME	EL EMPALME	GUAYAS	"	30	93.3%

(a) Prueba no válida

a 96 minutos de exposición

PRUEBAS DE SUSCEPTIBILIDAD AÑO: 1 9 8 4

No. DE PRUEBAS	E S P E C I E	N O M B R E DE L O C A L I D A D	C A N T O N	P R O V I N C I A	CONCENTRACION DEL INSECTICIDA.	Nº MOSQUITOS USADOS	PORCE DE MORTAL
1	A. albimanus	BABAHOYO	BABAHOYO	LOS RIOS	FENITROT.1.0	100	100%
1	A. albimanus	"	"	"	MALATHION5.0	100	100%
1	A. albimanus	HDA.TENGUEL	ROCAFUERTE	MANABI	D.D.T 4.0	100	100%
2	A. albimanus	"	"	"	FENITROT.1.0	100	100%
1	A. punctimacula	LA SEQUITA	PORTOVIEJO	"	D.D.T. 4.0	100	89%
2	A. punctimacula	"	"	"	FENITROT.1.0	100	100%
3	A. punctimacula	"	"	"	D.D.T. 4.0	100	98%
4	A. punctimacula	"	"	"	D.D.T. 4.0	100	95%
3	A. albimanus	BABHOYO	BABHOYO	LOS RIOS	D.D.T. 4.0	100	97%
4	A. albimanus	"	"	"	D.D.T. 4.0	100	100%
5.	A. albiamnus	"	"	"	D.D.T. 4.0	100	100%
1	A. punctimacula	"	"	"	D.D.T. 4.0	45	97.6%
1	A. albimanus	JAMA	BAHIA DE CARAQUEZ	MANABI	D.D.T. 4.0	100	98%
2.	A. albimanus	"	"	"	FENIT. 1.0	100	100%

(+) Prueba a 90 minutos de exposición

(x) Prueba a 120 " " "

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Table G-14

POBLACION Y SUPERFICIE DEL AREA MALARICA POR CANTONES DE LA REGION ORIENTAL DEL ECUADOR *

PROVINCIA	CANTON	POBLACION	SUPERFICIE (KM2)
NAPO	Aquarico	3.527	8.100
	Lago Agrio	29.220	2.049
	Orellana	32.396	7.689
	Putumayo	3.366	4.980
	Sucumbíos	2.537	3.021
	Archidona	16.667	1.793
	Tena	26.108	4.607
	Total Provincia:	113.821	32.239
PASTAZA	Pastaza	1.407	23.995
	Mera	11.642	924
	Total Provincia:	13.049	24.919
MORONA SANTIAGO	Morona	18.344	17.145
	Limón Indanza	10.005	1.951
	Palora	5.015	850
	Sucúa	12.043	1.990
	Santiago	7.998	1.820
	Gualaquiza	9.332	2.484
	Total Provincia:	62.737	26.240
ZAMORA CHINCHIPE	Chinchipe	7.758	181
	Yacuambi	2.725	105
	Zamora	37.988	2.613
	Total Provincia:	48.471	2.899

* Datos de población correspondientes a 1983

25 de Octubre 1984

4. Supplemental Tabular and Graphic Data

G-1 Response of *P. falciparum* to Chloroquine
G-2 Malaria Surveillance Results, 1982-84
G-3 Malaria Incidence by Province, 1974-83
G-4 Malaria Incidence by Province, 1977-1983
G-5 Malaria Incidence Patterns, First Semester, 1982-84
G-6 Malaria Incidence vs. Houses Sprayed, 1957-83.
G-7 SNEM Spray Schedule, Second Semester, 1984.
G-8 SNEM Spray Brigades, 1984.
G-9 SNEM Transport in Service, July 1984.
G-10 Distribution and Staffing of SNEM Laboratories, July 1984
G-11 Map of SNEM Laboratories.
G-12 Geographic Distribution of Anophelines in Ecuador.
G-13 Vector Susceptibility Tests, 1984.
G-14 Population and Size of Malarious Areas of the Oriente by Cantones.

Institutional and Administrative Analysis

1. Organizational Development

The Ecuadorean Malaria Eradication Service, SNEM, was created in 1955, twelve years prior to the formation of the Ministry of Health of which it now forms a part. SNEM originated under the auspices of the Ministry of Social Welfare and Health as part of a continental plan supported by PAHO and UNICEF for the eradication of malaria. Since that time, SNEM has grown steadily and relatively stably to its present size of 1,100 employees. Its operations and effectiveness have fluctuated significantly, however, largely due to presence or absence of complementary external resources and/or outbreaks of malaria. During the early period of 1955-64, SNEM functioned as one of the U.S./Ecuadorean Servicios, with joint direction by US health professionals, and during 1960-64 a large AID malaria loan was successfully implemented by SNEM. From its origins to the present day, SNEM has operated as a vertical program under the organizational umbrella of health or welfare ministries. Today, however, there is a desire and need for greater coordination and integration with general health services as well as other agencies both private and public. The present AID Malaria Project will help to achieve this objective.

In the 1980s, important organizational changes as well as economic crises have affected SNEM's functioning. Under a 1982 MOH reorganization, two Subsecretariats were created, one for the coast and one for the sierra with oriente provinces reporting directly to the Minister. SNEM, with headquarters in Guayaquil, was then placed under the coastal Subsecretariat. This has had very negative consequences, since the greatest malaria problems are in Esmeraldas Province, organizationally under the Sierra Subsecretariat, and oriente provinces, which report directly to the Minister. Thus, the SNEM Director had three lines of authority above him. Recognizing this situation, the MOH announced in October, 1984 a new restructuring, eliminating all but Guayas Province and the malaria-free Galapagos Islands from the Coastal Subsecretariat's jurisdiction, at the same time placing SNEM directly under the General Subsecretariat for Health and Director General, see MOH Organization Chart, attached). This new arrangement should greatly facilitate SNEM's ability to administer this Project.

A second important development in the 1980s has been the institution of collective bargaining/labor contract between SNEM and nearly its entire work force, including first line supervisors. The first labor contract ran from 1980-82, the second contract expires in January, 1985. Negotiations are now beginning for a new five year labor agreement, which would give the SNEM labor peace throughout LOP, but which could also result in higher labor costs.

Rising labor costs under these collective bargaining agreements, combined with the current GOE economic crises and severe flooding in malarious areas, has led to SNEM's budgetary problems of the 1980s. Intradomiciliary spraying was cut back due to lack of funds for importing insecticides while flooding hampered access to malaria areas, contributing to the rapid rise in malaria during 1983 and 1984. While the rapidly deteriorating malaria situation is

cause for alarm, it also presents the GOE with a new opportunity to revive public interest in attacking the malaria problem and internally for SNEM to adapt innovative solutions.

The present Project is designed in part with the objective of fortifying SNEM as an organization to meet these new demands of the decade of the 1980s.

2. SNEM Internal Organization and Operations

The Malaria Service is administered under a 3-tier structure: Central, Zonal and Sector levels. At the Central level, in Guayaquil, there are three Departments under the Director's Office (see Figure 2): General Administration, Field Operations and Epidemiology. General Administration has 12 professionals specializing in all key administrative areas. Field Operations is currently understaffed as the Chief and Assistant Chief positions are vacant. The Operations Chief is also designated as the Deputy Director of SNEM.

While it is probably good that most operations people are in the field, this Department is responsible for spraying of 300-400,000 homes two to four times a year, supervision of seven Zone Offices, programming and information system duties. SNEM will therefore fill these vacancies in the Operations Department to insure successful project implementation.

The Epidemiology Department includes an Epidemiology Section with three MD Epidemiologists; an Entomology Section with an MD Chief and five assistants; an Education Section with one health educator and a Parasitology Lab. While little education is being performed, there is a lab technician/microscopist course of three months duration under the auspices of this Division. Rather than attempting to increase SNEM health education staff, this Project will aim at incorporating the MOH health education division into the malaria program.

Seven Zone Offices (excluding the malaria-free central highlands and Galapagos islands) are responsible for regional administration of the malaria program. Each Zone Office has a Chief (MD), Entomology Assistant, an Administrator, a paymaster, warehouse director and maintenance shop. Some Zone Offices are responsible for an enormous territory: for example, the Zone II, Oriente office headquarters in Puyo is a 2-3 day trip from some of its outlying areas. With the rapid increase in malaria cases in the Oriente (six fold increase in Napo from 1982 to 1983), it is likely that a new Zone Office will be created in Lago Agrio, responsible for North Oriente, due to the distance from the Puyo Office. Vehicle repairs as well as outboard motor repairs are obviously difficult on a timely basis over the long distances in the Oriente zone.

The Zone Organization is similar to that of the central level with a Physician-malarialogist in charge, an administrator, paymaster, warehousemen and repair shop. The policy now exists whereby Zone Chiefs are named directly by the Minister of Health, not the SNEM Director. This would appear to lend itself to political, non-career appointments. Fortunately, practice the

tenures of Zone Chiefs have been very stable despite frequent ministerial changes.

SNEM field operations are primarily executed at the Sector Level. The seven zones are divided into 47 sectors. Each sector has a chief, at least one laboratory/technician, 2-3 brigades of spraymen (each brigade with 4-5 people, including the brigade chief), and an Evaluator (Supervisor) for each brigade. In addition, each sector has a network of voluntary collaborators, totalling some 6,000 nationwide. Over 500 MOH and MOD health centers, posts and hospitals also participate as collaboration points, their role usually limited to taking blood smears for sending to SNEM, and referral of patients to SNEM after an initial dose of chloroquine for presumed cases.

Brigades can spray seven houses per man per day on average, but can and sometimes do participate in activities other than spraying, including active case finding, *Aedes aegypti* control, yellow fever vaccination and periodic MOH mass vaccination campaigns. If transport problems can be resolved and in areas where DDT is still effective, requiring only two spray cycles annually, there are sufficient brigades to meet the need. However, much of the vehicle fleet is now six to ten years old and either is unserviceable or requires prohibative maintenance costs. Many areas require outboard motors and boats, also in frequent short supply or disrepair. The sector chief in Lago Agrio sector of Zone II, for example, has a truck, one motorcycle and one boat for the three supervisors; two spray brigades have no transport at all, except public buses or whatever they can muster up ad hoc. An inventory of the SNEM transport situation is found in Annex G, Table G-9. This factor explains the heavy emphasis placed on vehicle procurement under the proposed project (see Section V, Financial Plan).

The sector supervisors make regular monthly rounds to verify spraying activities, restock medication at collaborator posts and pick up blood smears from these collaborators. As noted elsewhere, there are often great time lags between the taking of a blood smear and the reporting back to the field of the examination conclusion.

The Voluntary Collaborator network represents a potentially massive outreach mechanism to combat malaria, with over 6,000 persons involved. The collaborators take blood samples, provide treatment with chloroquine and may do active case finding. Their potential effectiveness is only partially realized at present due to several factors. With the decline of malaria in the 1970s, many collaborators found themselves with little to do. High turnover, lack of funds for in-service training ,educational material or even minimal non-economic incentives, have led to a decline in the impact of this network, the precise extent of which is unknown but needs further study. The institutional strengthening of SNEM under this project will be extended to the collaborators. Planned actions to be financed in addition to short-term training include diplomas, distinctive badges or other symbol, possibly uniforms, and signs, identifying their residences. An intensive review of the collaborator situation will be carried out at the outset of the project to identify precisely what activities to include, and could be part of the community baseline study for educational purposes (see Section V, Financial Plan, Operational Research).

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3. GOE Administrative Capacity to Implement the Project

Past history has shown that when adequate resources are provided to SNEM, malaria has been contained at tolerable public health levels. With each new epidemic, however, the complexity of the central problem increase, added to which is SNEM's new mandate to include other vector borne diseases in the central program.

Currently, SNEM is executing a 400 million sucre budget. The record of expenditures vs. appropriations is very good as SNEM has succeeded in disbursing its entire budget, an achievement not common among GOE agencies. Under this project, SNEM will have a substantially larger budget to administer, entirely apart from the management of additional resources financed by AID. This will put a strain on their capacity, but AID expects SNEM to be able to adequately administer these funds. Most of the loan funds will be absorbed by three major procurements for insecticides ($2.7 million), transport ($1.5 million) and medicines ($0.4 million) requiring procurement action by AID. SNEM will of course have to arrange for receipt, storage and distribution. Secondly, under the master technical assistance contract AID will provide an experienced long-term advisor-cum-project assistant manager working within SNEM. This individual will be especially helpful in liaison with USAID headquarters and in developing the operations research and training implementation actions. Finally, under the master contract, the project will provide extensive short and long term training and TA to SNEM staff, much of which will strengthen their ability to manage the program.

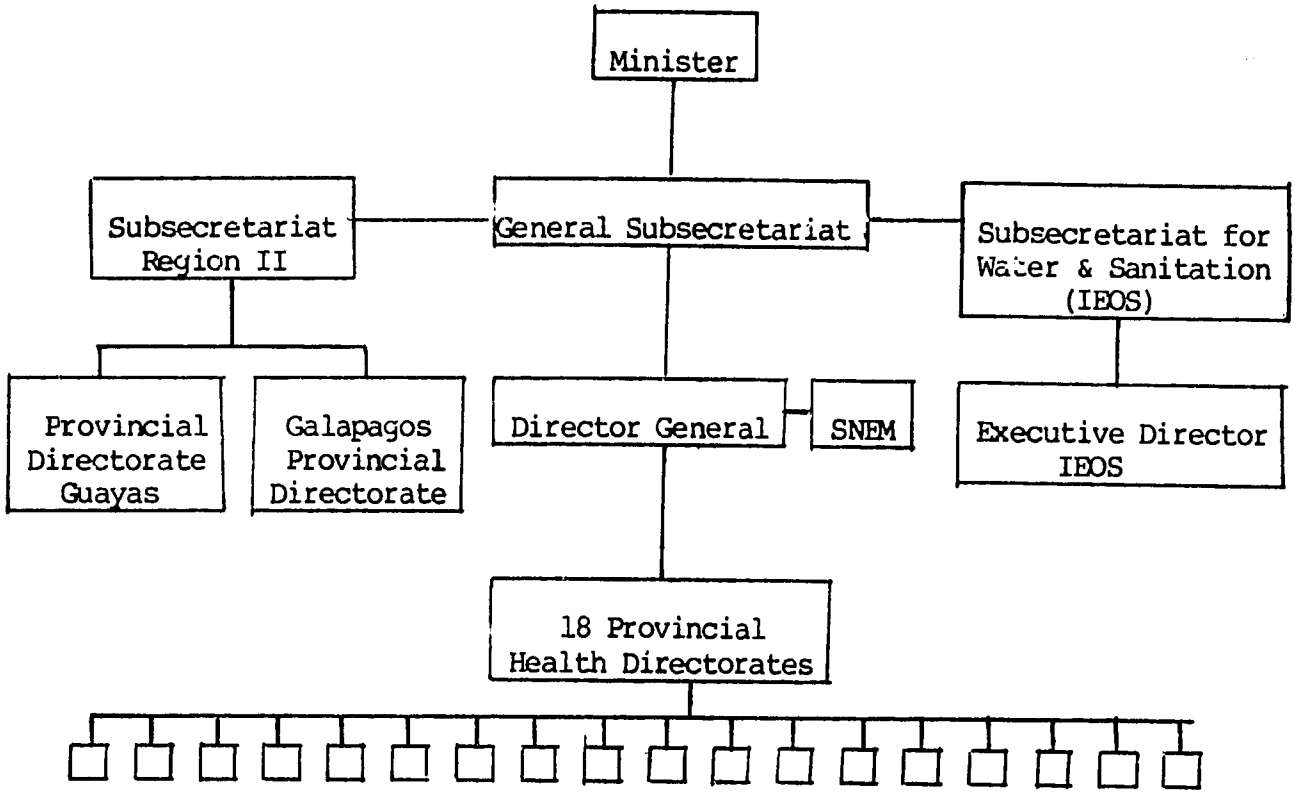
SNEM is admittedly short-staffed in its Field Operations Division-Headquarters Office. AID is confident, that the positions of Division Chief and Assistant Chief will be filled within three months of the signing of the Project Agreement and prior to expected arrival of the long term advisor. It is also planned that the incumbent of one of these two positions be specifically designated as project coordinator for this project and trained to understand both AID and host country procurement regulations. The first year project evaluation will also specifically address the question of SNEM's administrative capacity to achieve project goals.

Beyond SNEM, other MOH elements also need to be actively involved in this project if the goal of a broad-based institutional support for malaria control is to be realized. Plans are being made to establish a GOE Project Implementation Committee, to include the Director General of Health and key MOH Provincial Health Chiefs (i.e., Esmeraldas, Napo), along with the SNEM Director and Operations Chief. The Director General will be responsible for inclusion of presumptive malaria treatment as an integral part of MOH operating units for primary health care. To implement joint actions with the Ministry of Defense, an MOD official is also expected to be on the implementation team.

To insure optimal field level implementation, a model being successfully implemented in Esmeraldas Province will be followed nationally. Here the [illegible] Zone Chief and the MOH Provincial Health Director work as a team, holding regular joint planning meetings, sharing transport as necessary, and being mutually supportive in the field on a regular basis.

