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# EVALUATION REPORT

## Malaria Control Project/Ecuador
## (Project Number 518-0049)

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by

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# I. EXECUTIVE SUMMARY

## PROJECT SUMMARY

The purpose of the Malaria Control Project is to develop the institutional capabilities of the SNEM in such a way as to bring the current malaria epidemic under control, reduce nationwide malaria incidence, and maintain control over incidence levels. The project agreement between USAID/Ecuador and the Government of Ecuador (GOE) provides for a $6,500,000 Development Loan and a $3,000,000 Grant for the Project over a five-year period, from the date of authorization. The agreement was signed on March 21, 1985. The Project has five principal components.

1. Program Management

$1,365,000 of grant funds for long- and short-term technical assistance to strengthen SNEM malaria control operations in the areas of management, epidemiology, surveillance, drug sensitivity, insecticide resistance, and evaluation.

2. Operational Research

$535,000 of the grant funds to support research in vector control, vector ecology, computerization of malaria data for stratification, interventions in health education, and prevalence studies of other vector-borne diseases.

3. Training

$900,000 of grant funds for long- and short-term training of SNEM personnel in vector control, epidemiology, entomology, and administrative management; short-term in-country training for evaluators and voluntary collaborators; and training of trainers in health education.

4. Evaluation

$200,000 of grant funds to finance the services of U.S. malariologists to participate in annual program reviews and project evaluation summary reviews.

5. Commodity Support

$6,500,000 of loan funds to finance insecticides, application equipment, transport. laboratory supplies, antimalarial drugs, etc.

## METHODOLOGY USED

Each member of the evaluation team was assigned a technical component area for concentration. Assignment of team members to a specific topic was based on area of expertise for which each member had been selected. Areas requiring evaluation not fitting one of the technical components were addressed by the entire team. Work was accomplished through formal and informal interviews with GOE/SNEM officials and USAID staff in one-on-one and group sessions, field trips, and review of reports and documents made available by SNEM and other agencies and individuals. Report preparation was shared by the team, and a draft of the main document as well as a more formal Executive Summary in both English and Spanish were prepared to be left with the A.I.D. mission in Quito prior to separation of the team on May 14, 1987. The final report is the responsibility of the team leader in cooperation with VBC.

## SUMMARY OF FINDINGS

### 1. Administration

It appears that the contractor, United Schools of America, has failed to meet performance expectations of USAID/Ecuador, GOE/SNEM, or the Long Term Advisor, resulting in a variety of administrative difficulties affecting the project. This problem is recognized as an evaluation issue and is dealt with in this report. Other administrative problems include: (1) the reluctance of the Minister of Health to purchase DDT for SNEM operations even though the material is considered efficacious for malaria control in many situations in Ecuador; (2) continuing problems in labor relations that are compromising program objectives; and (3) a lack of administrative training in the past. However, training of mid-level administrators is scheduled for the near future. The efficiency of the SNEM Directorate, together with a committed Long-Term Advisor, compensates for many of the difficulties.

### 2. Operational Research

The presence of a knowledgeable and experienced Long-Term Advisor working with a realistic and committed SNEM Director has combined to cause a variety of operational research projects to be implemented. The project has attracted extramural technical assistance from a variety of sources including CDC, VBC, PAHO, and various local sources. To date, specific operational research has been implemented, is in progress, or has been completed in: computerization of the malaria information system, stratification, sensitivity of *Plasmodium falciparum* to drugs,

Anopheles vector incrimination, urban mosquito control studies, development of an urban anopheline evaluation system, evaluation of breeding and Aedes aegypti larval densities by block surveys, premise insecticide testing, insecticide resistance studies, and various projects in vector-borne disease other than malaria including leishmaniasis, onchocerciasis and Chagas' disease, as well as a series of KAP studies stratified by geographical, cultural, and racial variables.

3. Surveillance

The 1984 malaria epidemic resulted in an increase in the number of malaria cases from 8,748 in 1980 to 78,599 in 1984. By the end of 1986, the number of malaria cases had decreased to 51,430. One purpose of this project is to assist SNEM/Ecuador in moving from the policy and strategy of eradication toward a malaria control strategy with the objective of developing a prevention, surveillance and control program. The control strategy would be based on local malaria epidemiology--integrating control activities with those of the General Health Services and with active community participation. The malaria case detection system has been revised and is currently based on passive case detection, i.e., a network of voluntary collaborators and the General Health Services. The project is providing technical assistance and materials to strengthen the activities. Diagnosis and treatment of malaria has been decentralized through the location of the microscopy laboratories in the health services at the periphery. With technical support from the project, the sensitivity of P. falciparum to chloroquine and other anti-malaria drugs is being monitored. Entomological surveillance is being improved through the training of technical staff. The Information System is being revised in preparation for a more advanced stage in which computerization of data will permit a prompt analysis for decision making. The General Health Services are being utilized in malaria surveillance activities through participation in administration of anti-malaria treatment. Coordination of anti-malaria activities will be enhanced through the creation of a National Committee on Malaria. Progress has been on stratification of malarious areas with continuing support from this project.