Figure No. 1

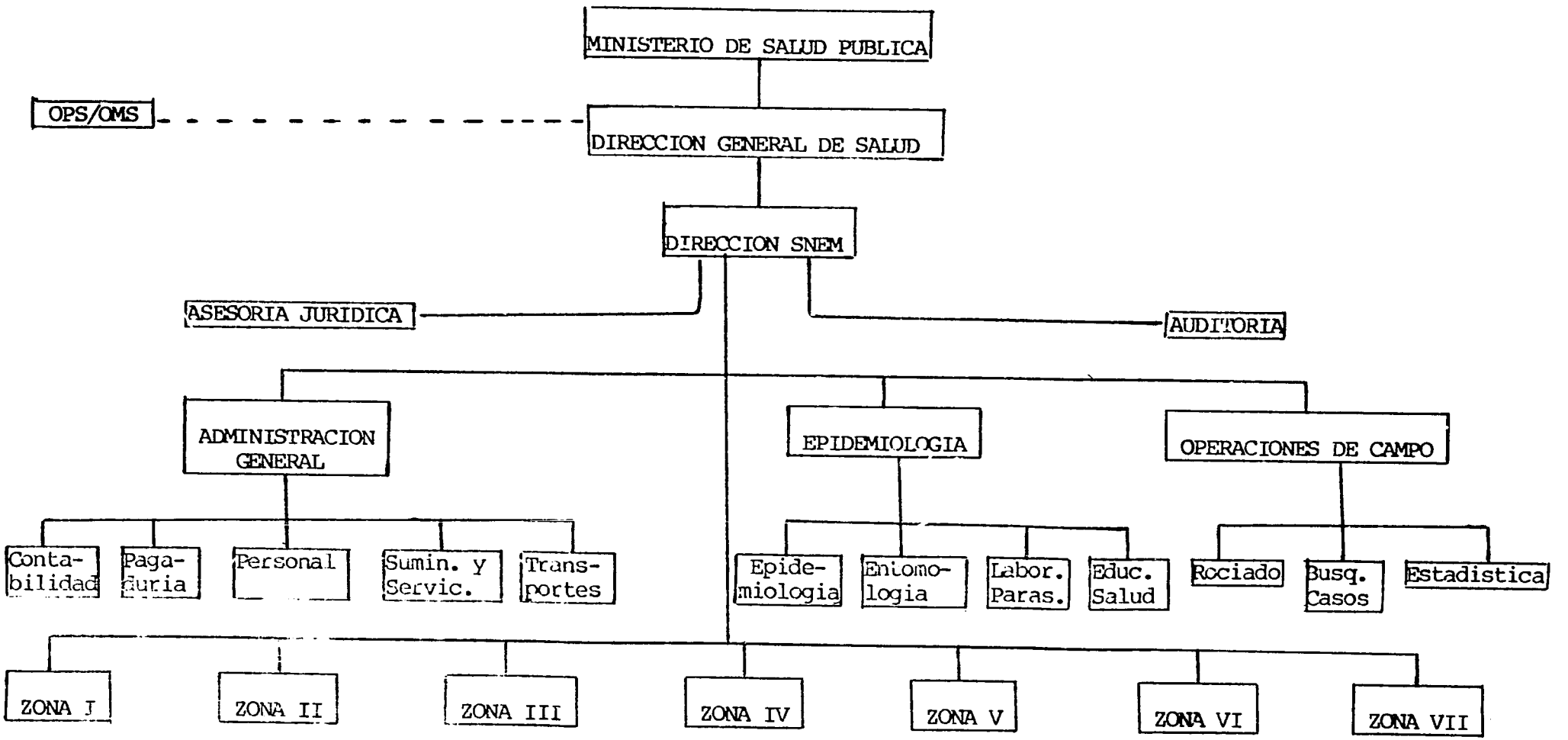
MOH Organization Chart*

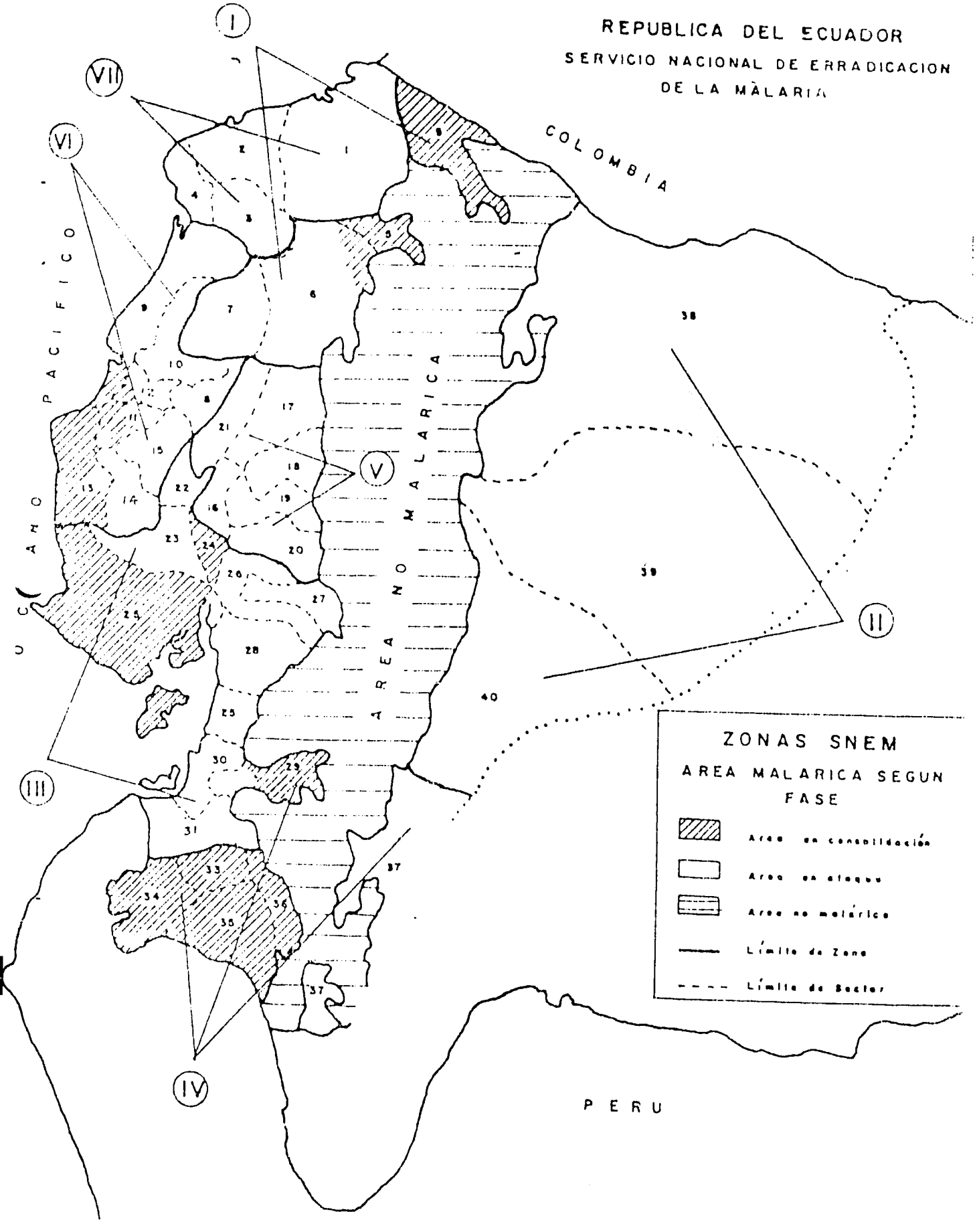


* This is a partial organigram based on new organization decreed by Minister of Health in October, 1984. No official version yet available.

Figure No. 2

SNEM ORGANIZATION CHART





Dib. Gladys de Corpi

DISTRIBUTION OF SNEM PERSONNEL BY FUNCTIONS AND BY ZONES - 1984

CL	FICATION	CENTRAL OF.			ZONE I			ZONE II			ZONE III			ZONE IV			ZONE V			ZONE VI			ZONE VII		
		P	O	V	P	O	V	P	O	V	P	O	V	P	O	V	P	O	V	P	O	V	P	O	V
1.	SNEM Director	1	1	0																					
2.	Lawyer, class 4	1	1	0																					
3.	Edic., class 10	1	1	0																					
4.	Financial Director	1	1	0																					
5.	Public Relations Chief, Class 3	1	1	0																					
6.	Chief Accountant, class 3	1	1	0																					
7.	Accountant, class 3	1	1	0																					
8.	General Treasurer, class 1				1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	0	1
9.	General Treasurer, class 3	1	1	0																					
10.	Asst. Adm. Anal., class 1	1	0	1																					
11.	Executive Officer	1	1	0																					
12.	Senior Logistician	1	0	1																					
13.	Maint. Shop Foreman	1	1	0																					
14.	Executive Officer				1	1	0	1	1	0	1	1	0	1	1	0				1	1	0	1	0	1
15.	Doctors, class 5	1	1	0																					
16.	Doctors, class 4	2	2	0	1	1	0	1	0	1	3	3	0	1	1	0				1	1	0	1	1	0
17.	Biochemist	1	1	0																					
18.	Microbiologist	2	1	1																					
19.	Health Subs.	1	1	0																					
20.	Civil Engineer, Class 4	1	0	1																					
21.	Sanitary Engineer, Class 5																1	1	0						
22.	Statistician	1	1	0																					
23.	Directorate Secretary	1	1	0																					
24.	Driver	7	6	1	5	3	2	1	1	0	9	8	1	2	2	0	8	8	0	5	4	1	1	2	-1
25.	Janitor or Messenger	4	4	0	1	0	1	1	1	0	2	2	0	1	1	0	1	1	0	1	1	0	1	0	1
26.	Office Machine Operator	1	1	0																					
27.	Clerk	1	1	0										1	0	1									
28.	Assistant Accountant, class 3	1	1	0																					
29.	Assistant Accountant	1	1	0																					
30.	Auxiliary Accountant, class 2	1	1	0																					
31.	Warehouse Keeper	1	1	0	1	0	1	1	1	0	1	1	0				1	1	0	1	1	0	1	1	0
32.	Supplier	1	1	0																					
33.	Guard	5	4	1	2	1	1	2	1	1	3	2	1				2	1	1	2	1	1	2	1	1
34.	Collaborator Support	5	3	2							1	1	0												
35.	Mechanic	6	6	0	1	1	0				1	1	0	1	1	0				1	1	0			
36.	Entomology Asst.	4	4	0				1	0	1	1	0	1	1	1	0	1	0	1	1	1	0	4	4	0
37.	Microscopists	5	4	1	2	2	0	1	1	0	0	7	1	1	2	-1	3	5	-2	4	4	0	4	1	-2
38.	Statistial Secretary	2	2	0																					
39.	Field microscopist				1	0	1				1	0	1	1	0	1							1	0	1
40.	Social Service Asst.				1	0	1				10	8	2				2	2	0	2	4	-2	2	1	1
41.	Secretaries	6	6	0	3	3	0	2	2	0	4	4	0	2	1	1	2	2	0	2	2	0	3	3	-1
42.	Sanitary Inspector				3	4	-1	5	3	2	13	11	2	5	10	-5	7	7	0	12	11	1	[illegible]	[illegible]	[illegible]
43.	Sanitary Workers				1	0	1	2	0	2	2	4	-2				2	0	2				[illegible]	[illegible]	[illegible]
44.	Malaria Inspector				21	20	1	29	23	6	60	53	7	26	17	9	42	36	6	56	43	[illegible]	29	34	-5
45.	Field Supervisor				1	1	0	1	1	0	3	3	0	1	0	1	1	1	0	1	1	[illegible]	1	1	0
46.	Maintenance Asst.	1	0	1																					
47.	Warehouse Technician	1	1	0																					
48.	Rural Doctor																1	0	1						
49.	Agronomist, class 4	1	1	0																					
50.	Asst. Accountant class1	1	0	1																					
51.	Entomology Assistant																								
TOTAL		77	67	10	46	38	8	49	36	13	124	110	14	45	38	7	75	66	[illegible]	[illegible]	83	[illegible]	[illegible]	[illegible]	[illegible]

PROJECTED SNEM BUDGET

1985 - 1989

(SUCRES 000)

	1985	1986	1987	1988	1989
Salaries	330,695	344,709	430,886	430,886	538,607
Contract Services	16,040	20,050	25,062	27,568	30,324
Supplies and Equipment	103,257	129,000	161,250	177,375	195,112
Capital Equipment and Construction	2,000	2,000	3,000	3,000	3,000
Yellow Fever Vaccination	3,000	3,750	4,000	4,500	4,500
TOTAL	454,992	499,509	624,198	643,329	771,543
GENERAL TOTAL			S/.3,788,157		

OTHER VECTOR BORNE DISEASES

A. Onchocerciasis

Onchocerciasis (river blindness) is recognized by W.H.O. as one of the six most serious public health problems in the tropics. Total blindness is common, and those less severely infected suffer from premature aging. In economic terms, it has been shown that the disease costs the countries affected tens of millions of dollars every year in reduced productivity alone. No treatment is known; the only recourse is prevention. Today foci of onchocerciasis are found in the west coast of Africa from Sierra Leone to the Congo and in the east for Sudan to Malawi. In the New World, the disease occurs in Guatemala, Mexico, Venezuela, Brazil, Colombia and Ecuador.

Onchocerciasis is caused by the cutaneous filaria Onchocerca volvulus. The tiny female black fly of the genus Simulium is the carrier of the disease and is generally found close to rivers where she lays her eggs. The black fly needs to suck blood for its eggs to mature. The cycle begins when a young black fly feeds on the blood of a human already suffering from onchocerciasis. The black fly herself becomes infected. In turn she then infects other humans with the onchocercal larva.

Upon infection, skin lesions form. These generally take on the form of an erythematous, vascular, pruritic rash, with altered pigmentation. With prolonged heavy infections, definite thickening of skin is common with formation of papules, dry, scaling epidermis and uneven depigmentation with persistent itching. Late complications include pendulous bags of skin in the groin with elephantiasis of scrotum and lower limbs. Eye lesions due to onchocercal infection are the most serious complication. The worm (or microfilaria) enters the eye, stimulating an inflammatory response. This causes much eye irritation and loss of visual acuity. When posterior eye lesions are caused by the worm, blindness occurs.

1. History

The first documented case of onchocerciasis in Ecuador occurred in 1952. A Dr. Jaime Rivadeneira, a pathologist, while doing a histopathological study on an eye from a resident in the Esmeraldas province, found microfilariae in the conjunctiva. This diagnosis was confirmed by a tropical disease specialist, Dr. Luis Leon. In 1977, a suspected tuberculous cervical nodule was removed from a young boy from the Rio Canandí area, Esmeraldas province, and upon histological study onchocerciasis was confirmed. In 1979, an epidemiological survey of the incidence of the disease was done on the Rio Cayapas, canton Eloy Alfaro, province of Esmeraldas, 100 kilometers upriver - an area populated by Blacks of African descent and Chachi, an indigenous Indian tribe. A total of 300 persons were examined and 73% prevalence of onchocerciasis was found. Based on these studies, a complete epidemiological study of onchocerciasis to determine its geographical distribution was undertaken in 1980-1982, using the methodology recommended by W.H.O.

2. Geographical Distribution and Prevalence

Onchocerciasis was found only in the province of Esmeraldas, the northernmost province of the country, (Figure I-1). The areas positive for onchocerciasis can be classified as one major focus, the Rio Santiago Basin (which includes 16 river tributaries and 39 communities with a population of 10,860), and 5 satellite foci found on separate distinct river systems. These satellite foci were formed by the migration of onchocercal positive persons from the major site. Prevalence of infection of each area is seen in Table I-1. The head waters of the Rio Cayapas (Rio Haulpi) had the heaviest infected area (85%), with a decrease of prevalence seen in communities approaching the mouth of the river. The incidence of infection varies among the several foci, depending on geographical location and the ethnic composition of the population. In both races, the incidence of disease was directly related to vector-control (Table I-2). Men had a higher infection rate than women.

3. Clinical Manifestations

The clinical features of onchocerciasis in Ecuador were the same as found in other foci world-wide. The clinical manifestations of the disease in Ecuador varied according to the geographical areas of endemicity (Table I-3). A large segment of the population positive for the disease had no clinical manifestations. However, it is apparent that the greater the intensity of disease due to transmission the more manifest the clinical features. This phenomenon also indicates that the infection is early in its development and of moderate intensity.

4. Ocular Pathology

The area of greatest importance in relation to onchocerciasis is the ocular damage it causes. The resulting loss of visual acuity and finally blindness greatly affects the life style and economical pattern of the people. In Ecuador, the posterior eye lesions which lead to blindness are the major eye problems of those infected with the disease (Table I-4). Some 1[illegible]% of those with onchocerciasis have permanent eye lesions, with loss of visual acuity; 2.5% already are blind. As the intensity of disease increases due to continued transmission by the vector (Simulium), the ocular pathology increases in frequency and intensity.

5. Vector

A pilot study on the Rio San Miguel has shown that there are two major black fly species that transmit the disease; Simulium exiguum and Simulium quad. Epidemiological surveys have shown that these vectors exist in both the coastal and eastern jungle areas of Ecuador--up to an elevation of approximately 1,000 meters.

FOCI OF ONCHOCERCIASIS IN THE PROVINCE OF ESMERALDAS - 1984

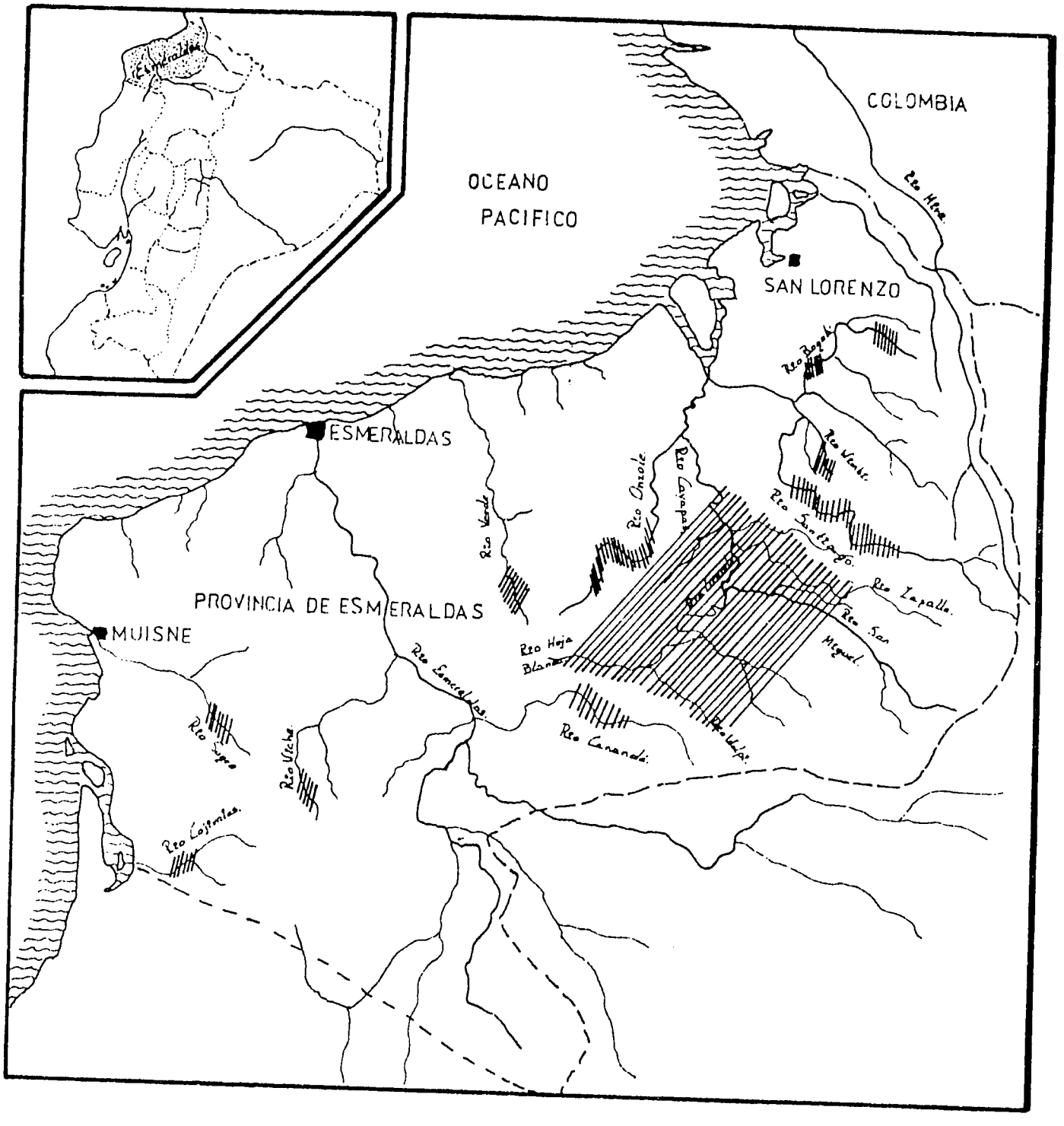


FIGURE I-1

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TABLE I-1

GEOGRAPHICAL DISTRIBUTION OF O. VOLVULUS INFECTIONS

AMONG RESIDENTS OF THE PROVINCE OF ESMERALDAS, 1980-82

Location	Examined (No.)	Prevalence (%)	Race (%) Chachi	Black
RIO SANTIAGO BASIN				
Rio Hualpi	13	85	100.0	00.0
Rio Hoja Blanca	64	82	100.0	00.0
Rio Chimbagal	194	80	100.0	00.0
Rio Grande	376	72	72.4	27.6
Rio San Miguel	412	57	71.8	28.2
Rio Zapallo	498	51	78.6	21.4
Rio Cayapas	2,494	27	36.4	63.6
Rio Camarones	158	22	100.0	00.0
Rio Zapallito	187	20	21.4	78.6
Rio Onzole	823	17	10.7	89.3
Rio Santiago	1,316	18	00.0	100.0
Rio Tululvi	37	32	100.0	00.0
Rio Huimbi	169	8	00.0	100.0
Rio Bogotá	82	1	00.0	100.0
SATELLITE FOCI				
Rio Verde	114	22	64.0	36.0
Rio Canande	392	17	89.5	10.5
Rio Viche	110	16	100.0	00.0
Rio Sucio	220	9	81.8	18.2
Rio Cojimies	172	1	59.1	45.9

Source: 1980-82 Epidemiological Survey by Dr. Ronald Guderian

TABLE I-2

RACE-SEX DISTRIBUTION OF THOSE POSITIVE FOR ONCHOCERCIASIS IN THE HYPERENDEMIC AND HYPOENDEMIC AREAS

	HYPERENDEMIC		HYPOENDEMIC	
	Examined	Positive	Examined	Positive
MEN	1,144 (14.6%)	744 (67.6%)	2,885 (36.8%)	561 (19.4%)
WOMEN	1,011 (12.9%)	592 (58.6%)	2,791 (35.7%)	308 (11.0%)
CHACHILLA	1,569 (20.0%)	1,003 (63.9%)	1,622 (20.7%)	257 (15.8%)
Men	832 (53.0%)	571 (68.6%)	826 (50.9%)	159 (19.2%)
Women	737 (47.0%)	432 (58.6%)	796 (49.1%)	97 (12.1%)
BLACKS	586 (7.5%)	365 (62.3%)	4,054 (51.8%)	613 (15.1%)
Men	312 (53.2%)	203 (65.1%)	2,059 (50.7%)	402 (19.5%)
Women	274 (46.8%)	160 (58.4%)	1,995 (49.3%)	211 (10.6%)

Source: 1980-82 Epidemiological Survey by Dr. Ronald Guderian

TABLE I-3

CLINICAL PRESENTATION AND FEATURES OF ONCHOCERCIASIS IN RESIDENTS OF HYPERENDEMIC AND HYPOENDEMIC AREAS IN ESMERALDAS PROVINCE

CLINICAL VARIANT	HYPERENDEMIC		HYPOENDEMIC	
	% of people examined	Incidence of clinical features (%)	% of people examined	Incidence of clinical features (%)
No clinical evidence of disease	42.1		84.6	
With clinical evidence of disease	57.9		15.4	
Skin				
Onchocercal modules		59.5		84.6
Macular papular rash		67.2		27.4
Ichthyosis		7.3		11.9
Lichenification		12.4		7.4
Macular dyspigmentation		7.6		6.0
Depigmentation		2.6		0.7
Edema		10.6		5.9
Lymph node				
Lymphadenitis, lymphedema of inguinal and crural nodes		11.4		0.0
Ocular				
Punctate Keratitis		87.7		81.5
Blindness		2.5		0.0

Source: 1980-82 Epidemiological Survey by Dr. Ronald Guderian

TABLE I-4

DISTRIBUTION BY RACE AND AGE OF THE TYPE OF OCULAR LESIONS
FOUND AMONG PATIENTS WITH OCULAR ONCHOCERCIASIS

Race and Age	Patients with Ocular Oncho.	Punctate Keratitis		Microfilariae in the anterior chamber		Iritis		Chorio-retinitis		Optic atrophy	
		No.	%	No.	%	No.	%	No.	%	No.	%
Chachi											
5-9	3	3	100.0	1	33.3	0	0.0	0	0.0	0	0.0
10-14	7	7	100.0	1	14.3	0	0.0	0	0.0	0	0.0
15-19	27	25	92.6	10	37.0	0	0.0	0	0.0	0	0.0
20-29	47	37	78.7	28	59.6	1	2.1	1	2.1	0	0.0
30-39	38	33	86.8	20	52.6	2	5.3	5	13.2	0	0.0
40-49	41	38	92.7	21	51.2	0	0.0	6	14.6	1	2.4
50+	43	38	88.4	22	51.2	3	7.0	11	25.6	0	0.0
total	206	181	87.9	103	50.0	6	2.9	23	11.2	1	0.5
Black											
5-9	6	5	83.3	2	33.3	0	0.0	0	0.0	0	0.0
10-14	12	11	91.7	2	16.7	0	0.0	0	0.0	1	8.3
15-19	20	16	80.0	9	45.0	1	5.0	3	15.0	3	15.0
20-29	31	22	71.0	116	51.6	0	0.0	6	19.4	1	3.2
30-39	30	23	76.7	14	46.7	1	3.3	4	13.3	3	10.0
40-49	50	43	86.0	13	26.0	2	4.0	6	12.0	4	8.0
50+	50	44	88.0	14	28.0	2	4.0	16	32.0	5	10.0
total	199	164	82.4	70	35.2	6	3.0	35	17.6	17	8.5
TOTAL	405	345	85.2	173	42.7	12	3.0	58	14.3	18	4.4

Source: 1980-82 Epidemiological Survey by Dr. Ronald Guderian

Transmission studies have shown that the fly prefers the lower limbs of man as its primary biting site. The transmission potential studies shown that 30-40 larvae are deposited with each bite. However, specific data concerning the vectors in all the other onchocercal foci are lacking. Because the disease is directly related to the transmission by the vector, obtaining base-line entomological data in each focus is a priority.

6. Surveillance

From January to August 1984, the onchocercal foci in the province of Esmeraldas were re-examined and there is evidence to show that all foci have active transmission of the disease except Rio Cojimies. In 1984, there is a 100% prevalence rate of disease (up from 51% to 85% in the period 1980-82) in the areas from Rio Zapallo to Rio Haulpi in the Rio Santiago Basin. In all the other foci, the prevalence of infection increased 10% over a two year period. However, these observations need to be confirmed by entomological studies. Due to the migration of young people from the major foci for employment reasons, small foci have now been detected in three other provinces.

B. Leishmaniasis

Leishmaniasis results from an infection of man with the protozoa of the genus Leishmania, which are normally parasites of canines and rodents. Transmission is effected by the sandfly of the genus Phlebotomus. The disease is characterized by a specific ulcerating granuloma of the skin, and in a proportion of cases, the mucocutaneous areas. After the depostion of the parasite by the bite of an infective female sandfly, an initial papule arises which, after scaling and crusting over, breaks down into a slowly extending and very indolent ulcer. Healing, which in some cases can occur spontaneously or with treatment, leaves a very depressed scar. In the case of some western hemisphere strains of the disease, mucocutaneous lesions have developed in nasopharyngeal tissues, even years after the primary lesion has healed or even when there has been no recognized initial lesion. This form of leishmaniasis can be fatal.

Since American leishmaniasis is always zoonotic, little can be done to control the source of infection. Care must be taken in setting new settlements in the forest, leaving a cleared strip of bush around dwellings to break contact between man and the forest. Use of insect repellents may be helpful for a limited time when work in the forest must be undertaken.

The occurrence of leishmaniasis is worldwide. It can be found in the Indian subcontinent, the Middle East, Africa and in every country of Central and South America.

1. History

The first documented study to show the existence and geographical distribution of leishmaniasis in Ecuador was done by Dr. Luis A. Leon in the 1940's. For some 30 years, the only effort made was to treat those who sought medical help. Documentation of reported cases was begun by the MOH Department of Epidemiology in 1979. No program of active case detection has ever been

initiated, so the data obtained represent only a fraction of the actual incidence. In 1982-83, Dr. Hashiguchi of Japan did a two year study on the natural reservoir host of Leishmania in the Provinces of Guayas and El Oro.

2. Clinical Manifestations

There are three clinical forms of the disease described in Ecuador, each caused by a distinct Leishmania species. The cutaneous leishmaniasis or oriental sore is caused by Leishmania tropica. This infection causes single or multiple ulcerative skin lesions. Although these lesions do not cause death, they are troublesome and unsightly. Once healed, many bear the typical scar of a healed sore. The second form, chicle ulcer, is caused by the species Leishmania mexicana. It is found in the low-lying rain forests and it is an occupational disease, attacking those who work in the interior parts of the rain forest. The lesions usually occur on the face, often beneath the lower eyelid or next to the ear. When it occurs on the pinna of the ear, a very chronic disfiguring lesion results. The third form, espundia or mucocutaneous lesions are caused by Leishmania braziliensis. The infection usually begins as a sore of the ordinary cutaneous type but soon there is metastasis to the mucocutaneous area of the nose and upper lip. Ulceration may destroy the whole nasal system and buccal cavity. Secondary infections are common. Death (which may occur) is largely attributable to secondary bacterial pneumonias.

3. Geographical Distribution

The geographical distribution of leishmaniasis (all three types included) is shown in Figure I-5. The Provinces of Pastaza and Morona Santiago in the amazonic regions are the most severely affected, followed by the Provinces of Napo and Esmeraldas in the coastal region. The reported cases of leishmaniasis in each province over the last five years is given on Table I. A general increase in reported incidence is noted; in clinical cases actually treated, the incidence of the disease in the last three years has greatly increased. In the first six months of 1984, some 190 cases have already been reported.

4. Control

A reduction in the incidence of leishmaniasis follows general sanitary measures which include removal of refuse and rubble where sandflies breed, and the provision of good housing. Residual spraying for malaria control has reduced the incidence of leishmaniasis in several areas, but with the interruption of the spraying program, the incidence of infection has increased in these areas.

FIGURE I-2

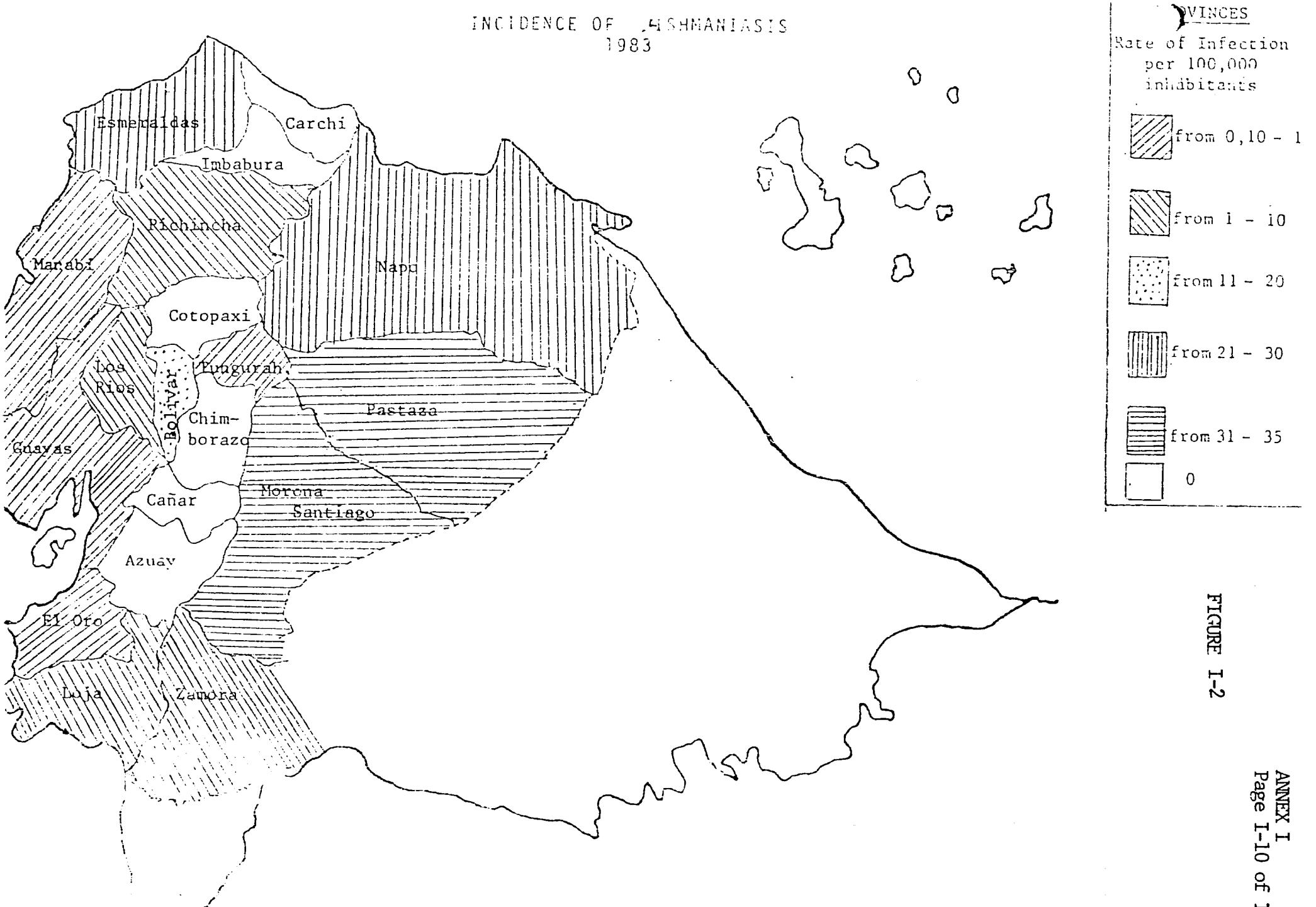
INCIDENCE OF LEISHMANIASIS
1983
PROVINCES
Rate of Infection per 100,000 inhabitants
from 0,10 - 1
from 1 - 10
from 11 - 20
from 21 - 30
from 31 - 35
0
Esmeraldas
Carchi
Imbabura
Pichincha
Napo
Manabi
Cotopaxi
Los Rios
Tungurahua
Bolivar
Chim-borazo
Pastaza
Guayas
Cañar
Morona Santiago
Azuay
El Oro
Loja
Zamora

TABLE I-5

INCIDENCE OF LEISHMANIASIS BY PROVINCES

YEARS: 1979-1983

PROVINCES	1979		1980		1981		1982		1983	
	CASES	RATE	CASES	RATE	CASES	RATE	CASES	RATE	CASES	RATE
Carchi	-	-	-	-	-	-	-	-	-	
Imbabura	-	-	-	-	1	0.38	-	-	-	-
Pichincha	77	6.04	79	5.94	80	5.05	122	8.57	65	4.39
Cotopaxi	-	-	7	2.52	-	-	1	0.34	-	-
Tungurahua	-	-	-	-	1	0.30	3	0.88	2	0.58
Bolívar	-	-	1	0.60	2	1.18	33	22.24	27	18.28
Chimborazo	-	-	-	-	-	-	-	-	-	
Cañar	-	-	-	-	-	-	-	-	-	
Azuay	-	-	-	-	-	-	-	-	-	
Loja	4	1.00	6	1.46	7	1.67	21	5.58	27	7.14
Esmeraldas	-	-	-	-	1	0.34	19	7.38	78	29.62
Manabi	-	-	1	0.10	-	-	-	-	1	0.11
Los Ríos	4	0.81	2	0.39	2	0.37	13	2.73	8	1.65
Guayas	-	-	1	0.05	-	-	10	0.47	3	0.14
El Oro	1	0.29	-	-	-	-	-	-	2	0.55
Napo	1	1.16	-	-	5	5.13	37	31.55	30	23.71
Pastaza	1	3.77	5	18.57	1	3.66	3	9.13	11	32.18
Morona Santiago	-	-	2	2.83	3	4.07	1	1.38	25	33.17
Zamora Chinchipe	-	-	-	-	-	-	-	-	5	9.96
Galápagos	-	-	-	-	-	-	-	-	-	
TOTAL	88	1.09	104	1.24	103	1.19	263	3.16	284	3.32

Rate per 100,000 inhabitants

C. Chagas' Disease

The disease was first described in central Brazil in 1909 by Carlos Chagas. In his unique monograph, he described the parasite, the disease it causes in humans and the characteristics of infection in experimental animals, as well as the vector and its ecology. His studies of the clinical manifestations and electrocardiographic alterations of chronic Chagas' cardiomyopathy received little attention until the late 1940's.

American trypanosomiasis or Chagas' disease is an acute and chronic infection caused by Trypanosoma cruzi. T. cruzi is a protozoon that occurs in man as a hemoflagellate and as an intracellular parasite without an external flagellum. The adult trypanosomes are ingested by any of several invertebrate, blood sucking reduviid bugs (Triamata species) either in the larval nymphal or adult stage. After they have passed through many stages in the intestinal canal of the invertebrate vector over a period of 8-10 days, fully formed trypanosomes known as "metacyclic forms" appear in the hindgut. Transmission occurs by the deposition of fecal material passed while the vector bites a vertebrate host. Infection is through contamination of conjunctiva, mucus membranes, abrasions or wounds of the skin by fresh infected Triatomine bug feces. Transmission may also occur by blood transfusion. Organisms may pass through the placenta to cause congenital infections.

Upon infection, acute disease generally occurs in children, with chronic manifestations generally appearing later in life. Many infected persons have no clinical manifestations. Acute disease is characterized by variable fever, malaise, lymphadenopathy and hepatosplenomegaly. Inflammation response at the site of infection (chagone) may last up to eight weeks. Unilateral bipalpebral edema (Romona sign) occurs in a significant percentage of acute cases. Life-threatening or fatal manifestations include myocarditis and meningoencephalitis. Chronic sequelae include myocardial damage with cardiac dilation and arrhythmias and intestinal problems involving megaesophagus and megacolon.

1. History

The existance of isolated cases of Chagas' disease in the coastal provinces is well documented. Records of fatal cases due to Chagas' can be found from the Province of Loja to Esmeraldas. However, it was only in 1983 that SNEM, with consultation by the Panamerican Health Organization, began a program of basic investigation of the entomological and morbidity aspects of the disease in the Province of Guayas. In 1984, the studies were expanded to the Provinces of Los Rios, El Oro and Loja.

2. Prevalence and Distribution

The initial pilot study in the Province of Guayas shows a relatively low infestation of the vector of Chagas' (Table I-6). Of all the homes in the city of Guayaquil, only 0.32% were investigated with 0.1% positive for the vector. In the rural areas, 16.2% of all the communities were investigated with a positivity rate for the vector of 2.7%. In the same communities, 3.3.%

TABLE I-6

PREVALENCE OF CHAGAS' IN PROVINCE OF GUAYAS

ENTOMOLOGICAL - PARASITOLOGICAL SURVEY - 1983

Areas Investigated	City of Guayaquil	Rural Communities
No. of communities/population	1,300,0	2,269
No. of communities selected		469 (20.7%)
No. of communities studied		367 (16.2%)
No. of communities positive		10 (2.7%
No. of homes	244,500	192,568
No. of homes selected	12,300 (5%)	9,610 (5%)
No. of homes investigated	785 (0.3%)	6,389 (3.3%)
No. of homes positive	1 (0.1%)	43 (0.7%)
No. of vector captures	1	326
No. of vector positive for *T. cruzi*	0 (0.0%)	82 (25.2%)

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of the homes were investigated, of which 0.7% were infestated. While no vector positive for the parasite was found in the urban area (only one vector captured), 25.2% were positive for the parasite in the rural areas.

Recent studies (1984) in the Provinces of Los Rios, El Oro and Loja essentially indicate that only the Province of Loja has communities with vectors positive for the parasite T. cruzi (Table I-7). Of all the communities studied, 27.6% were positive for the vector; 4.8% of the homes were infested. Of the vectors captured, 16.7% were positive for the parasite T. cruzi. These studies indicate that certain rural areas in the Provinces of Guayas and Loja are potential areas for the clinical presentation of Chagas'.

Though the entomological-parasitological survey indicated no infected vector for Chages' in the city of Guayaquil and in the Province of El Oro, serological studies indicate that the population at some time has had contact with the parasite T. cruzi (Table I-8). A higher response occurred in the Province of El Oro than the city of Guayaquil.

These studies indicate that further investigation is needed to provide more epidemiological data on the positive areas for Chagas'. Also the continuation of the epidemiological surveys in the other coastal provinces are necessary.

D. Yellow Fever

West Africa was probably the original home of yellow fever. From there it is postulated that disease was transported to Europe and the Americas by ships carrying the infected mosquito. The disease never established itself in Europe because of the lack of the vector mosquito. In the Americas, the disease has been reported from as far north as Baltimore in the United States to southern Brazil in the south.

The basic patterns of transmission of yellow fever virus may be distinguished; (1) from human to mosquito to human (epidemic or urban yellow fever) and (2) from non-human primate to mosquito to human (endemic, sylvatic, epizootic or enzootic yellow fever). The epidemic or urban yellow fever is transmitted by only a few species of the genus Aedes, predominantly by Aedes aegypti. Endemic or sylvatic yellow fever is transmitted by several other species of Aedes and by the members of the genera Haemagogus and Sabithic.

The etiologic agent of yellow fever is a small virus belonging to the tagavirus family. Except for a few cases in Trinidad in 1954, no outbreak of urban yellow fever has been transmitted by Aedes aegypti in the Americas since 1942. Urban yellow fever outbreaks are still reported in Africa. Sylvatic yellow fever is enzootic in northern South America, including the eastern regions of Ecuador, Peru and Bolivia. The disease has occurred from time to time in all mainland Latin American countries from Mexico to Argentina.

TABLE I-7

PREVALENCE OF CHAGAS' IN PROVINCES OF LOS RIOS, EL ORO, LOJA

ENTOMOLOGICAL - PARASITOLOGICAL SURVEY - 1983

Areas Investigated	Province of Los Rios	Province of El Oro	Province of Loja
No. of communities	1,730	582	674
No. of communities selected	289 (16.7%)	156 (26.8%)	95 (14.1)
No. of communities studied	105 (6.1%)	48 (8.2%)	58 (8.6)
No. of communities positive	2 (1.9%)	3 (6.3%	16 (27.6%)
No. of homes	103,170	66,772	22,027
No. of homes selected	5,152 (5%)	4,054 (6.1%)	1,110 (5.0%)
No. of homes studied	2,457 (2.4%)	481 (0.7%)	664 (3.0%)
No. of homes positive	3 (0.1%)	6 (1.2%)	32 (4.8%)
No. of vector captures	3	60	42
No. of vector positive for T. cruzi	0 (0%)	0 (0%)	7 (16.7%)

TABLE I-8

PREVALENCE OF CHAGAS' IN PROVINCES OF LOS RIOS, EL ORO, LOJA

ENTOMOLOGICAL - PARASITOLOGICAL SURVEY - 1983

Areas Investigated	Guayaquil (Guayas)	Zaruma (El Oro)	Portovelo (El Oro)
No. of samples	2,078	496	414
No. of samples positive	54	49	8
Percentage positive	2.6%	11.7%	7.1%

Acute infections are of short duration and of varying severity. The cases are clinically indeterminant: sudden-onset fever, headache, backache, prostration, nausea and vomiting. As the disease progresses, the pulse slows and weakens as the fever rises. Common hemorrhagic systems include epistoxis, buccal bleeding, hematimeisis, and melena. There is a moderate jaundice in the early stages with intensification occurring later. Fatality rates among indigenous populations of endemic areas are less than 5% but may reach 50% among non-indigenous groups.

1. History

According to the medical records of Ecuador, Aedes aegypti, the vector for urban yellow fever, was eradicated from the country in the 1960's. However, with the presence of the vector in and its dissemination from neighboring countries, such as Colombia, a surveillance program for the vector in the coastal provinces was instituted in 1974.

At the same time there was no anticipation of the eradication of epizootic and enzootic yellow fever in the eastern amazonic provinces. Transmission from nonhuman primates to humans has continued to occur over the years. Finally, however, a program was instituted to prevent further outbreaks in this endemic area by the initiation and maintenance of a vaccination program.

2. Surveillance Program in the Coastal Provinces

The surveillance team of SNEM consists of ten brigades, a total of 42 inspectors, whose responsibility is to maintain vector surveillance of 124 communities in seven coastal provinces. Their primary responsibility is active case detection. In each community 10%, 30% or 100% of the homes are inspected for the vector, depending upon the size of the community. In some designated areas, the technique of egg-laying traps is used. Larvae are also collected from stagnant water sources. All collected mosquitos and larval specimens are sent to the central laboratory for classification. National regulations prevent SNEM from inspecting all cargo ships that come into the different seaports. To compensate for this restriction, 100% of all buildings and homes surrounding the ports are inspected. (All land and air transport coming from infested countries are inspected.)

In the last ten years, re-infestations have been detected in five different occasions; 1977, 1979, 1981, 1982, 1983 in the Province of Manabi. All re-infestations occurred in each year in the city of Manta (seaport) and in 1981 in the city of Portoviejo. The latter was an extension of a re-infestation of Manta, where contaminated boxes of apples were transferred to Portoviejo.

Upon detection of Aedes aegypti, an intense study is immediately done to define the affected area. Methods of attack include destruction of contaminated materials, water treatment with Abate, intense spraying of the

interior and exterior areas of all buildings with insecticide. Bimonthly entomological checks are made to ensure complete eradication.