4. Training

It is expected that by the EOP institutional capability will be greatly strengthened through the combination of study tours, technical training and skills development, and long-term training. The project is accomplishing steady progress in the training of SNEM and other GOE/MSP personnel. Especially noteworthy is the SNEM project, administered jointly with the Subsecretary of Health in Guayaquil, to train General Health

Services staff. To date, 230 physicians, nurses and others have attended a five-day course on the diagnosis and treatment of malaria and other vector-borne diseases.

5. Health Education/Community Participation

To date, the project has not implemented its rural health education program. Appropriate technical assistance for materials development and evaluation, mass media campaigns, and community participation strategies is currently being identified. The effort to increase community participation in urban areas (Guayaquil) by enlisting the active support of various institutions and schools is being accomplished through a series of presentations and workshops.

RECOMMENDATIONS

1. Organization and Management

- It is recommended that USAID/Ecuador review the performance of the contractor for compliance and take necessary measures to bring contractor support of this project to a level acceptable to USAID/Ecuador, GOE/SNEM, and the LTA.

- It is recommended that the grant-supported positions provided for in the GOE/A.I.D. agreement to assist the LTA and not yet filled (administrative assistant and bilingual secretary) be filled as soon as possible.

- It is recommended that there be close cooperation between USAID and GOE in the determination of specifications for equipment to be supplied by or through USAID to assure that all needs are met.

- It is recommended that USAID encourage the GOE to purchase DDT for use in the program where it has been determined that the use of this insecticide is indicated.

2. Surveillance

- SNEM should develop a model for epidemiological surveillance. In 1986, the Province of Esmeraldas (Zone VII) produced more than 50% of the malaria cases in Ecuador. It is recommended that the Department of Epidemiology, SNEM, initiate operationally oriented epidemiological activities in Zone VII for at least one year with monitoring

to continue to determine effectiveness and needed modifications. It is further recommended that SNEM add professional staff, especially physicians, in Zone VII.

- SNEM should identify a person at the central level to assume responsibility for the coordination of malaria surveillance activities for the country-wide network.

- It is recommended that consideration be given to studies on the chloroquine-pruritus syndrome in different ethnic communities.

- Decentralization of malaria diagnostic and treatment services, adequately equipped, should be accelerated, placing laboratories in the hospitals and general health services in the periphery.

- It is recommended that mobile entomological teams be given field assignments on the basis of epidemiological stratification.

- There should be developed a simplified epidemiological investigative scheme based on malaria cases to help determine necessary control measures for different epidemiological strata.

3. Operational Research

- Because of the diversity of research topics, organizational interests, funding and technical assistance under this project, it is recommended that SNEM designate a coordinator of research to work closely with the Long-Term Advisor.

- Even in the absence of a SNEM coordinator of research, it is recommended that a SNEM professional from the central office in Guayaquil be identified and actively involved with each definitive operational research project, on-site where practical, with the objective of professional growth and institutional development. If this is done, SNEM will be continually apprised of plans, activities, progress and results of specific investigative activities under this project.

- The following research topics are recommended for early implementation in conjunction with efforts to improve malaria control: efficacy of malaria surveillance using clinical indicators being applied by the voluntary collaborators (blood-filming of suspected cases); alternative therapeutic schemes for treatment of P. vivax infections; and, evaluation of the alternative drugs, amodiaquine and Fansidar, in areas of documented chloroquine resistance.

4. Training

- SNEM should continue its joint training program with the Subsecretary of Health, Guayaquil, on the clinical management of malaria for General Health Services personnel and other professionals such as military physicians.

- Efforts should be made to bring the program of observational study tours and long-term participant training up-to-date with the project time line.

- In order to initiate and institutionalize a program of community participation/support in malaria control, SNEM should prepare a training and continuing education plan for the voluntary collaborators and their immediate supervisors, the auxiliary evaluators.

5. Health Education/Community Participation

- The first institutional priority regarding health education should be the development of a general plan of education for both rural and urban areas. Technical assistance should be sought in developing this plan.