3. Control Program in the Eastern Amazonic Provinces

The outbreak of sylvatic yellow fever in the eastern amazonic provinces of Ecuador has been intermittent but regular. Reported incidences of the last seven years are given in Table I-9. The two worst outbreaks were in 1979, where 21 deaths occurred in the Province of Zamora Chinchipe and in 1983, where 8 deaths were reported in the Province of Morona Santiago.

In cooperation with the local provincial health officials. SNEM has initiated and maintained an active vaccination program in this amazonic region as the only means of disease control (Figure I-3). As of 1983, the four provinces have the following vaccination coverage: Napo, 58%; Pastazo, 92%; Morona Santiago, 15% (only one canton has been vaccinated); Zamora Chinchipe, 25% (only the area surrounding the city of Zamora has been vaccinated). With the establishment of the different provincial centers of vaccination, complete coverage is expected in the next two years. All travellers to the amazonic region can be vaccinated in the six designated health centers.

Since the institution of the surveillance program on the coastal region, no case of urban yellow fever has been detected. However, continued surveillance is necessary to combat any possible re-infestation of the vector and possible subsequent epidemic. The vaccination program in the amazonic region has had a strongly positive effect in the Province of Pastaza where nearly total coverage has been obtained. Until complete coverage is obtained in the other provinces, outbreaks of sylvatic yellow fever will continue to occur.

YELLOW FEVER CONTROL PROGRAM AND EPIDEMIOLOGICAL SURVEILLANCE

CASES OF SYLVATIC YELLOW FEVER - ECUADOR

1975 - 1983

VINCE	YEARS	AGE GROUPS 0 - 1 C	SC	2 - 4 C	SC	5 - 9 C	SC	10 - 14 C	SC	15 & + C	SC	TOTAL CONFIRMED	UNCONFIRMED	COMMUNITIES
ɔ	1975	-	-	-	-	-	-	-	-	3	-	3	-	Lumbaqui
ɔ	1978	-	-	-	-	-	-	-	-	1	-	1	-	Nuevo Rocafuerte
ɔ	1979	-	-	-	-	1	-	-	-	-	-	1	-	Ahuano (San Pedro)
ɔ	1979	-	-	-	-	-	-	-	-	-	3	-	3	San José (Lumbaqui)
ɔ	1980	-	-	-	-	1	-	1	-	-	-	-	2	Palmeras, Vía Coca km. 17
ɔ	1981	-	-	-	-	-	-	-	-	2	-	2	-	Rio Napo
-total		-	-	-	-	1	1	-	1	6	3	7	5	
ɔra	1979	-	-	-	-	-	-	2	-	22	19	24	19	Cuenca del Rio Nagaritza
ɔra	1981	-	-	-	-	-	-	-	1	-	1	-	2	Palanda Zone
-total		-	-	-	-	-	-	2	1	22	20	24	21	
ɔna Santiago	1980	-	-	-	-	-	-	-	-	2	1	2	1	Taisha and Putuime
-total		-	-	-	-	-	-	-	-	2	1	2	1	
:aza	1983	-	-	-	-	-	-	-	-	-	8	-	-	x Sarayacu
-total		-	-	-	-	-	-	-	-	-	8	3	5	
AL		-	-	-	-	1	1	2	2	30	29	36	32	

: Until June 1983
= Cases Confirmed
= Cases Unconfirmed

TABLE I-9

VACCINATION PROGRAM AGAINST SYLVATIC
YELLOW FEVER IN ECUADOR

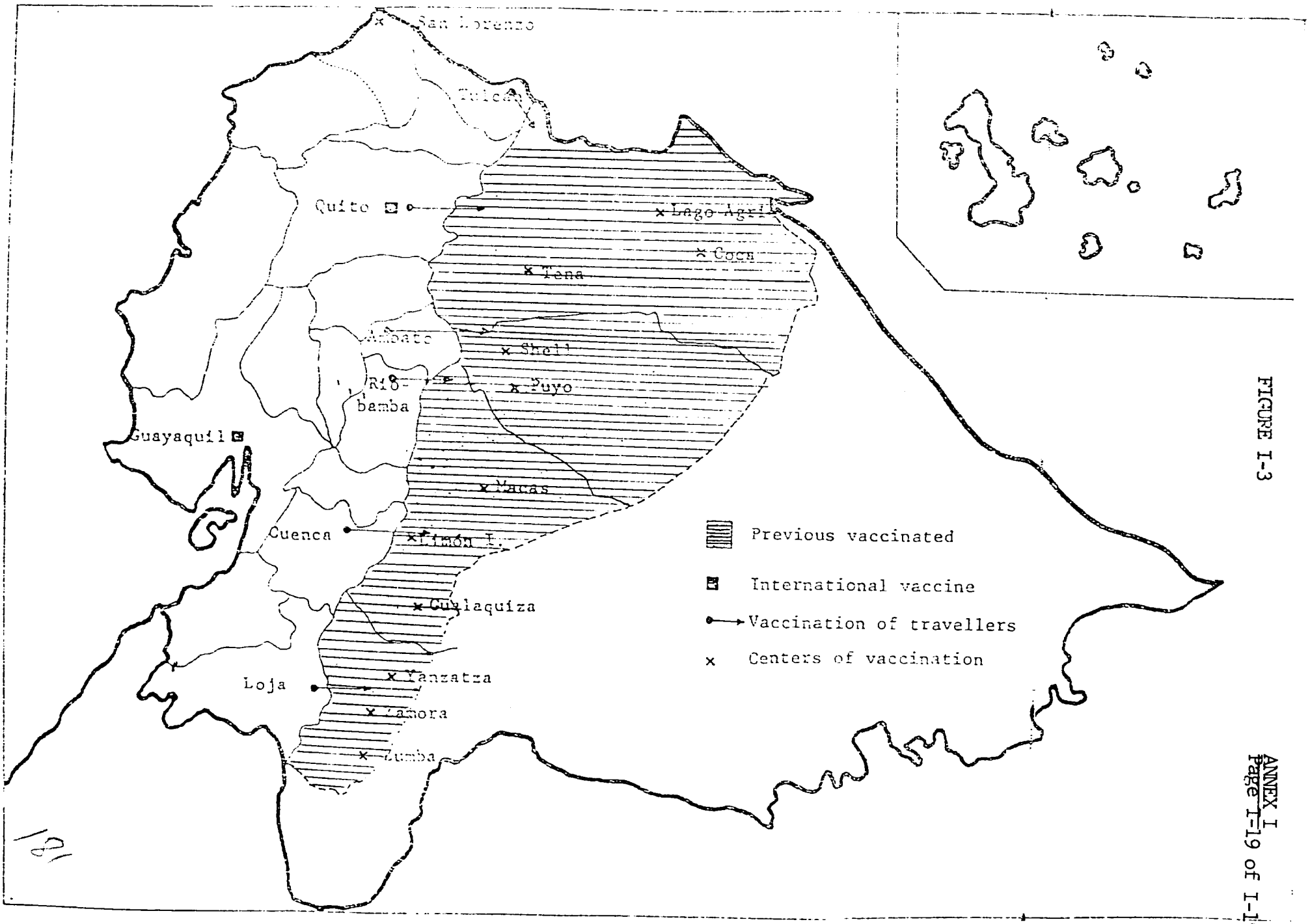

FIGURE I-3

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SOCIAL SOUNDNESS ANALYSIS

SUMMARY:

Ecuador's 108,000 square miles are divided into three distinct zones: a temperate, malaria-free highland area lying between the two Andean mountain ranges; hot humid lowlands on the Pacific coast, and rainy, tropical lowlands in the east. Both of the lowland areas are malarious, below the 1,500 meter level. This malarious area comprises nearly two thirds of the country; its population--about 5.4 million or over 60% of the nation's estimated million people--represents the number of Ecuadoreans at malaria risk.

The nation's population is generally considered to be composed of four main groups: Indian (30%), Spanish (10%), Indian-Spanish, or mestizo (50%) and African (9.5%). All others combined represent only 0.5%. Since the Spanish and Indian populations are heavily concentrated in the Andean highlands, the ethnic mix in the malarious areas appears to be quite different: a black group of perhaps 200,000 concentrated in the northern coastal zone; a number of Indian groups--Chachi and Colorado on the coast, and Quichua, Shuar and others in the east--with combined populations of about 300,000. The enormous bulk of the population of the malarious area is mestizo--Spanish-speaking and Christian. Unlike the blacks and the Indian tribal groups, many of the mestizo population are rootless. They are also impoverished, land-hungry and tremendously mobile. Further, their mobility extends in two directions--to the already crowded cities, but also to the less settled rural areas, where petroleum production, lumbering operations and, above all, available land, have proved to be irresistable magnets. Such migration has resulted in unplanned colonization, deforestation, land-waste, erosion and flooding--an additional burden for future generations.

Smaller in numbers, the traditional rural society--tribal groups and Africans--is significantly different from what may be termed the transitional rural society, the upwardly and outwardly mobile mestizo population. Tribal stability--in relation to their traditional abodes and to their place in nature--has enabled them to preserve their identity, their languages, their cultural identities, their religious and medical beliefs.

Two factors are present which make it possible to predict a favorable response to the proposed malaria program, from the mestizo small-holders or rural settlers to the traditionalist tribal groups and only slightly less traditionalist African population:

1. The more than four centuries of religious and medical evangelism throughout Ecuador have had a major influence. Even in the tribal areas, where Shamanism and ancestral religions strongly influence the nominal Christian faith, and the traditional medicine-men and witch doctors remain all-powerful, malaria is considered a natural rather than a supernatural disease, which is in some manner related to a kind of mosquito and is best

treated by "modern" medicine, whether provided by SNEM, by church mission groups, or by the local drugist. Drug treatment of malaria is popularly approved.

2. SNEM's performance, now in its third decade, has been such as to win at least acceptance and usually favor throughout the country. This acceptance probably derives in part from SNEM's pattern of employing locally the personnel who make occasional contact with the populace - specifically, the brigades of spraymen and their supervisors. The points of permanent contact--the 6,000 volunteer collaborators who reside in the rural communities of Ecuador--are selected from the families of community leaders, and are frequently young women of better-than-average educational and social status--well-accepted in their communities.

The existing "positive" reaction toward SNEM and its activities should not be taken for granted, at least in some areas. It is at a high point at this time because of the present epidemic outbreak of malaria, with its accompanying high morbidity. When disease incidence falls, the need for careful surveillance will continue, yet demand for and acceptance of SNEM interventions may decline. The development of programs of health education must be made to coincide with the present favorable predisposition of the population toward SNEM and its activities.

Popular Attitude towards Residual Spraying

While DDT used as a residual spray remains generally effective against malaria vectors, many household pests (cockroaches, bed-bugs, flies) are no longer susceptible to DDT, and the former enthusiasm for DDT is on the wane. Newspaper articles and pronouncements of some of Ecuador's environmental preservationists (e.g. Fundación Natura) have also led to fears of environmental contamination by DDT. A technical dialog with such organizations to demonstrate the safety of DDT when properly used and restricted to use for public health purposes may be essential to terminate their opposition to the use of DDT, and, indeed, to enlist their support.

Especially in the frontier areas along the Colombian border, there is now a popular resistance to the entrance of sprayers into dwellings--because of the use of these houses for illicit drug storage. By themselves, SNEM employees cannot be expected to overcome this trend of resistance which indeed involves physical danger to the sprayman.

Popular Attitude towards Drug Treatment

As noted above, there is a ready recognition throughout rural Ecuador of malaria as a treatable disease. People recognize the symptoms of malaria, recognize that the suffering of the disease can be avoided, and search for treatment in the form of pills--from voluntary collaborators of SNEM, from religious missions, from health services, from local stores, or even from street salesmen.

This acceptance of the pill is not without problems. Although chloroquine has few serious side effects, it should be taken with meals; there have been complaints of dizziness, sleepiness, "gastritis" and in black communities, pruritus.

Another charge is that the treatment is not fully effective; disease recurrence (quite possible from new infection) is not uncommon. Equally possible, of course, is that the patient has never received the full treatment while waiting (for a period of months) for confirmation of malaria infection. Finally, the presence in the country of resistant strains of P.falciparum means that the standard chloroquine treatment will not always prove effective. Yet the Fansidar which successfully treats P.falciparum malaria is not only far more expensive than chloroquine, but is ineffective against the more common vivax malaria.

Clearly, then, the program requires a major health education effort on the need to complete the full course of treatment for malaria; regular resupply of essential drugs to the voluntary collaborators; a far more rapid return to the voluntary collaborator (or other treatment source) of blood slide diagnosis, confirming not only the presence of the malaria parasite but which kind of parasite; and prompt and correct treatment of the identified form of malaria.

Migration and Malaria

Ecuador is currently undergoing a remarkably rapid population redistribution, attributable in part to the high birthrate in the coastal provinces but in far greater measure to migration. Population in many parts of the Oriente appears to be expanding at the rate of 20% annually. The pressure which such rapid population transfers place on the economic and social infrastructure of the growing areas is already great and will grow.

One effect of these movements is to transfer malaria bodily into areas which have not had a serious malaria threat--e.g., the suburbs of Guayaquil. A second is to bring groups of land-hungry settlers not previously exposed to major malaria risk into contact with the country's most virulent malaria threat--in Esmeraldas--where the concomitant exposure to other vector-borne diseases is taking a further toll. Finally, the lure of employment in the oil fields and the lumber camps of the Oriente is drawing settlers into areas where the social and health infrastructure is virtually non-existent, and where the malaria threat is as yet unmeasured.

Man-Made Malaria

Lumbering activities in both coastal and Oriente jungle areas, and oil exploration and exploitation in Napo, have a common theme: they involve the opening of extensive access roads to hitherto virgin areas. Such roads are not engineered to eliminate water impoundments; as a result, there are created countless breeding sites for the vectors of malaria and other diseases. Colonists and existing populations alike are unaware of the threat of such

dammed water to their health. And with the colonists have come malaria infections. These "development areas" are new malaria foci.

SNEM has at least some engineering capacity, and should advise on the construction of roads to avoid the creation of man-made malaria foci. Additionally, a SNEM health educaton campaign--through the voluntary collaborators, health services, health promotores, communal organizations, schools, and municipalities--can identify communal projects as well as individual actions which can avert the malariogenic impact of unplanned "development". Mass communication campaigns through such media as regional radio stations--in both Spanish and vernacular languages--can be effective in promoting community and individual efforts.

Malaria's Place in the Health System

Malaria at this time receives so little attention in the Ecuadorean medical education system that the graduating physician (with a few hours of malaria theory and no hours of practice) may not even be able to diagnose a case of malaria. This is reflected in the health services of the MOH; suspected malaria patients are normally referred to SNEM for diagnosis and treatment. Cooperation of MOH with SNEM activities is totally passive; may take blood slide and/or give presumptive treatment, and refer patient to SNEM, but take no other action. All malaria activities are centralized in SNEM.

A major thrust of a successful program of malaria control must involve the Primary Health Care system, all educational facilities of the MOH, common training of Voluntary Collaborators and Health Promotores, and a major enlistment of popular participation. These factors are explicitly taken into account in the design of this project.

Project Beneficiaries

The principal beneficiaries of the malaria control project will be the inhabitants of small rural communities associated with agricultural and lumber production. This population group is, in the main, made up of low-income farmers, together with tribal groups which are hunters and gatherers. Also benefitted will be the rural migrants, both to the urban-marginal zones where socio-economic and health conditions augment the malaria risk and to the rapidly developing areas in Esmeraldas and in the Oriente where health services are virtually non-existent. Thus, the program will benefit the entire malarious portion of the country, concentrating in rural areas. While particular benefit flows to pregnant women and small children, upon whom the burden of malaria mortality falls most heavily, the program also benefits the entire economically active adult population, for whom the disease represents 15 days of labor incapacity annually and a longer period of gradual recovery.

In a larger sense, the beneficiary is the Ecuadorean economy, as decreased malaria incidence permits the development of agricultural and forest zones and their incorporation into the national productive system.

PROJECT ECONOMIC ANALYSIS

1. Macroeconomic Overview

After almost a decade of high economic growth, an improving balance of payments and, consequently, increasing foreign exchange reserves, 1981 marked the start of a period of increasing difficulties for Ecuador. The balance of payments registered its first deficit in over four years in 1981. The deterioration in the balance of payments was accompanied by a general weakening of the economy. From a peak of 5.1 percent in 1979, real GDP growth fell to 1.4 percent in 1982 and was negative by 3.3 percent in 1983.

Adverse external developments (high international interest rates and a drop in oil export revenues) were compounded by domestic expansionary demand policies and overvaluation of the sucre, bringing about more rapid inflation, a continuing deterioration of the balance of international payments, and economic stagnation. In the second half of 1982 and the first half of 1983 these problems were exacerbated by severe weather conditions which caused flooding and affected export shipments and transportation.

The key agricultural and industrial sectors registered declines of 14.9 and 5.6 percent respectively. Unemployment reached 9 percent. Investment in 1983 was only 16.5 percent of GDP, compared with 25 percent in 1981 and 1982, as cuts in public spending brought about a fall in the public sector deficit from 4.2 percent of GDP in 1982 to 3.1 percent of GDP in 1983. Inflation rose from 16.3 percent in 1982 to almost 60 percent in 1983, mainly due to basic food and raw materials shortages resulting from the floods, as well as to devaluation of the currency and increases in the price of goods and services supplied by the public sector. In the meantime, however, the balance of payments showed a marked improvement as the current account deficit fell from U.S.$1.2 billion in 1982 to U.S.$104 million in 1983, while the country's total reserves (minus gold) more than doubled to U.S.$632.4 million with respect to the previous year.

Expecting a recovery in 1984, the government had initially forecast a real GDP growth of 1/2 percent. This now appears to be on the low side and the projection has been adjusted to around 1 to 1.5 percent. The main stimulus should derive both from a revival in agriculture as weather conditions return to normal, and from continued oil production increases. Accordingly, unemployment should drop in 1984. Inflation by year end 1984 is expected to have fallen to 25 percent. A substantial improvement was already evident in the first nine months of this year.

Ecuador appears on course to meeting the targets set by the IMF program which expired at the end of July. The program included a limit of a 4 percent budget deficit to GDP ratio for 1983; the final outturn appears to have been well within the limit. The public and publicly guaranteed debt reached only U.S.$4.5 billion, at the end of last year, the ceiling having been U.S.$4.6 billion. A minimum level of net international reserves of U.S.$110 million was set for end 1983 whereas in fact they reached U.S.$151 million. For the

end of the first half of this year the target was U.S.$143 million, and by May the figure was close, at U.S.$141 million. Meanwhile central bank credit to the government has been kept within the prescribed limits and during the first quarter the bank's net domestic assets reached 18 billion sucres compared with the IMF's ceiling of 18.5 billion. There also have been moves towards the trade liberalization recommended by the IMF.

2. Project [illegible]sis - Summary and Conclusions

This [illegible]nalysis appraises the malaria control project in terms of whether i[illegible]e from an economic standpoint.

Malaria is a major health problem in Ecuador; the disease is highly endemic in the coastal, eastern, and low mountain regions of the country, which constitute sixty percent of the land area and contain over two-thirds of its population. The number of malaria cases detected and treated have risen from 8,700 in 1980 to an estimated 80,000 by the end of 1984. A conservative measure of this year's actual number of cases could exceed 400,000. Without the preventive and curative measures to be effected by this project, the actual number of cases could well grow to almost 2 million annually by 1989 (see Table K-3)--a 60% increase in 1984 over 1983, followed by 40% annual increases in the next three years and thereafter a tapering off in the rate of increase (but not in actual numbers of new cases) to 32% and 27%. This pattern of compounded increases has been typical of uncontrolled epidemic malaria in other countries.

The project, during its five years of implementation, will prevent about 5.6 million malaria cases and enable the economy to save over U.S.$126 million equivalent (see Tables K-3 and 28). Project costs are U.S.$40.2 million equivalent, estimated at the free market exchange rate of U.S.$1.00 = Sucres 100.00.

Substantial direct and indirect benefits will be derived from this project. This analysis has quantified only those benefits that can be realistically valued in monetary terms. These are the savings from reduced expenditures for medical treatment and income loss. The avoided expenditures and losses during the five years of implementation are as follows: over U.S.$1.3 million in presumptive treatment (Table K-14); U.S.$16.0 million in radical treatment (Table K-19); U.S.$100.0 million in hospitalization (Table K-22); and U.S.$8.7 million in income loss (Table K-27).

Current estimates indicate that the opportunity cost of capital lies between 12 and 15 percent; this analysis has chosen the higher figure to determine the economic profitability of this project.

The project was subjected to three of the most commonly used primary tests of value. The benefit-cost ratio is 2.93 indicating that the project is acceptable in terms of generating benefits in excess of its costs (i.e., for every U.S.$1.00 spent on malaria control, the project will yield U.S.$2.93 in benefits). The project's net present worth is U.S.$51.2 million and the economic rate of return (ERR) exceeds 50 percent (Table K-29).

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Since accurate projections in estimating costs and particularly benefits, are relatively difficult in health projects, several sensitivity tests were conducted in order to study the impact that changes in costs and benefits would have on the profitability of the project (see Tables K-30, 31 and 32).

3. Methodology

The essence of this economic analysis is the comparison of what the economy's expenditures and losses would be "with" and "without" the project. The difference between the two, enables a determination of the net benefits derived as a result of this malaria control project. It should be noted, however, that while the savings from reduced requirements for medical attention to the ill and income loss can be estimated with some precision, they represent only the tip of the iceberg; the great bulk of the actual cost of illness remains submerged and unknown.

Since Ecuador has neither significant subsidies nor administrative price controls which would require the use of accounting prices, the monetary expressions are all at domestic market prices. Because this project's labor costs account for a significant proportion of its total costs, this analysis does not value labor at its opportunity cost. To have done so would have only slightly decreased the benefits and would have had the effect of significantly reducing the project costs.

The period of analysis is five years. The values of the costs and benefits have been divided by years and appropriately discounted over time to yield present values. The discount rate selected is 15 percent.

The results of a sensitivity analysis to test the effects on the ERR of cost overruns and shortfall in benefits are presented in Tables K-30, 31 and 32).

Information pertaining to technical issues such as incidence with and without the project, costs of drugs and hospitalization, number of days lost from work, etc., was obtained from local and expatriate malaria experts.

4. Project Cost Estimates

All the resources, both physical and human, that will go into the implementation of this project have been identified and quantified. Project cost estimates are based on current costs but include physical and price contingencies of 15 percent. The present value at 15 percent of this project's cost is U.S.$26.5 million (Table K-29).

5. Malaria Cases Projections

The data used to estimate the number of malaria cases that can be expected from 1985 to 1989 in the absence of a malaria control project, and the number of cases to be expected during the life of the project, was derived from official government population statistics and estimates provided by the malaria technical experts (see Tables K-1 thru 7).

6. Costs Without the Project

In the absence of this malaria control project, the number of preventable cases will rise from 460,000 in 1985 to 1.9 million in 1989. Of these, preventable P. vivax cases will increase from 345,000 to near 1.4 million and the severe cerebral malaria (P. falciparum) cases will grow from 140,000 in 1985 to over 470,000 in 1989 (see Tables K-3 thru 11).

Without the project, the Ecuadorean economy will be faced with additional annual expenditures which will rise from U.S.$1.5 million to U.S.$6.3 million for drugs, U.S.$8.3 million to U.S.$33.6 million for hospital treatment, and U.S.$720,000 to U.S.$2.9 million for loss of income, from 1985 to 1989.

Projected expenditures to be incurred without the project in presumptive and radical treatment, and in hospitalization, are presented in Tables 12 thru 22. The cost of hospitalization ranged from U.S.$30.0 to U.S.$50.0 equivalent per day; the former figure was used. An additional cost to the economy is represented by the loss of earnings of an employed individual as a result of malaria. The procedure used to estimate the loss of income is shown on Tables 23 thru 27. Although official statistics indicate that over 62 percent of total adult population (over 15 years old) are gainfully employed, this analysis is based on the assumption that only 30 percent of adults suffering from malaria are fully employed.

Because malaria cases will occur during implementation of the project, their cost to the economy have been estimated following the same principles as those applied for calculating the costs without the project.

7. Benefits

Execution of the project would primarily benefit some 5.7 million individuals who live in the areas infected by malaria--in particular, young children and pregnant women, who bear the greatest burden of malaria mortality, but also the entire economically active adult population, for whom the disease represents 15 days of labor incapacity. The project's direct benefits are the expenditures avoided in drug use, hospital treatment and loss of income. All costs incurred by the project have been subtracted from the project's total direct benefits.

In addition to the direct benefits that lend themselves to quantification, the project will produce a greater number of indirect benefits whose impact could not be properly assessed in economic terms during the time available for this analysis. Of these, the following are considered the most significant:

- strengthening of the general health delivery system;

- decrease of the incidence of other diseases (malaria reduces the general state of an individual's health);

- supporting the government's efforts to colonize large areas partly uninhabitated (particularly in the Provinces of Napo, Pastaza, Morona Santiago and Zamora Chinchipe);

- enabling the expansion of agricultural acreage and thus increasing total agricultural production (malaria has the immediate effect of slowing down the expansion of cleared land and reducing the amount of land brought under cultivation);

- increasing the amount of produce that is harvested (farm families affected by malaria show reduced harvests); and

- alleviating labor bottlenecks which hamper development projects being implemented in the provinces affected by malaria.

8. Sensitivity Analysis

The results of the sensitivity analysis tests show that if the project costs had been underestimated by 50 percent or if they would suffer a 50 percent annual increase, the economic rate of return would still be over 50 percent (Table K-30).

Alternatively, the rate of return has been calculated on the assumption that the benefits had been overestimated by 50 percent or, what is the same, that the projected losses to be avoided would be 50 percent less than expected. Under this assumption, the economic rate of return also remains above 50 percent (Table K-31).

The last sensitivity test (Table K-32) shows that if the project costs were to increase by 40 percent per annum and the project benefits were to be reduced by a similar percentage, the economic rate of return is greater than 50 percent.

9. Cost Effectiveness

The alternatives available to reduce the incidence of malaria are essentially the following:

- to attack the parasite through the massive provision of prophylactic drugs;

- to attack the mosquito through a massive campaign of insecticide spraying; and

- to attack the parasite and the mosquito in a balanced manner, while introducing other measures that lower the cost of the most expensive element, which is insecticide.

The proposed malaria control project has chosen the third alternative as the most cost effective way to reduce the incidence of malaria in Ecuador.

Table K-33 shows that under this approach the annual cost per beneficiary is U.S.$1.64 equivalent.

The cost implications of reducing malaria incidence through the provision of prophylactic drugs to the population residing in malaria regions have also been examined. The analysis shows that the cost per beneficiary is more than 50% higher that incurred under the project. Table K-34 provides the analysis' results and an explanation as to how it was conducted. It should be noted that the per capita cost of this alternative has only considered the cost of the malaria prophylactic and has not computed other incidental expenditures such as the salaries and wages of those in charge of the distribution, rental of facilities, transport costs, etc.

Because massive insecticide spraying would have costs which are prohibitive, it has been deemed unnecessary to determine its cost-effectiveness.

10. Recurrent Costs Issue

Since the beginning of 1983, stabilization has been the main aim of the Ecuadorean government's fiscal policy, and the budget deficit has been virtually eliminated. This was achieved after the government abolished most export tax exemptions, introduced import surcharges, reduced duty exemptions, increased domestic petroleum prices and electricity and telephone rates, and further restricted expenditures. The Central Bank's credit to the public sector has been kept within the limits set by the IMF.

Given the government's commitment and actions leading towards maintaining a sound fiscal situation, it is only reasonable to conclude that the government's agreement to provide the financial resources needed to implement this project is to be be honored.

11. Conclusions

On the basis of this economic analysis, the Malaria Control Project to the Government of Ecuador is suitable for AID's assistance.

ECONOMIC ANALYSIS TABLES

TABLE K-1

PROJECTED POPULATION IN MALARIA AFFECTED PROVINCES
(Thousands)

Provinces	1982*	1985	1986	1987	1988	1989
Carchi	128.1	131.1	131.2	131.3	131.5	131.6
Imbabura	248.6	262.7	265.6	268.6	271.5	274.6
Pichincha	1,369.1	1,565.3	1,627.6	1,692.4	1,759.7	1,829.8
Cotopaxi	274.3	303.8	309.2	314.7	320.3	326.1
Bolivar	149.5	152.5	152.1	151.5	151.1	150.5
Chimborazo	331.5	357.7	360.6	363.6	366.6	369.6
Cañar	175.9	189.5	192.8	196.2	199.6	203.1
Azuay	438.1	484.9	494.7	504.8	515.1	525.5
Loja	356.5	379.3	379.7	380.1	380.4	380.8
Esmeraldas	247.9	277.1	282.4	287.8	293.4	299.1
Manabi	885.3	975.2	982.4	989.7	997.1	1,004.4
Los Rios	451.1	507.3	515.7	524.3	532.9	541.8
Guayas	2,022.9	2,339.3	2,418.6	2,500.6	2,585.4	2,673.1
El Oro	337.1	385.3	396.1	407.1	418.5	430.1
Napo	115.1	149.2	160.8	173.2	186.6	201.1
Pastaza	31.8	36.5	37.9	39.4	40.9	42.5
Morona Stgo.	70.2	80.1	82.8	85.7	88.7	91.8
Zamora Chin.	29.1	54.5	56.5	58.7	60.9	63.1
Total	7,662.1	8,631.3	8,846.7	9,069.7	9,300.2	9,538.6

Note: * 1982 Preliminary Census

Source: National Institute of Statistics and Census and own estimates.

TABLE K-2

POPULATION AT MALARIA RISK - BY AGE GROUP
(Thousands)

	Total	Under 15 Years	Over 15 Years
1985	5,694.4	2,368.9	3,325.5
1986	5,836.7	2,428.1	3,408.7
1987	5,982.7	2,488.8	3,493.9
1988	6,132.2	2,551.0	3,581.2
1989	6,285.5	2,614.8	3,670.8

Note: 41.6 percent of the population are under 15 years of age.

Source: SNEM data for 1984 and own estimates, projecting population growth at 0.025% annually.

TABLE K-3

MALARIA CASES PROJECTIONS: WITH AND WITHOUT PROJECT
(Thousands)

	Without	With	Avoided
1985	560.0	100.0	460.0
1986	800.0	80.0	720.0
1987	1,120.0	40.0	1,080.0
1988	1,480.0	25.0	1,455.0
1989	1,880.0	15.0	1,865.0
Total	5,840.0	260.0	5,580.0

Source: Technical experts.

TABLE K-4

MALARIA CASES WITHOUT PROJECT: BY TYPE OF MALARIA
(Thousands)

	Total	P. vivax	P. falciparum
1985	560.0	420.0	140.0
1986	800.0	600.0	200.0
1987	1,120.0	840.0	280.0
1988	1,480.0	1,110.0	370.0
1989	1,880.0	1,410.0	470.0

Note: 75 percent of malaria cases are P. Vivax

Source: Technical experts.

TABLE K-5

MALARIA CASES WITH PROJECT: BY TYPE OF MALARIA
(Thousands)

	Total	P. vivax	P. falciparum
1985	100.0	75.0	25.0
1986	80.0	60.0	20.0
1987	40.0	30.0	10.0
1988	25.0	18.8	6.3
1989	15.0	11.3	3.8

Note: 75 percent of malaria cases are P. Vivax

Source: Technical experts.

TABLE K-6

P. VIVAX MALARIA CASES AVOIDED
(Thousands)

	Without	With	Avoided
1985	420.0	75.0	345.0
1986	600.0	60.0	540.0
1987	840.0	30.0	810.0
1988	1,110.0	18.8	1,091.2
1989	1,410.0	11.3	1,398.7

Source: Tables 4 and 5

TABLE K-7

P. FALCIPARUM MALARIA CASES AVOIDED
(Thousands)

	Without	With	Avoided
1985	140.0	25.0	115.0
1986	200.0	20.0	180.0
1987	280.0	10.0	270.0
1988	370.0	6.3	363.7
1989	470.0	3.8	466.2

Source: Tables 4 and 5

TABLE K-8

P. VIVAX CASES WITHOUT PROJECT: BY AGE GROUP
(Thousands)

	Total	Under 15 Years	Over 15 Years
1985	420.0	174.7	245.3
1986	600.0	249.6	350.4
1987	840.0	349.4	490.6
1988	1,110.0	461.8	648.2
1989	1,410.0	586.6	823.4

Source: Table 6

TABLE K-9

P. FALCIPARUM CASES WITHOUT PROJECT: BY AGE GROUP
(Thousands)

	Total	Under 15 Years	Over 15 Years
1985	140.0	58.2	81.8
1986	200.0	83.2	116.8
1987	280.0	116.5	163.5
1988	370.0	153.9	216.1
1989	470.0	195.5	274.5

Source: Table 7

TABLE K-10

P. VIVAX CASES WITH PROJECT: BY AGE GROUP
(Thousands)

	Total	Under 15 Years	Over 15 Years
1985	75.0	31.2	43.8
1986	60.0	25.0	35.0
1987	30.0	12.5	17.5
1988	18.8	7.8	11.0
1989	11.3	4.7	6.6

Source: Table 6

TABLE K-11

P. FALCIPARUM CASES WITH PROJECT: BY AGE GROUP
(Thousands)

	Total	Under 15 Years	Over 15 Years
1985	25.0	10.4	14.6
1986	20.0	8.3	11.7
1987	10.0	4.2	5.8
1988	6.3	2.6	3.7
1989	3.8	1.6	2.2

Source: Table 7

TABLE K-12

PRESUMPTIVE TREATMENT DRUG COST WITHOUT PROJECT

	Under 15 Years			Over 15 Years			
	Total (000)	Seeking Treatment (000)	Cost ($000)	Total (000)	Seeking Treatment (000)	Cost ($000)	Total Cost (000)
1985	2,368.9	1,184.5	213.2	3,325.5	1,662.8	598.6	811.8
1986	2,428.1	1,214.1	218.5	3,408.7	1,704.3	613.6	832.1
1987	2,488.8	1,244.4	224.0	3,493.9	1,746.9	628.9	852.9
1988	2,551.0	1,275.5	229.6	3,581.2	1,790.6	644.6	874.2
1989	2,614.8	1,307.4	235.3	3,670.8	1,835.3	660.7	896.1

Notes: 50 percent of population in each age group will seek medical attention due to some type of fever, three times a year.

Drug dosages obtained from SNEM and administered as follows:
a. Under 15 Years: 2 chloroquine tablets per visit.
b. Over 15 Years: 4 chloroquine tablets per visit.

Drug cost: U.S.$.03 per 150 mg. of chloroquine tablet

Sources: SNEM publication and technical expert's advice.

TABLE K-13

PRESUMPTIVE TREATMENT DRUG COST WITH PROJECT

	Under 15 Years			Over 15 Years			
	Total (000)	Seeking Treatment (000)	Cost ($000)	Total (000)	Seeking Treatment (000)	Cost ($000)	Total Cost ($000)
1985	2,368.9	1,066.0	191.1	3,325.5	1,496.5	538.7	729.8
1986	2,428.1	971.2	174.8	3,408.7	1,363.5	490.9	665.7
1987	2,488.8	871.1	156.8	3,493.9	1,222.9	440.2	579.0
1988	2,551.0	765.3	137.8	3,581.2	1,074.4	386.8	524.6
1989	2,614.8	653.7	117.7	3,670.8	917.7	330.4	448.1

Notes: Population seeking medical attential due to some type of fever will decrease by 50 percent by the end of the project.

Drug dosages obtained from SNEM and administered as follows:
a. Under 15 Years: 2 chloroquine tablets per visit.
b. Over 15 Years: 4 chloroquine tablets per visit.

Drug cost: U.S.$.03 per 150 mg. of chloroquine tablet

Sources: SNEM publication and technical expert's advice.

TABLE K-14

PRESUMPTIVE TREATMENT DRUGS COSTS: WITH AND WITHOUT PROJECT
(U.S.$000)

	Without	With	Costs Avoided	P.V. 15%
1985	811.8	729.8	82.0	71.3
1986	832.1	665.7	166.4	125.8
1987	852.9	579.0	273.9	180.2
1988	874.2	524.6	349.6	200.0
1989	896.1	448.1	448.0	223.1
	4,267.1	2,947.2	1,319.9	800.4

Source: Tables 12 and 13

TABLE K-15

P. VIVAX DRUGS COST WITHOUT THE PROJECT

	Under 15 Years		Over 15 Years		
	Cases (000)	Cost ($000)	Cases (000)	Cost ($000)	Total Cost ($000)
1985	174.7	181.7	245.3	529.8	711.5
1986	249.6	259.6	350.4	756.9	1,016.4
1987	349.4	363.4	490.5	1,059.5	1,422.9
1988	461.8	480.3	648.2	1,400.1	1,880.4
1989	586.6	610.1	823.4	1,778.5	2,388.6

Notes: Three P. Vivax attacks per year.

Drug dosages obtained from SNEM and administered as follows:
a. Under 15 Years: 5 chloroquine and 1.5 primaquine/attack.
b. Over 15 Years: 11 chloroquine and 3 primaquine tablets per attack.

Drug cost: U.S.$.03 per 150 mg. of chloroquine tablet
U.S.$.13 per 15 mg. primaquine tablet

Sources: SNEM publication and technical expert's advice.

TABLE K-16

P. VIVAX DRUGS COST WITH THE PROJECT

	Under 15 Years		Over 15 Years		
	Cases (000)	Cost ($000)	Cases (000)	Cost ($000)	Total Cost ($000)
1985	31.2	32.4	43.8	94.6	127.1
1986	25.0	26.0	35.0	75.6	101.6
1987	12.5	13.0	17.5	37.8	50.8
1988	7.8	8.1	11.0	23.8	31.9
1989	4.7	4.9	6.6	14.3	19.1

Notes: Three P. Vivax attacks per year.

Drug dosages obtained from SNEM and administered as follows:
a. Under 15 Years: 5 chloroquine and 1.5 primaquine/attack.
b. Over 15 Years: 11 chloroquine and 3 primaquine tablets per attack.

Drug cost: U.S.$.03 per 150 mg. of chloroquine tablet
U.S.$.13 per 15 mg. primaquine tablet

Sources: SNEM publication and technical expert's advice.

TABLE K-17

P. FALCIPARUM DRUGS COST WITH THE PROJECT

	Under 15 Years		Over 15 Years		
	Cases (000)	Cost ($000)	Cases (000)	Cost ($000)	Total Cost ($000)
1985	58.2	235.7	81.8	669.9	905.7
1986	83.2	337.0	116.8	956.6	1,293.6
1987	116.5	471.8	163.5	1,339.1	1,810.9
1988	153.9	623.3	216.1	1,769.9	2,393.2
1989	195.5	791.8	274.5	2,248.2	3,039.9

Notes: Three P. Falciparum attacks per year.

Drug dosages obtained from SNEM and administered as follows:
a. Under 15 Years: 5 chloroquine and 1.5 fansidar/attack.
b. Over 15 Years: 11 chloroquine and 3 fansidar tablets per attack.

Drug cost: U.S.$.03 per 150 mg. of chloroquine tablet
U.S.$.80 per 15 mg. per fansidar tablet

Sources: SNEM publication and technical expert's advice.

TABLE K-18

P. FALCIPARUM DRUGS COST WITH THE PROJECT

	Under 15 Years		Over 15 Years		
	Cases (000)	Cost ($000)	Cases (000)	Cost ($000)	Total Cost ($000)
1985	10.4	42.1	14.6	119.6	161.7
1986	8.3	33.6	11.7	95.8	129.4
1987	4.2	17.0	5.8	47.5	64.5
1988	2.6	10.5	3.7	30.3	40.8
1989	1.6	6.5	2.2	18.0	24.5

Notes: Three P. Falciparum attacks per year.

Drug dosages obtained from SNEM and administered as follows:
a. Under 15 Years: 5 chloroquine and 1.5 fansidar/attack.
b. Over 15 Years: 11 chloroquine and 3 fansidar tablets per attack.

Drug cost: U.S.$.03 per 150 mg. of chloroquine tablet
U.S.$.80 per 15 mg. per fansidar tablet

Sources: SNEM publication and technical expert's advice.

TABLE K-19

RADICAL TREATMENT DRUGS COSTS: WITH AND WITHOUT THE PROJECT
(U.S.$000)

	Without	With	Costs Avoided	P. V. 15%
1985	1,617.2	288.8	1,328.4	1,155.7
1986	2,310.0	231.0	2,079.0	1,571.7
1987	3,233.8	115.3	3,118.5	2,052.0
1988	4,273.6	72.7	4,200.9	2,402.9
1989	5,428.4	43.6	5,384.8	2,681.6
	16,863.0	751.4	16,111.6	9,864.0

Source: Tables 15 thru 18

TABLE K-20

HOSPITALIZATION COST WITHOUT THE PROJECT

	P.Vivax Cases			P. Falciparum Cases			
	Total Cases (000)	Require Hospit. (000)	Hospit. Cost ($000)	Total Cases (000)	Require Hospit. (000)	Hospit. Cost ($000)	Total Cost ($000)
1985	420.0	42.0	3,780.0	140.0	35.0	6,300.0	10,080.0
1986	600.0	60.0	5,400.0	200.0	50.0	9,000.0	14,400.0
1987	840.0	84.0	7,560.0	280.0	70.0	12,600.0	20,160.0
1988	1,110.0	111.0	9,990.0	370.0	92.5	16,650.6	26,640.0
1989	1,410.0	141.0	12,690.0	470.0	117.5	21,150.0	33,840.0

Notes: 10 percent of P. Vivax cases require hospitalization for 3 days.
25 percent of P. Falciparum cases require hospitalization for 6 days.

Hospital bed cost per day is U.S.$30.00.

Sources: Technical expert's advice.

TABLE K-21

HOSPITALIZATION COST WITH THE PROJECT

	P.Vivax Cases			P. Falciparum Cases			
	Total Cases (000)	Require Hospit. (000)	Hospit. Cost ($000)	Total Cases (000)	Require Hospit. (000)	Hospit. Cost ($000)	Total Cost ($000)
1985	75.0	7.5	675.0	25.0	6.3	1,125.0	1,800.0
1986	60.0	6.0	540.0	20.0	5.0	900.0	1,440.0
1987	30.0	3.0	270.0	10.0	2.5	450.0	720.0
1988	18.8	1.9	169.2	6.3	1.6	283.5	452.7
1989	11.3	1.1	101.7	3.8	1.0	171.0	272.7

Notes: 10 percent of P. Vivax cases require hospitalization for 3 days.
25 percent of P. Falciparum cases require hospitalization for 6 days.