- Strong consideration should be given to the initiation of a small-scale, community-based malaria control project in a priority region of the country (e.g., a small group of communities in northern Esmeraldas Province).

- The urban educational strategy underway in Guayaquil in 1985-86 should be reactivated so that the initial steps taken are not lost.

- It is recommended that a study be initiated to identify migration patterns in Guayaquil, including KAP of different neighborhoods and ethnic groups. A second study is needed to identify those areas of the city which have local malaria transmission and *P. falciparum* resistance to chloroquine.

## II. DESCRIPTION OF PROJECT

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## III. PREVIOUS EVALUATIONS/REPORTS

There have been no previous evaluations of this project. Technical consultants have been involved in various areas and have submitted reports which contain technical appraisals of project efficiency, progress and problems. The evaluation team reviewed numerous documents relating to the project (Annex IV). Reports, protocol papers, and agreements involving technical assistance and administration have been considered in the preparation of this document.

## IV. DEVELOPMENT BENEFITS TO DATE

- The implementation of this project, concentrating activities in urban areas, is believed to have contributed to the stemming of the recent malaria epidemic in all provinces except Esmeraldas, where it continues.

  In this period of transition for SNEM from the eradication strategy to multifaceted control, the infusion of A.I.D.-supported management, technical assistance and research has been vital.

- Many of the surveillance, control and educational activities of this project will result in an increased ability to attack malaria in Ecuador, using control strategy.

- A workshop for Ecuadorian professionals focusing on research to improve the control of malaria and other vector-borne diseases was completed in August 1986.

- The development of a computerized malaria information system for Ecuador with implications for extension to general health programs is well advanced.

- Urban mosquito surveillance and control projects are in place in Guayaquil and Esmeraldas.

- A number of studies on the evaluation and development of a broad range of market-available insecticides have been implemented.

- The first stage in the incrimination of anopheline vectors of malaria, i.e., a key to species identification, has been completed.

- The CDC/PASA and VBC technical assistance agreements are in place and, together, address many of the research requirements of the project.

- The majority of the specific project entities implemented under this project have resulted in a "network" of professionals and institutions with continuing project inputs.

- Training of General Health Services personnel in the clinical management of malaria is a strong first step in the integration of malaria control with control of other health problems.

- SNEM efforts to control malaria in urban areas by working with municipal agencies and schools and in rural areas by working with community health promoters (Instituto Ecuatoriano de Obras Sanitarias) contribute to the development of human resources available for malaria control.

# V. EVALUATION OF PROJECT COMPONENTS

## A. Administration and Management

### 1. Background

The reciprocal of the graphic curve indicating the fall and rise of malaria in Ecuador reflects the management practices of SNEM. During five or six years in the early 1960s of efficient SNEM operations free of many of today's constraints, malaria was reduced from near current levels to a point where Ecuador was virtually malaria free and SNEM was a strongly-motivated, well-organized, entity poised to move into other rural basic public health delivery programs. Exceptions to the overall successes were: (1) Esmeraldas, which had started with extremely high malaria rates and where the rates were being reduced at a steady, but relatively slower, pace; (2) Santo Domingo de los Colorados, which had been virtually uninhabitable, with a 100% malaria incidence, and had been improved to a point where even though the rate was higher than most of the rest of the country, it was rapidly becoming a major tourist center; and (3) the Oriente, which in those pre-oil discovery days was ignored because its population was very small and very hostile.

The equating of management to malaria eradication or control may appear rather presumptuous, but the fact is that Ecuador is without major technical entomological problems at the moment. A current stumbling block appears to be the inability to place trained and motivated personnel, armed with proper equipment and supplies, at the points where vector control treatment, by whatever method is required.

Malaria in Ecuador pre-dates the arrival of the first Spanish conquistadors; the native population was already accustomed to using quinine for its treatment. The increase and change in composition of the population and the extension and improvement of means of transportation in the country resulted in a massive increase in the malaria rates by the end of WWII.

The availability of efficient anti-malarial drugs and residual insecticides during that period led the newly-formed WHO to develop the scheme of worldwide eradication of malaria. This plan involved periodic spraying of the interiors of virtually all dwellings in the malarious areas and the development of a sampling network for rapid detection and treatment of the disease. Such a program was begun in Ecuador in the late 1950s.

Dynamic public health operations such as this were a new departure in Ecuador, as they were in most developing countries. Traditionally, these health services were geared to symptomatic diagnosis and treatment of the infected individual, rather than preventive actions designed to protect the public at large. The latter type of program obviously required careful planning, efficient administration, and close supervision of mobile units throughout the country, and nothing in the structure and/or operation of the Ministries of Health was geared to such functions. This, plus the fact that the malaria eradication schedule was sold as a temporary short-term (eight year) operation led to the formation of semi-autonomous organizations such as SNEM/Ecuador.