Hospital bed cost per day is U.S.$30.00.

Sources: Technical expert's advice.

TABLE K-22

HOSPITALIZATION TREATMENT COSTS: WITH AND WITHOUT THE PROJECT
(U.S.$000)

	Without	With	Costs Avoided	P. V. 15%
1985	10,080.0	1,800.0	8,280.0	7,203.6
1986	14,400.0	1,440.0	12,960.0	9,797.8
1987	20,150.0	720.0	19,430.0	12,784.9
1988	26,640.0	452.7	26,187.3	14,979.1
1989	33,640.0	272.7	33,367.3	16,616.9
	104,910.0	4,685.4	100,224.6	61,382.4

Source: Tables 20 and 21

TABLE K-23

INCOME LOSS WITHOUT THE PROJECT: P. VIVAX CASES

	Over 15 Years P. Vivax Cases (000)	Gainfully Employed (000)	Unable to Work (000)	Total Income Loss ($000)
1985	245.3	98.1	24.5	291.9
1986	350.4	140.2	35.0	417.0
1987	490.6	196.2	49.1	583.8
1988	648.2	259.3	64.8	771.4
1989	823.4	329.4	82.3	979.8

Notes: 40 percent of adult P. Vivax cases are employed.
25 percent of employed P. Vivax cases will be unable to work.
Minimum daily wage is U.S.$1.70 equivalent.
Average number of days off work is 7.

TABLE K-24

INCOME LOSS WITH THE PROJECT: P. VIVAX CASES

	Over 15 Years P. Vivax Cases (000)	Gainfully Employed (000)	Unable to Work (000)	Total Income Loss ($000)
1985	43.8	17.5	4.4	52.1
1986	35.4	14.0	3.5	41.7
1987	17.5	7.0	1.8	20.8
1988	11.0	4.4	1.1	13.1
1989	6.6	2.6	0.7	7.9

Notes: 40 percent of adult P. Vivax cases are employed.
25 percent of employed P. Vivax cases will be unable to work.
Minimum daily wage is U.S.$1.70 equivalent.
Average number of days off work is 7.

TABLE K-25

INCOME LOSS WITHOUT THE PROJECT: P. FALCIPARUM CASES

	Over 15 Years Falciparum Cases (000)	Gainfully Employed (000)	Unable to Work (000)	Total Income Loss ($000)
1985	81.8	32.7	16.4	584.1
1986	116.8	46.7	23.4	834.0
1987	163.5	65.4	32.7	1,167.4
1988	216.1	86.4	43.2	1,543.0
1989	274.5	109.8	54.9	1,959.9

Notes: 40 percent of adult P. Falciparum cases are employed.
50 percent of employed P. Falciparum cases will be unable to work.
Minimum daily wage is U.S.$1.70 equivalent.
Average number of days off work is 21.

TABLE K-26

INCOME LOSS WITH THE PROJECT: P. FALCIPARUM CASES

	Over 15 Years Falciparum Case (000)	Gainfully Employed (000)	Unable to Work (000)	Total Income Loss ($000)
1985	14.5	5.8	2.9	103.5
1986	11.7	4.7	2.3	83.5
1987	5.8	2.3	1.2	41.4
1988	3.7	1.5	0.7	26.4
1989	2.2	0.9	0.4	15.7

Notes: 40 percent of adult P. Falciparum cases are employed.
50 percent of employed P. Falciparum cases will be unable to work.
Minimum daily wage is U.S.$1.70 equivalent.
Average number of days off work is 21.

TABLE K-27

INCOME LOSS: WITH AND WITHOUT THE PROJECT
(U.S.$000)

	Without	With	Costs Avoided	P. V. 15%
1985	876.0	155.6	720.4	626.7
1986	1,251.0	125.2	1,125.6	851.1
1987	1,751.2	62.2	1,689.0	1,111.4
1988	2,314.4	39.5	2,274.9	1,301.2
1989	2,939.7	23.6	2,916.1	1,452.2
	9,132.3	406.1	8,726.2	5,342.7

Source: Tables 23 thru 26

TABLE K-28

TOTAL COSTS AVOIDED
(U.S.$000)

	Costs Without Project	Present Value 15%	Costs With Project	Present Value 15%	P.V. Costs Avoided
1985	13,384.4	11,644.4	2,974.2	2,587.6	9,056.8
1986	18,793.1	14,207.6	2,461.9	1,861.2	12,346.4
1987	25,987.9	17,100.0	1,476.5	971.5	16,128.5
1988	34,124.1	19,519.0	1,089.5	614.1	18,904.9
1989	43,104.2	21,465.9	788.0	392.4	21,073.5
	135,371.8	84,024.4	8,790.1	6,383.5	77,640.9

Source: Tables 13 thru 27

TABLE K-29

BENEFIT-COST RATIO, NET PRESENT WORTH,
INTERNAL ECONOMIC RATE OF RETURN
(U.S.$000)

	Project Benefits		Project Costs			
	Gross	P. V. 15%	Gross	P. V. 15%	Net Benefits 15%	Net Benefits 50%
1985	10,410.2	9,056.8	7,272.0	6,326.6	2,730.2	2,093.1
1986	16,331.2	12,346.4	7,271.0	5,496.9	6,849.5	4,022.7
1987	24,511.4	16,128.5	7,972.0	5,245.6	10,882.9	4,895.7
1988	33,034.6	18,904.4	8,343.0	4,772.2	14,132.7	4,892.1
1989	42,316.2	21,073.5	9,310.0	4,636.4	16,437.1	4,356.9
		77,640.9	40,168.0	26,485.4	51,155.5	20,349.6

Benefit-Cost Ratio at 15% ... = 2.93
Net Present Worth at 15% ... = U.S.$51,155.5 equivalent
Internal Economic Rate of Return over 50%

TABLE K-30

SENSITIVITY ANALYSIS: PROJECT COSTS
INCREASED BY 50 PERCENT
(U.S.$000)

	Project Benefits		Project Costs			
	Gross	P. V. 15%	Gross	P. V. 15%	Net Benefits 15%	Net Benefits 50%
1985	10,410.2	9,056.8	10,908.0	9,489.9	(433.1)	(332.0)
1986	16,331.2	12,364.4	10,906.5	8,245.4	4,119.0	2,419.1
1987	24,511.4	16,128.5	11,958.0	7,868.4	8,260.1	3,715.8
1988	33,034.6	18,904.9	12,514.5	7,158.3	11,746.6	4,066.2
1989	42,316.2	21,073.5	13,965.0	6,954.6	14,118.9	3,742.4
		77,640.9	60,252.0	39,728.1	37,912.8	13,733.4

Benefit-Cost Ratio at 15% ... = 1.95
Net Present Worth at 15% ... = U.S.$37,912.8 equivalent
Internal Economic Rate of Return over 50%

TABLE K-31

SENSITIVITY ANALYSIS: PROJECT BENEFITS
DECREASED BY 50 PERCENT
(U.S.$000)

	Project Benefits		Project Costs			
	Gross	P. V. 15%	Gross	P. V. 15%	Net Benefits 15%	Net Benefits 50%
1985	5,205.1	4,528.4	7,272.0	6,326.6	(1,798.2)	(1,378.7)
1986	8,165.6	6,173.2	7,271.0	5,496.9	676.3	397.2
1987	12,255.7	8,064.3	7,972.0	5,245.6	2,818.7	1,267.9
1988	16,517.3	9,447.9	8,343.0	4,772.2	4,675.7	1,618.5
1989	21,158.1	10,536.7	9,310.0	4,636.4	5,900.3	1,564.0
		38,750.5	40,168.0	26,485.4	12,265.1	3,563.9

Benefit-Cost Ratio at 15% ... = 1.46
Net Present Worth at 15% ... = U.S.$12,265.1 equivalent
Internal Economic Rate of Return over 50%

TABLE K-32

SENSITIVITY ANALYSIS: BENEFITS DECREASE BY 40%, COSTS INCREASED BY 40% (U.S.$000)

	Project Benefits		Project Costs			
	Gross	P. V. 15%	Gross	P. V. 15%	Net Benefits 15%	Net Benefits 50%
1985	6,246.1	5,434.1	10,180.8	8,857.3	(3,423.2)	(2,624.5)
1986	9,798.7	7,407.9	10,179.4	7,695.7	(287.8)	(169.0)
1987	14,706.8	9,677.1	11,160.8	7,343.8	2,333.3	1,049.6
1988	19,820.8	11,337.5	11,680.2	6,681.1	4,656.4	1,611.8
1989	25,389.7	12,644.1	13,034.0	6,491.0	6,153.1	1,630.9
		46,500.7	56,235.2	37,079.6	9,431.8	1,498.8

Benefit-Cost Ratio at 15% ... = 1.25
Net Present Worth at 15% ... = U.S.$9,431.8 equivalent
Internal Economic Rate of Return over 50%

TABLE K-33

COST EFFECTIVENESS: MALARIA CONTROL PROJECT

	Total Population Malaria Zones ($000)	Malaria Costs With Project ($000)	Project Implementation Costs ($000)	Total Project Costs ($000)	Per Capita Cost ($000)
1985	5,694.4	2,974.2	7,272.0	10,246.2	1.80
1986	5,836.7	2,461.9	7,271.0	9,732.9	1.67
1987	5,982.7	1,476.5	7,972.0	9,448.5	1.58
1988	6,132.2	1,089.5	8,343.0	9,432.5	1.54
1989	6,285.5	788.0	9,310.0	10,098.0	1.61
				48,958.1	1.64

Note: Malaria costs with the project are those resulting from malaria cases during implementation of the project.

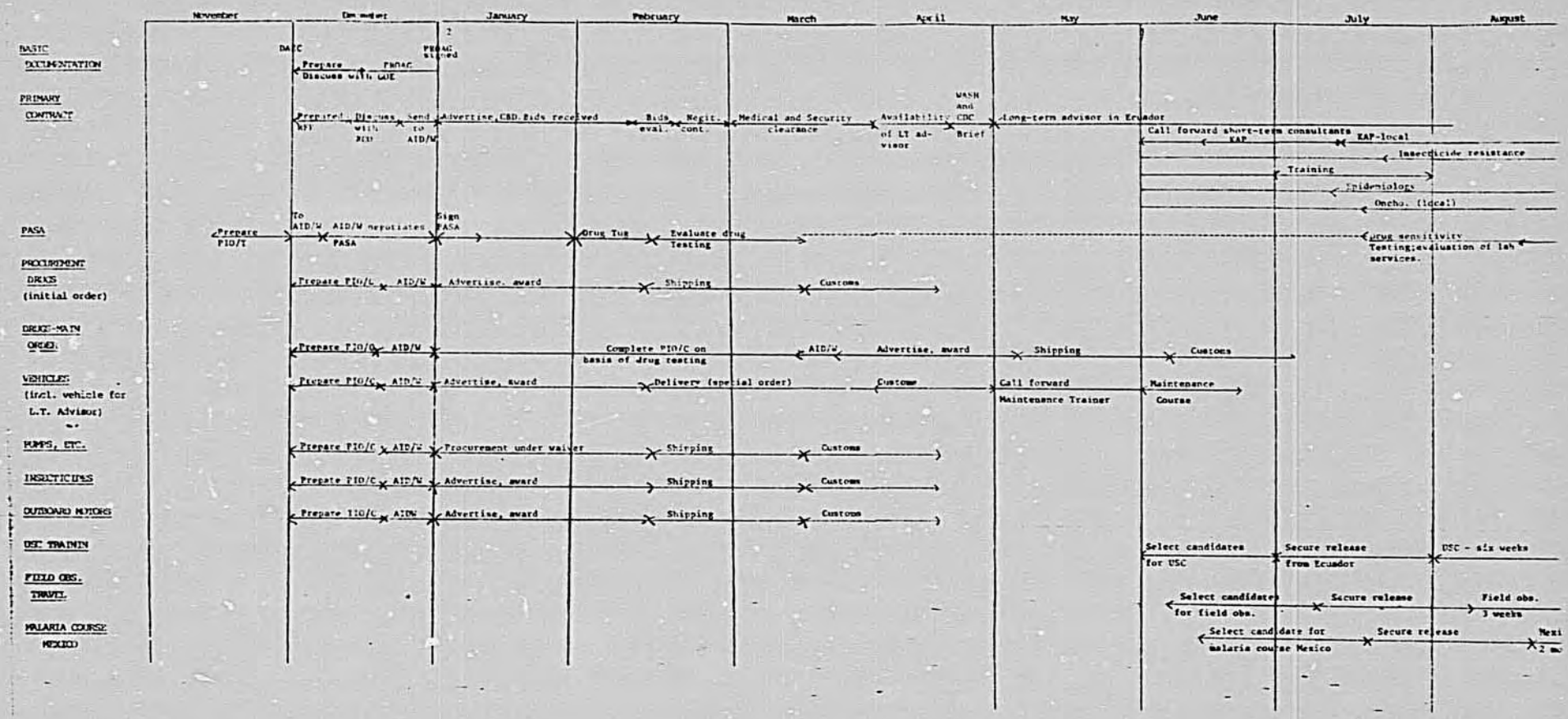
TABLE K-34

COST EFFECTIVENESS: PROPHYLACTIC TREATMENT

	Total Population Malaria Zones (000)	Population Under 15 Years (000)	Preventive Drugs Costs ($000)	Population Over 15 Years (000)	Preventive Drugs Cost ($000)	Total Preventive Cost ($000)	Per Capita Cost ($000)
1985	5,694.4	2,368.9	3,695.5	3,325.4	10,325.2	14,070.7	2.47
1986	5,836.7	2,428.1	3,788.9	3,408.7	10,634.6	14,423.5	2.47
1987	5,982.7	2,488.8	3,883.6	3,493.9	10,900.5	14,784.1	2.47
1988	6,132.2	2,551.0	3,980.7	3,581.2	11,173.0	15,153.7	2.47
1989	6,285.5	2,614.8	4,080.2	3,670.8	11,452.3	15,532.5	2.47
						73,964.5	

Note: Prophylactic treatment dosages are as follows:
a. Under 15 Years Old: 1 chloroquine tablet per week.
b. Over 15 Years Old: 2 chloroquine tablets per week.

Source: Technical expert's advice.



ANNEX L

PERFORMANCE NETWORK AND DETAILED IMPLEMENTATION PLAN

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UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON D.C. 20523

ANNEX M

LAC/DR-IEE-84-47

ENVIRONMENTAL THRESHOLD DECISION

Project Location	: Ecuador
Project Title and Number	: Malaria Control 518-0049
Funding	: $2,500,000 (G), $7,500,000 (L)
Life of Project	: 5 years
IEE Prepared by	: Lawrence Cowper S&T/H, AID/W
Recommended Threshold Decision	: Negative Determination
Bureau Threshold Decision	: Concur with Recommendation
Comments	: None
Copy to	: Orlando Llenza, Director USAID/Quito
Copy to	: Lawrence Cowper, S&T/H, AID/W
Copy to	: Douglas Chiriboga, LAC/DR
Copy to	: IEE File

James S. Hester Date AUG 23 1984

James S. Hester
Chief Environmental Officer
Bureau for Latin America
and the Caribbean

INITIAL ENVIRONMENTAL EXAMINATION

I. Project Location: Ecuador
Project Title and Number: Malaria Control
Funding Planned: LOP ($000) A.I.D. $ 7,500 (Loan)
$ 2,500 (Grant)
G.O.E. $33,000 (Equiv.)

Life of Project: Five Years
Project Assistance Completion Date: September 30, 1990
IEE Prepared by: Lawrence T. Cowper
AID/W, S&T/Health
Health Science
Administrator

Date Prepared: July 26, 1984

Threshold Decision: Pursuant to the authority delegated to the USAID Director and based on an Initial Environmental Examination (IEE) for the proposed use of A.I.D. project funds to support a targeted comprehensive anti-malaria program involving intradomiciliary spraying, drug distribution, larviciding, source reduction and natural biological controls as described herein, I recommend the following negative determination:

"The proposed action is not an action which will have a significant effect on the human environment over and above that described below and is, therefore, not an action for which a more detailed Environmental Impact Statement or Assessment will be required under this project."

Mission Director's Concurrence

S/
Orlando Llenza
USAID Director

7-30-84
Date

INITIAL ENVIRONMENTAL EXAMINATION (IEE)

I. Project Description

This project will provide technical assistance, support for applied research in malaria control and other vector-borne diseases, training, and commodities to assist the GOE to implement its nation wide malaria control program. The Project will provide funding to be used in an effective malaria control program focusing primarily on the rural population of Ecuador, thus enhancing orderly economic and social development in the fields of health and agriculture. The project will enhance the quality of the environment in those areas where source reduction and water management practices are made a part of the program. Insecticides will be used in the program, but these chemicals which have been used in Ecuador with no adverse effects in the past will be applied in a manner which is not detrimental to the environment. Health safeguards are presently in place in the field program. Careful attention will be paid to training and supervision in the handling and application of insecticides. The National Service for Malaria Eradication and Other Vector-Borne Diseases (SNEM) has applied Organophorphorus (O.P.) and Chlorinated Hydrocarbon insecticides previously without serious cases of insecticide intoxication.

II. Evaluation of Environmental Impact

2.1 General

The A.I.D. Environmental Impact Statement (EIS) included an in-depth review of the impact of malaria programs on the environment. The conclusions of the EIS were that the major insecticides used in world-wide malaria control programs such as DDT, malathion, fenitrothion and Abate have a favorable risk-benefit impact on the environment due to their method of application in public health program, i.e., within the house structure. This project will apply standard application techniques for Organophorphorus (O.P.) and other insecticides as in the past. It is expected that a reduction in the amount of insecticide will be occurring over the project's life. One of the purposes of the comprehensive EIS submitted by A.I.D. and accepted by the Environmental Protection Agency (EPA) was to avoid duplicating environmental review efforts for projects of a similar nature in countries with comparable conditions. Additional specific environmental studies made on malaria control programs within the last five years in India, Thailand, Nepal, Haiti, and Pakistan have all reached the same favorable risk-benefit environmental conclusions. The points of similiarity between this project and previous environmental studies, both for O.P. and Chlorinated Hydrocarbon insecticide use and the other methods of malaria control, obviate the need for another in-depth analysis. All the above reports are available in AID/Washington, S&T/Health.

2.2 Insecticides to be used in Project

2.2.1. Chlorinated Hydrocarbons (DDT).

The major insecticide procured by the GOE for its anti-malaria activities is DDT. While the A.I.D. project will not be procuring DDT for this program a summary review of its environmental implications is presented in this IEE.

The effectiveness of DDT as an insecticide was discovered in 1939 but it was first synthesized in 1874. Initially it was used to protect military areas and personnel against vector borne diseases such as malaria and typhus. In 1945, DDT was released for commercial use. That year 15,079 tons were produced in the United States. Use in the U.S. increased until 1959 and then declined gradually. Concern developed in the late 1960's that DDT might have adverse environmental effects not previously expected. However, in developing countries of the world where malaria was a serious problem, the continued use of DDT was necessary.

In January of 1971 a statement entitled "The Place of DDT in operations against malaria and other vector-borne diseases" was presented at the forty-seventh session of the executive board of the World Health Organizaton. The statement points out that DDT is being replaced for control of many vector-borne diseases by other insecticides and the use of DDT is declining. However, for the present, no economic alternative to DDT is available and the epidemiological, operational, and financial consequences of the withdrawal of DDT would be very grave. The statement reviews the effects of DDT on man and wildlife and discusses environmental contamination from its use in anti-malarial campaigns. It concludes that:

"1. Indoor spraying of DDT in routine anti-malarial operations does not involve a significant risk to man or to wildlife. The withdrawal of DDT from the malaria programmes would be fraught with great danger and is unjustifiable in the light of present knowledge. The Organization should do everything in its power to ensure that DDT remain available for this purpose.

2. Outdoor use of DDT should be avoided as far as possible.

3. Further research is needed on subsitute insecticides..."

The use of DDT in the Ecuador anti-malaria program is confined to spraying the inside of houses and other buildings at the rate of 2 gm per sq. meter. In this situation it appears that only insignificant amounts will get into the environment utilized by wildlife and the relevant consideration must be the possible effects on humans.

The environmental impact of using DDT in malaria control programas has been thoroughly considered by AID, PAHO and the U.S. Public Health Service as well as by the GOE. These agencies are all in agreement that DDT is the safest and most effective insecticide for use in malaria control and does not threaten the environment when it is applied by the standardized methods recommended by PAHO and AID.

1. The DDT is sprayed only on surfaces where it will not wash away, i.e. on the inside of walls of houses and on sheltered areas of adjacent buildings. Thus, it is unlikely that any appreciable amounts of DDT can escape into the soil and subsequently into groundwater or streams.

2. DDT is characterized by low volatility and none of it escapes into the atmosphere.

3. PAHO advisors are provided to ensure proper spraying and storing of the DDT.

PAHO and the U.S. Public Health Service both have responsibilities in the broad field of human health and have available to them the world's leading experts in the field of pesticide use, toxicology of pesticides and the safe handling and proper use of pesticides. Both organizations are on record to the effect that DDT is the cheapest, most effective and the safest insecticide available for use as a residual wall spray to control malaria mosquitoes.

Dr. Steinfield, Surgeon-General of the United States Public Health Service in testifying before the EPA hearings on DDT stated, "The safety record for the use of DDT in the malaria eradication program is nothing short of phenomenal. Although billions of pounds have been used in anti-malaria programs during the past quarter of a century, there is no record of illness attributable to DDT resulting directly from the normal spraying operations among either the hundreds of thousands of sprayment or the hundreds of millions of occupants of DDT treated homes."

In a WHO publication entitled, "The place of DDT in Operations Against Malaria and Other Vector-Borne Diseases," an assessment of environmental contamination from the use of DDT in antimalarial operations is given as follows:

"Whereas damage to wildlife has sometimes followed the application of DDT in agricultural and forestry practice, the same risks do not now accompany the use of DDT in antimalaria operations. Since the vast majority of the DDT used in the control of malaria is applied as a residual spray indoors, only a small fraction of the insecticide is likely to involve any direct contamination of the environment. This, however, may take place during the

process of spraying the houses with DDT, when a certain amount of contamination of the floor and immediately surrounding soil outside does take place. Some measurements have indicated that about 6% of the spray is deposited on the floor inside and some 2% on the outside soil around the houses. The deposit ouside houses, if calculated for rural areas with an average of 100 inhabitants per square km, as in parts of tropical Africa, would amount to a DDT input of 10 g per hectare: it will be seen that this is 200 times less than a standard DDT application of 2 kg. per hectare as employed on cotton crops. Moreover, whereas only one or two applications are made to houses per year, multiple applications are made to cotton during its growing season. The DDT sprayed on the inside walls and falling to the floor is held by those surfaces. Hence, provided the insecticide is used indoors as in the case of antimalaria operations, it would appear that there is little possibility of the insecticide contaminating the surrounding local vegetation and water sources that would endanger wildlife."

Since the use of DDT in malaria eradication or control programs is exclusively as a residual on the inside of buildings and it is not used as a larvicide, the amount getting into the outside environment are minimal. Nevertheless, since DDT has aroused considerable controversy and emotion, a brief review of some environmental effects is presented. DDT tends to persist in the environment for relatively long periods of time and does accumulate in the tissues of animals and concentrations tend to magnify in some organisms over a period of time. DDT in soil has an average half life of 3 years (Edwards 1973). In Maryland occasionally cropped soil had 40% of the DDT applied after 17 years (Nash and Woolson 1967).

At the present time a vast literature exists on the effects of DDT on the environment. A review of the total literature is not practical here but the following presents the essential elements of it. There is widespread disagreement over the use of DDT and it has been banned in a number of developed countries even though some scientists favor continuation of its essential uses. In the United States DDT is banned but is allowed when necessary to protect human health. It was used in California in 1976 for control of plague (R.F. Peters, Pers. Com.).

Because of the overriding necessity for DDT in malaria eradication and control it is still used for that purpose in many areas of the world. However, because of reported serious adverse effects on some forms of wildlife, notably fish and some birds, the use of DDT in malaria control is restricted to indoor residual spraying where the risk of exposing wild-life is extremely limited.

2.2.2. <u>Organophosphorus Insecticides</u> (Malathion, Fenthion, Abate)

In addition to DDT, the Ecuador malaria program will be applying organophosphorus (O.P.) insecticides, fenitrothion, malathion, and abate in its spray operation program in limited areas of the country. At present, O.P. insecticides are only applied as residual sprays in Esmeraldas zone.

Malathion has undergone several environmental examinations in connection with its use in AID-assisted malarial control efforts in Sri Lanka, Pakistan, India, Nepal and Zanzibar. All of these environmental examinations have concluded that malathion as applied as a residual spray in malaria control programs does not adversely affect the environment provided that (1) strict compliance to A.I.D. specifications for malathion is enforced; (2) proper training and supervision of spray personnel is carried out; (3) adequate protective equipment is provided to spray personnel and (4) periodic cholinesterase testing is done on spray operation personnel. Over the last few years approximately 85 million pounds of U.S. supplied malathion has been applied in AID-assisted malaria programs without a single serious intoxication episode. There has been a few moderate intoxication cases but the worst cases only required a brief overnight stay in a hospital. This remarkable record was accomplished by strict enforcement of health safeguards, adequate training and a high quality technical insecticide. Ecuador has applied only limited amounts of malathion in the past years. The methods of application by SNEM were in conformity with worldwide health standards and there were no incidences of malathion intoxication. If malathion will again be applied in the program over the project period, there is every reason to believe that it will be applied in an environmentally acceptable manner.

Fenitrothion has gone through the seven stage trials of screening by the World Health Organization (WHO) and is one of the compounds recommended by WHO for residual spraying in malaria control program. Fenitrothion like malathion does inhibit cholinesterase activity. However, Ecuador has not experienced any health problems in its spray operations with this insecticide due to the safeguards build into the program of protective clothing, frequent testing of cholinesterase levels in personnel, adequate supervision, regular and refresher training, and proper storage and distribution practices. Fenitrothion has been used in Haiti, Thailand and Pakistan in their operational malaria programs. All three of these malaria control programs are also being assisted by A.I.D. Fenitrothion is registered in the U.S.A. with the Environmental Protection Agency (EPA) for a variety of uses. There have been numerous significant studies on the environmental impact of fenitrothion since it was reported as a chemical in 1956. These studies include tests on man, cows, dogs, rats, rabbits, fish, birds, steers, and sheep. In a WHO program using fenitrothion as a residual insecticide in Kisumu, Kenya, only one mild case of intoxication was reported in 2,000 man-days of spraying. Fenitrothion was applied widely as a residual spray in Pakistan in 1981-1984, and no serious intoxication problems with spraymen or villagers were reported.

As fenitrothion is a wide-spectrum insecticide, it is apt to kill a number of non-target organisms in the areas where it is used unless accurate operational techniques are adopted. This insecticide is higly toxic to bees, but as its primary use in malaria control is as an indoor residual spray, this should not cause environmental problems. Additional information on fenitrothion is available in various EA's prepared for other malaria control programs in Asia and Latin America (Haiti).

The larvicide, Abate, an organophosphate, may be used as a supplementary control measure during the life of the project in some local locations. This compound has been shown in studies to be low in toxcity if taken orally and applied dermally. Normal application concentrations of Abate in water under field conditions is about 0.5 ppm. Even if an adult were to drink the water treated directly and if 2 litres were consumed, the maximum amount of Abate imbibed daily would be about 1 mg. This compares with a dosage of 256 mg/man/day fed to human volunteers for 5 days and 64 mg/man/days for four weeks without clinical symptoms or side effects. Through the dermal route, Abate was found to be even less toxic. Abate has a short half-life, is not stored in the body, and produces no known chronic or residue effect. Abate offers little potential for harm to human health (Pg. 224, AID, EIS).

In addition to the safeguards for insecticide use already existing and being used in the Ecuador SNEM program, the A.I.D. project is planned to provide an experienced U.S. funded malaria specialist who will take particular attention to matters concerning the procurement, storage and application of insecticides.

2.3 Biological Control

The project does foresee the use of larvivorous fish in the project as a supplemental biological control measure in mosquito control in selected areas. It is planned to use only indigenous fish for this purpose in the operation. There may be experimental use of non-indigenous larvivorous fish, but all such trials will be carefully controlled and cleared with environmental offices.

It is also possible that a biological larvicide, BTI, may be experimentally used in specific locations. There are no known adverse environmental implications to this compound.

III. Recommendation

In view of the above examination of the environmental issues of this project, it is recommended that a negative determination be made for this program.

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Environmental Impact Checklist

IMPACT IDENTIFICATION AND EVALUATION FORM

N - No environmental impact
L - Little environmental impact
M - Moderate environmental impact
H - High environmental impact
U - Unknown environmental impact
1 - Positive impact
- - Negative impact

Impact Areas and Sub-areas

A. Land Use

1. Changing the character of the land through:

a. Increasing the population	N
b. Extracting natural resources	N
c. Land cleaning	L
d. Changing soil character	N
2. Altering natural defenses	N
3. Foreclosing important uses	N
4. Jeopardizing man or his works	N
5. Other factors increase agricultural productivity	L

B. Water Quality

1. Physical state of water	N
2. Chemical and biological states	N
3. Biological balance	N
4. Other factors	

C. Atmosphere

1. Air additives	N
2. Air pollution	L
3. Noise pollution	N
4. Other factors	

D. Natural Resources

1. Diversion, altered use of water _____ N _____
2. Irreversible, inefficient, commitments _____ N _____
3. Other factors _____

E. Cultural

1. Altering physical symbols _____ N _____
2. Dilution of cultural traditions _____ N _____
3. Other factors _____

F. Socio-economic

1. International impacts _____ M _____
2. Change in population _____ L _____
3. Changes in cultural patterns _____ N _____
4. Other factors _____

G. Health

1. Changing a natural environment _____ L _____
2. Eliminating an ecosystem element _____ N _____
3. Risk of intoxication of SNEM staff _____ M _____
4. Other factors _____

H. General

1. International Impacts _____ M+ _____
2. Controversial Impacts _____ N _____
3. Larger Program Impact _____ M+ _____
4. Other Factors _____

J. Other Possible Impacts (not listed above)

A SUMMARY OF OBSERVATIONS MADE IN JULY 1984

OF INSECTICIDE HANDLING PROCEDURES USED BY SENM

IN ECUADOR

Major attention was devoted to the question of health safeguards in the SNEM field program during the preparation of the Project Identification Document (PID). A review was made of the GOE/SNEM guidelines for testing, handling, and storing insecticides and the actual practices in the field operation.

The findings and conclusions of this review are reported below as a part of the IEE.

1. It was agreed that only insecticides meeting U.S. Environmental Protection Agency and A.I.D. specifications and standards are to be used in the project.

2. Procurement procedures will include testing of insecticides at the time of manufacture and at other important times as may be determined along the schedule leading to the application at the village level.

3. There is a concerted effort on the part of the GOE to store insecticides properly, not only at the zone level but also at village level. Field checks made in July 1984 on zonal insecticide storage facilities during the course of preparing this PID indicated that stock control and warehousing practices were satisfactory. The zonal warehousing reviewed at Esmeraldas, Santo Domingo, and Guayaquil were secure, well drained, with cement floors and walls which provided protection from rain and sun. Careful inspection was made of the residual insecticide containers which were stored in the warehouses. There were damaged boxes of insecticide, but generally speaking, the warehousing situation was satisfactory. The storage area at Esmeraldas was not clean due to spillage of insecticide during the packing operation. This aspect needs more supervision and will be carefully monitored during the project. The packaging of U.S. supplied insecticides will be consistent with A.I.D. specifications. There is to be a detailed caution label on each box. The date of production, batch number, manufacturer's name and location, product name, and chemical breakdown are all on this label. This label requirement is used in other malaria programs and has found to be satisfactory.

4. From the zone and/or sector warehouses, boxes are moved to village or spray locations just prior to spraying. Field visits made during July 1984 indicated that temporary village stores were satisfactory for the short period of time that the insecticides are

stored there. Every effort is made to use storage which is secure and which protects the insecticide from adverse weather conditions. Warehousing needs continual supervision but is considered adequate for the present in the program. However, the warehouse capacity may need expansion if a 4-cycle per year spray operation is approved as additional insecticide quantities will have to be stored.

5. Field teams using O.P. and Chlorinated Hydrocarbon insecticides in the zones are given training in proper handling prior to each operational round. A chain of directives was reviewed starting at the SNEM Headquarters and leading organizationally to zone malaria offices and to the spraying brigades. Circulars on insecticide usage have been issued to all GOE zone officers from SNEM Headquarters. It should be noted that O.P. insecticides are only being used in Esmeraldas zone at present. A copy of the SNEM instruction for handling insecticides is attached.

6. A review of the protective equipment issued to each spray person was also made. Each spray person is given five sets of clothes which includes a set of gloves. Soap is issued for washing the clothes as well as for personal hygiene. Spraymen are instructed to wash frequently during the day and prior to smoking or eating. There were instances observed where proper protective clothing was not worn and corrective action was suggested. A mask is provided to each spray person and changed daily. A sample mask was observed during the field observation. Actual spray operations were observed at Playa Grande, Esmeraldas zone on July 18, 1984 and practices did conform to SNEM instructions.

7. Supervision of the teams is done by the National and Zonal Malaria Offices. Spraymen work a five-day week in the operation season, but if signs of depressed cholinesterase appear spraymen are assigned to other duties.

8. A review of the SNEM cholinesterase testing procedures was done during the preparation of this IEE. The Zone Malaria Officer in Esmeraldas confirmed that cholinesterase testing is done on each spryman and supervisor prior to the initiation of spraying primarily in order to screen out persons who have abnormally low cholinesterase levels at the outset. During the 1983 operation, spray personnel were reported as having no intoxication problems due to insecticides. Cholinesterase testing is carried out by SNEM every two weeks on spray personnel. Field investigation indicated that spray personnel did receive regular cholinesterase tests. There are two cholinesterase testing kits in Ecuador at present. It may be practical to increase this number of kits as the operation expands. All personnel engaged in the operation receive regular training on insecticide management and safety.

Best Available Document

El DDT es un compuesto químico-orgánico que en forma pura (grado técnico o 100%) es un polvo cristalino de color blanco cremoso, soluble en los derivados del petroleo y otros solventes. Puede presentarse también en forma de escamas. Es prácticamente insoluble en agua. Con el DDT técnico se preparan las soluciones. Estas se aplican sobre superficies impermeables, como paredes con pinturas de caucho o aceite, barnizados, planchas metálicas, etc.

También puede uitilizarse en forma de mezcla con material humectable para preparaciones acuosas. En este caso la presentación más común es el DDT 75%, que se completa con tritón o similares y polvos inertes. Con esta mezcla se preparan las suspensiones, que se aplican sobre superficies permeables (barro, madera, caña, etc.).

El DDT también se presenta para la preparación de emulsiones, pero éstas no se utilizan por las dificultades operacionales de campo.

PREPARACION DEL DDT EN SOLUCION

Se prepara en tanques de hierro o recipientes de plástico, según las cantidades que se necesiten o disponibilidad de recipientes, a una concentración del 5% (Por ejemplo: 5 kgs. de DDT técnico en 100 litros de querosene). Los pasos a seguir son:

1. Coloque el polvo de DDT que se desee utilizar en una cantidad apropiada de querosene, de forma que pueda revolverse con un palo o varilla de hierro;
2. Eche esta primera preparación en el tanque o recipiente que contenga la cantidad de querosene necesaria para el DDT correspondiente
3. Deje el recipiente con las proporciones adecuadas de DDT y querosene durante uno o dos días, hasta observar que se ha disuelto totalmente en el solvente.

Para hacer más rápida la solución se recomienda:

a) Revolver a intervalos convenientes;

b) Dejar el recipiente al sol pues el calor favorece la solución.

Forma práctica de preparar en el campo:

1. Tome un tanque de hierro de 200 litros; lave su interior
2. Eche 20 o 30 litros de querosene dentro del tanque;
3. Agregue 10 kilos de DDT técnico (100%);
4. Haga rodar el tanque;
5. Agregue kerosene hasta completar 200 litros;
6. Ruede el tanque à intervalos convenientes hasta que se disuelva totalmente el DDT en el querosene. Es mejor dejar el tanque al sol para facilitar la disolución del DDT. Esta operación puede durar dos o tres días;
7. Una vez conseguido esto, el producto está listo para ser colocado en la bomba aspersora para su aplicación.

PREPARACION DEL DDT EN SUSPENSION.

Se utiliza DDT al 75% para mezclarse con agua, a una concentración del 5%. Para una bomba aspersora con 8 litros de agua se emplea 533 gramos de DDT 75%. Esta cantidad debe ser pesada previamente y entregarse en fundas de plástico a los operadores.

Procedimiento de preparación en el campo:

1. El operario debe colocar alrededor de 2 litros de agua en el balde agregando luego la cantidad de DDT 75% que contiene la funda;
2. Remover la mezcla con una paleta de madera hasta formar una pasta suave;

3. Agregar agua hasta completar los 4 litros de capacidad del balde, removiendo nuevamente con la paleta;
4. Eche la mezcla en la bomba aspersora;
5. Vuelva a echar otros 4 litros de agua en el balde, remueva con la paleta para que se suspendan los residuos de DDT y vacíe en la bomba aspersora para completar los 8 litros correspondientes.
6. Dejar en el balde otra funda de DDT 75% en remojo (en forma de pasta) para preparar la próxima carga de la bomba aspersora.

PRECAUCIONES CON EL USO DEL DDT

El DDT es un plaguicida de toxicidad moderada para mamíferos, de escasa absorción por la piel y de acción relativamente lenta para los insectos. Como cualquier otro producto químico debe ser manejado con precaución, para lo cual se dan las recomendaciones siguientes:

Durante la preparación del insecticida:

1. Evitar el contacto con el producto; si esto ocurre, lave la parte del cuerpo contaminada;
2. Los solventes del DDT pueden causar irritación de la piel; evite entrar en contacto directo con el kerosene;
3. No permita que caiga DDT al piso y en caso que ocurriere, recójalo y entiérrelo;
4. No prepare la carga de DDT cerca de las corrientes de agua;
5. No permita que personas o animales domésticos se encuentren cerca del lugar donde se prepara el insecticida.

Durante la aplicación:

1. Coloque el insecticida fuera del alcance de personas y animales domésticos;
2. Retire de la vivienda todo alimento y proteja los utensilios de cocina o de mesa;
3. Evite en lo posible que el insecticida que se rocíe sobre las paredes caiga al piso de la casa;
4. Durante el rociado de la casa no deben estar presente los moradores, sobre todo los niños, así como los animales domésticos;
5. Procure que el insecticida rociado no caiga sobre sí mismo, por efectos del viento o por descuido;
6. Mantenga la bomba aspersora exteriormente limpia, quitando los residuos de insecticida después de terminar el trabajo de cada vivienda;
7. Mantenga la bomba aspersora en perfecto estado de funcionamiento para evitar fugas de insecticida;
8. Al lavar el equipo hágalo alejado de las corrientes de agua. Los residuos del lavado del equipo deben ser enterrados;
9. Una vez terminado el trabajo haga las siguientes recomendaciones al dueño de casa:
   a) Lavar utensilios de cocina que pudieran tener residuos de insecticida;
   b) Barrer el piso;
   c) Si hubiera insectos muertos por efecto del insecticida, recogerlos y quemarlos, evitando sean comidos por aves de corral;
   d) No limpiar las paredes ni arrancar papeles de la superficie de mismas.

Precauciones personales:

1. Evite entrar en contacto con el insecticida;
2. Lávese las manos y cara después de terminado el trabajo de cada vivienda;
3. Mantenga el uniforme limpio;
4. No fume ni coma cuando esté manipulando el insecticida;
5. Báñese diariamente.

ATTACHMENT C

EPIDEMIOLOGICAL SUMMARY AND MAPS

TABLE I

SUMMARY OF EPIDEMIOLOGICAL SITUATION OF MALARIA IN ECUADOR FOR THE PERIOD 1974 - 1983

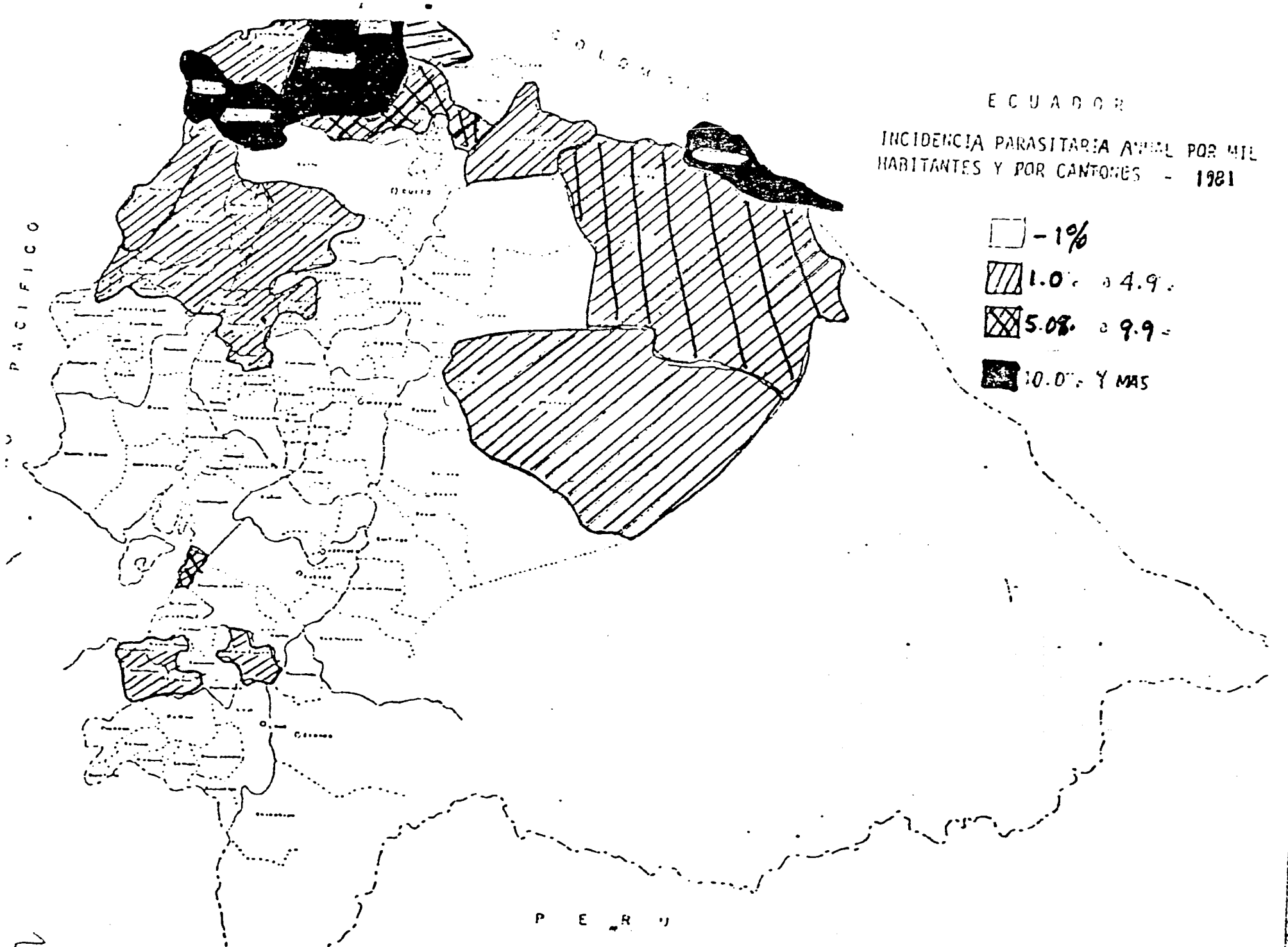
YEAR	TOTAL CASES	NO. OF CASES OF P.falciparum	ANNUAL PARASITE INCIDENCE
1974	5,481	1,003	1.6
1975	6,555	1,236	1.9
1976	10,974	1,945	3.0
1977	11,275	2,612	2.8
1978	9,815	2,205	2.4
1979	8,207	2,648	1.7
1980	8,748	2,755	1 8
1981	12,745	3,427	2.9
1982	14,633	3,126	2.7
1983	51,606	16,515	10.1

TABLE II

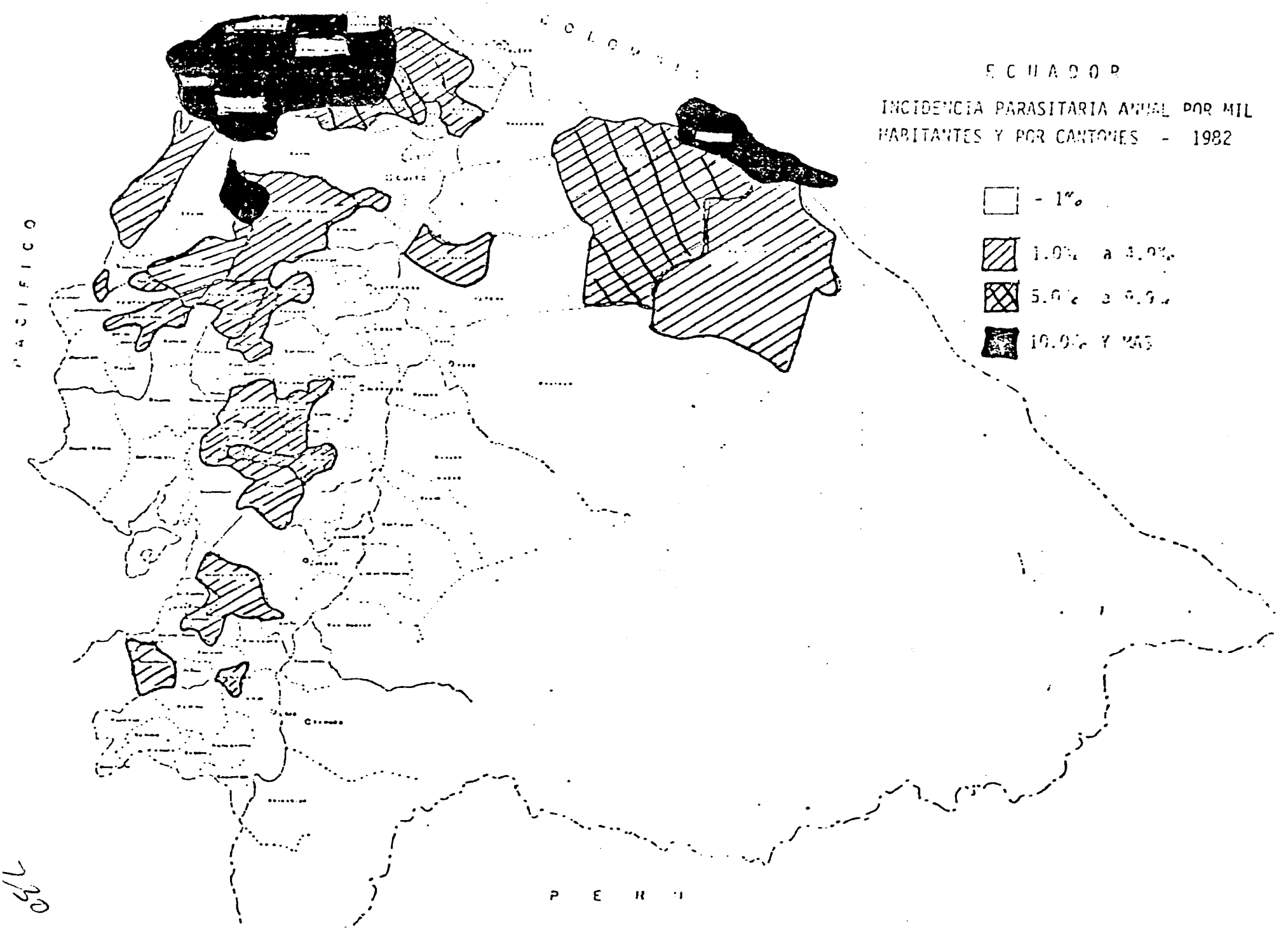
SUMMARY OF MALARIA CASES IN ESMERALDAS AND NAPO PROVINCES (1,000's)

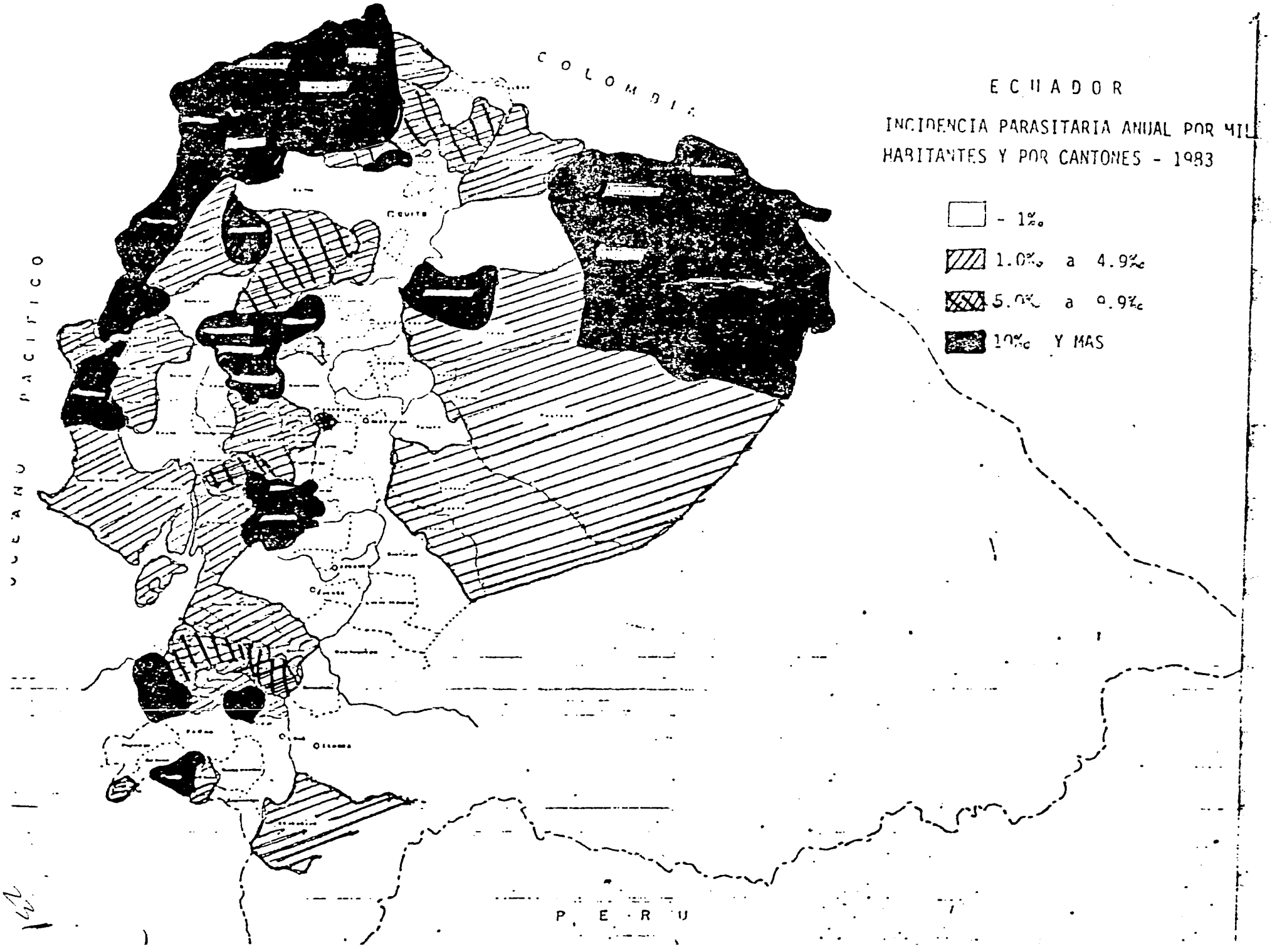
PROVINCE	1975	76	77	78	79	80	81	82	83
ESMERALDAS	2.9	4.0	5.0	4.6	4.5	5.3	7.8	6.9	19.4
NAPO	1.5	2.9	2.0	1.0	.5	.3	.5	.4	2.3

NOTE: In 1983, Esmeraldas represented 6.0% of the malarious population of the country (5.1 million), but provided 37% of the total cases in the country. In 1984, the cases of malaria between January and May exceeded 32,000 in Esmeraldas Province.


ECUADOR
INCIDENCIA PARASITARIA ANUAL POR MIL HABITANTES Y POR CANTONES - 1981
- 1%
1.0% a 4.9%
5.0% a 9.9%
10.0% Y MAS
PACIFICO
PERU

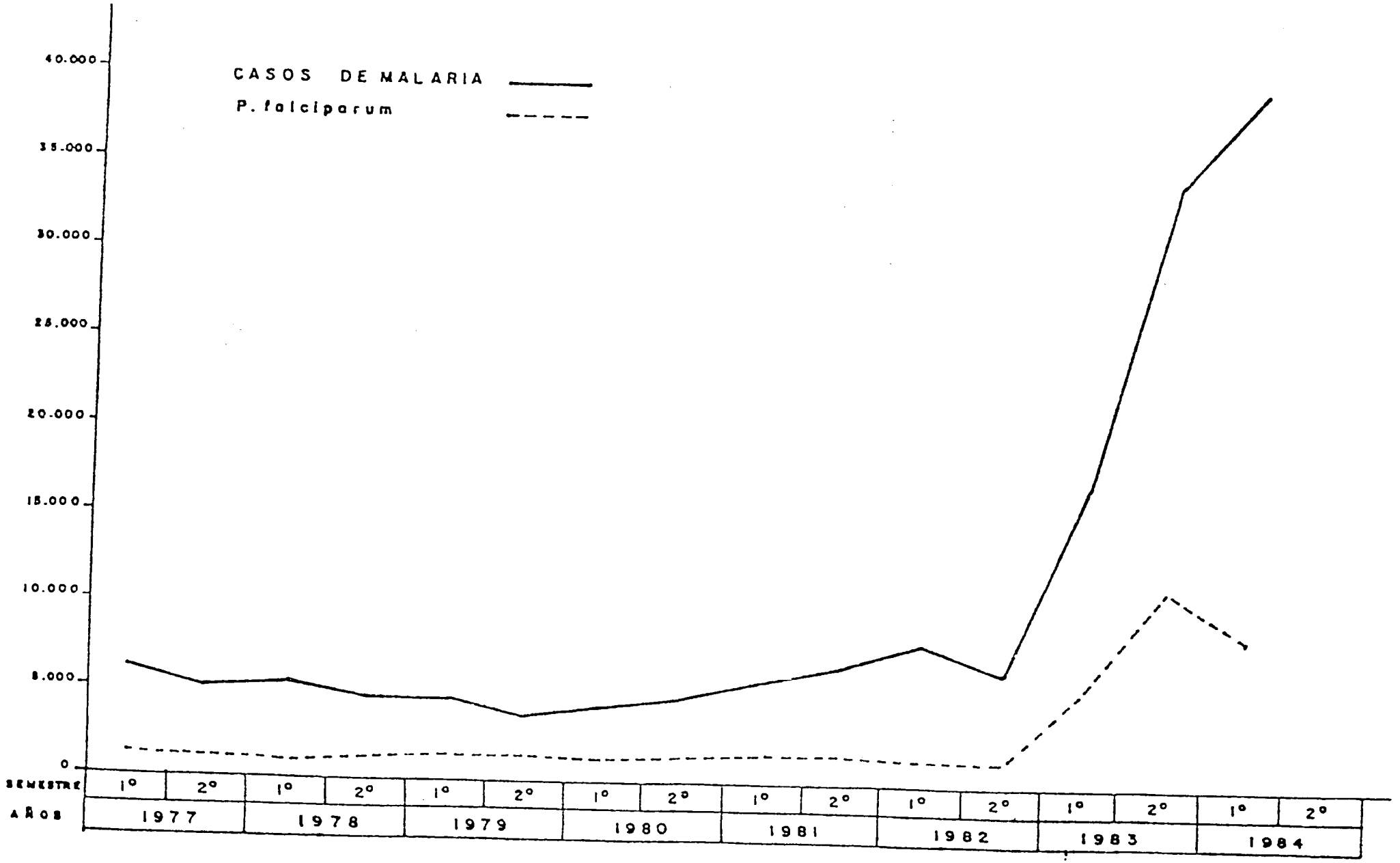
229


ECUADOR
INCIDENCIA PARASITARIA ANUAL POR MIL
HABITANTES Y POR CANTONES - 1982
- 1%
1.0% a 4.9%
5.0% a 9.9%
10.0% Y MAS
PACIFICO
PERU


ECUADOR
INCIDENCIA PARASITARIA ANUAL POR MIL HABITANTES Y POR CANTONES - 1983
- 1‰
1.0‰ a 4.9‰
5.0‰ a 9.9‰
10‰ Y MAS
COLOMBIA
PERU
OCEANO PACIFICO

SNEM (
Ecuador

CASOS DE MALARIA POR AÑOS Y SEMESTRES
1977 a 1983



POSSIBLE ECUADOREAN ARMY PARTICIPATION IN USAID/ECUADOR MALARIA PROJECT

I. CONTROL AT MILITARY INSTALLATIONS

A. Background

Presently it appears that all control aspects of malaria within army installations are being conducted by SNEM. Commanders request services from SNEM for spraying and other preventive services. Malaria slides are being read at SNEM laboratories.

B. Proposed Plan

It has been proposed to the Army Chief of Sanidad Militar (the counterpart of U.S. Army Surgeon General) that the above control aspects (and others like chemoprophylaxis, education, and training) can be accomplished by military personnel with advice and guidance from SNEM. This will require the selection of specific groups of individuals at the military unit level (company-size), training and equipping themto perform tasks such as spraying, educating the troops in malaria discipline, setting mosquito traps, collecting and possibly identifying mosquitoes, issuing chemoprophylaxis tablets, reporting, reading malaria slides, etc. The program followed by U.S. Army of using field sanitation teams at the company level was discussed with the Ecuadorean Army Surgeon. Two individuals (a Non Commisioned Officer Sgt. and an enlisted man) from each company receive an eight hour training in field sanitation that includes vector control and basic sanitation and health practices.

The Surgeon likes this system and would like to frame it on Ecuadorean Army units. This same team can be employed for the malaria control activities (as well as for Aedes) at the military installations. The whole concept of this team (mission, function, type of personnel, and training required) has already been translated to Spanish and given to the Surgeon who is studying and planning now. The only thing that is needed now to implement this program is the blessing of the C.G. Ecuadorean Army. In previous meeting with C.G. and Chief of Army Staff, this concept was mentioned (but not in the detail is presented here) and both have appeared to agree with the idea. At the present, the Surgeon is bringing the concept to his immediate supervisor who is the person who will have to obtain (C.G. approval).

II. CONTROL OUTSIDE MILITARY INSTALLATIONS

A. At Communities in the Neighborhood of Military Installations

The potential exists for the Field Sanitation Team referred above (plus other trained military personnel) and in coordination with Ministry of Health-SNEM, to conduct malaria control activities at communities in the vicinity of military installation. This is more probable at remote military units where these activities will be part of an overall civic action program. At present there is planning going on for a combined US-Ecuadorean Armies Civic Action Program to be conducted in certain specific areas of the

country. Malaria transmission is active in these areas and the disease is found in epidemic proportions.

B. At Other Larger Areas farther from Military Installations

Pools and other bodies of stagnated water that are breeding or potential breeding places for mosquito vectors of malaria and other vectors can be drained or filled by military units belonging to the Corps of Engineers. This same group can eliminate large breeding places within communities outside military installations. This action can be part of the Civic Action program referred to above.

B.G. Almeida, Chief of Ecuadorean Army Corps of Engineers in a recent meeting has expressed interest in the program. He has Engineer batallions at Esmeraldas, Guayaquil, Napo, etc. that can be utilized for this purpose. Presently, the Corps of Engineers is doing about 90% or more of the Minister of Public Works projects on a contract basis. This means that if the Corps were to be requested to work in the Malaria Project, there would have to be some reimbursement of monies spent for fuel, equipment, maintenance, and parts, and for any additional civilian personnel needed. In any event, it is cheaper to employ the Corps since they will be providing most if not all the manpower free. Gen. Almeida would like to have definite proposals for specific projects and will be happy to appoint a contact person to work with somebody from the Ministry of Health-SNEM.

INSECTICIDE SPRAY AND SHRIMP FARMS

Possible insecticides to be sprayed in the AID-assisted malaria control program are malathion, fenitrothion and DDT. The potential for insecticidal contamination of shrimp farms, either accidental or during normal operation of spraying, was discussed with Dr. Gonzalo Mejía, malariologist and Chief of Malaria Zone VII (Esmeraldas province). Comments were elicited from other people specifically as to their knowledge of any accidental contamination problems in the past.

Shrimp farms exist in all the coastal provinces (Esmeraldas, Manabí, El Oro, Guayas), but are more common in the south. Very few are found in Esmeraldas province, especially up north. None are found in the Oriente. Spraying in these areas will be intradomiciliary and does not involve outdoor areas. The possibility of any amount of insecticide getting into shrimp farms is considered almost nil. Contamination of run-off water that may find its way to shrimp farms, through empty insecticide containers and other material/equipment used in the mixing and storage of insecticides, is also considered practically impossible. A strict discipline is followed by the trained workers: all disposable contaminated materials and waste products from washings and other sources are collected daily and burned in a designated place. This prevents the insecticidal contamination of run-off water and other materials.

Zone VII also checks shrimp farms for mosquito larvae. Larvae have never been found in the farms checked. No evidence of insecticide contamination has been documented nor have any complaints been registered.

Another important source of insecticides in these areas is from agriculture. Dr. Mejía estimates about 100,000 kilos of insecticides are used in agriculture in Esmeraldas province. No insecticidal contamination of shrimp farms has occured as a result of agricultural usage.

MALARIA CONTROL PROJECT

Methods of Implementation and Financing

Method of Implementation	Method of Financing	Appr. Amount ($000)
Grant Funding		
A. Technical Assistance		
1. Dir. Institutional Cont.	Direct Payment	1,346
2. P A S A	Direct Payment	19
Subtotal		1,365
B. Research Proposals		
1. Dir. Institutional Cont.	Direct Payment	355
2. P A S A	Direct Payment	180
Subtotal		535
C. Training		
1. Dir. Institutional Cont.	Direct Payment	900
D. Evaluation		
1. Direct PSC's	Direct Payment	200
Total Grant		3,000
Loan Funding		
A. Commodities		
1. Dir. AID Procurement (Includes insecticides, spray equipment, laboratory supplies, drugs, office supplies & transportation costs.)	Direct Payment	5,918
B. Training		
1. Host Country Procurement	Direct Reimbursement	300
C. Inflation & Contingencies		
1. Dir. AID Procurement or Host Country Procurement	Direct Payment Direct Reimbursement	282
Total Loan		6,500
TOTAL PROJECT		9,500

I concur the above methods of implementation and financing represent the Mission's plan, and that the methods of financing comply with the Agency's approved methods according to the Payment Verification Policy Implementation Guidance dated December 30, 1983.

William D. Ross

William D. Ross,
Controller