During the period of its greatest success, approximately 1960-65, SNEM was managed jointly by the GOE and USAID, with operational funds from both of these entities. PAHO provided additional technical assistance and training; UNICEF donated the necessary insecticides and drugs, and loaned the fleet of vehicles used by SNEM.

Armed and organized, SNEM thus was able to spray effectively almost 100% of the dwellings in the malarious area with DDT twice annually on a regular schedule and to establish and service a network of 6,000 carefully chosen volunteers who took blood samples and administered antimalarial drugs in their villages. SNEM had evaluators who kept the volunteers supplied and motivated and who transported samples to the laboratories, who communicated results and dispatched drugs back to the volunteers. Other evaluators were stationed in all of the GOE hospitals and out-patient clinics to sample all fever cases. A corps of female evaluators made door-to-door surveys in the underdeveloped peripheral areas of Guayaquil on a monthly schedule.

The operation was somewhat flexible, e.g., it was determined that some of the bases being found in suburban Guayaquil were autochthonous, and investigations by SNEM and USAID entomologists revealed a typical breeding of the vector in drinking water barrels. A system was devised for the routine treatment of these sources with Abate -- solving the problem.

Obviously, such a large and diversified operation required good SNEM management and administration. Equipment and supplies were received and distributed to the field in a timely manner, and personnel were trained and carefully supervised. Most important, morale was high among the SNEM employees and this was reflected in their treatment of, and reception by, their ultimate clients, the people who lived in the malarious areas.

SNEM employees of that period wore distinctive uniforms in which they took pride, knew what their mission was, and were highly motivated to carry it out. Salaries and wages in SNEM were equivalent to those of MOH, but in SNEM they were paid on time, while Ministry employees' pay was usually several months delayed, forcing them to live on borrowed money. Unlike MOH employees, most of whom changed with every change of Ministers, SNEM employees were protected from such political pressures, providing them with job security and ensuring that SNEM retained its trained personnel.

All of these factors tended to separate SNEM from the general MOH staff, to emphasize its distinct and vertical character, and quite naturally, to engender a certain amount of envy on the part of the MOH employees. As a result, the tendency on the part of the latter was to refuse to handle anything pertaining to malaria and to shift it to SNEM. SNEM staff members had no problem with this since they felt that it was their responsibility and they were capable of handling it.

On the other hand, SNEM, with its entry into the homes of the populace and its network of people and transport, was often utilized by other agencies in their work. At that time, MOH had virtually no operational health education unit, while SNEM had a well-developed HE section with four mobile units in operation. On a number of occasions, these units were able to deliver other health messages in family planning, etc. in addition to their normal malaria work. The excellent mapping and human data bank information maintained by SNEM and updated every six months by the spray teams was used by the official census of the 1960s without an independent count in the malarious areas.

As a result of these efforts, by 1966 malaria cases were under 5,000 in all of Ecuador, with less than 400 cases of P. falciparum. These figures were based upon an honest and adequate sample, and most of the cases were concentrated in Esmeraldas and Santo Domingo de los Colorados.

A change in A.I.D. policy from grant to loan funding ended the cooperative management of all of the projects in which A.I.D. was involved. SNEM, while theoretically maintaining its vertical structure, became an administrative part of MOH and began to suffer the same transport shortages, logistics log jams, wage payment delays, and lowering of morale as MOH in general.

Since that time, the deterioration of SNEM has been reflected in the rise in malaria rates. The less than 5,000 cases in 1966 rose to over 78,000 reported cases in 1984, and the 1964 figure of less than 400 cases of P. falciparum rose to over 15,000 reported in 1984. Even more striking is that the more

recent figures are based upon a less-than adequate sample. Best estimates are that the 1984 figures represent only about one-fifth of the actual number of cases.

Granted that the abnormal "El Niño" rainfall and floods of the early 1980s had an impact on the malaria incidence, the downward curve of SNEM productivity and the upward curve of malaria cases had already been established before this period (Figure 1, SNEM graph of spraying and epidemiology, 1965-1986).

In a country where less expensive insecticides are still effective against the vector, and some combination of drugs against the parasite, the return of malaria rates to pre-SNEM levels can only be attributed to a failure of the delivery system which should be able to place trained personnel, with the necessary equipment and supplies, at the point where preventive action should be taken. Such a failure is one of management and administration.

2. Findings

a. Personnel

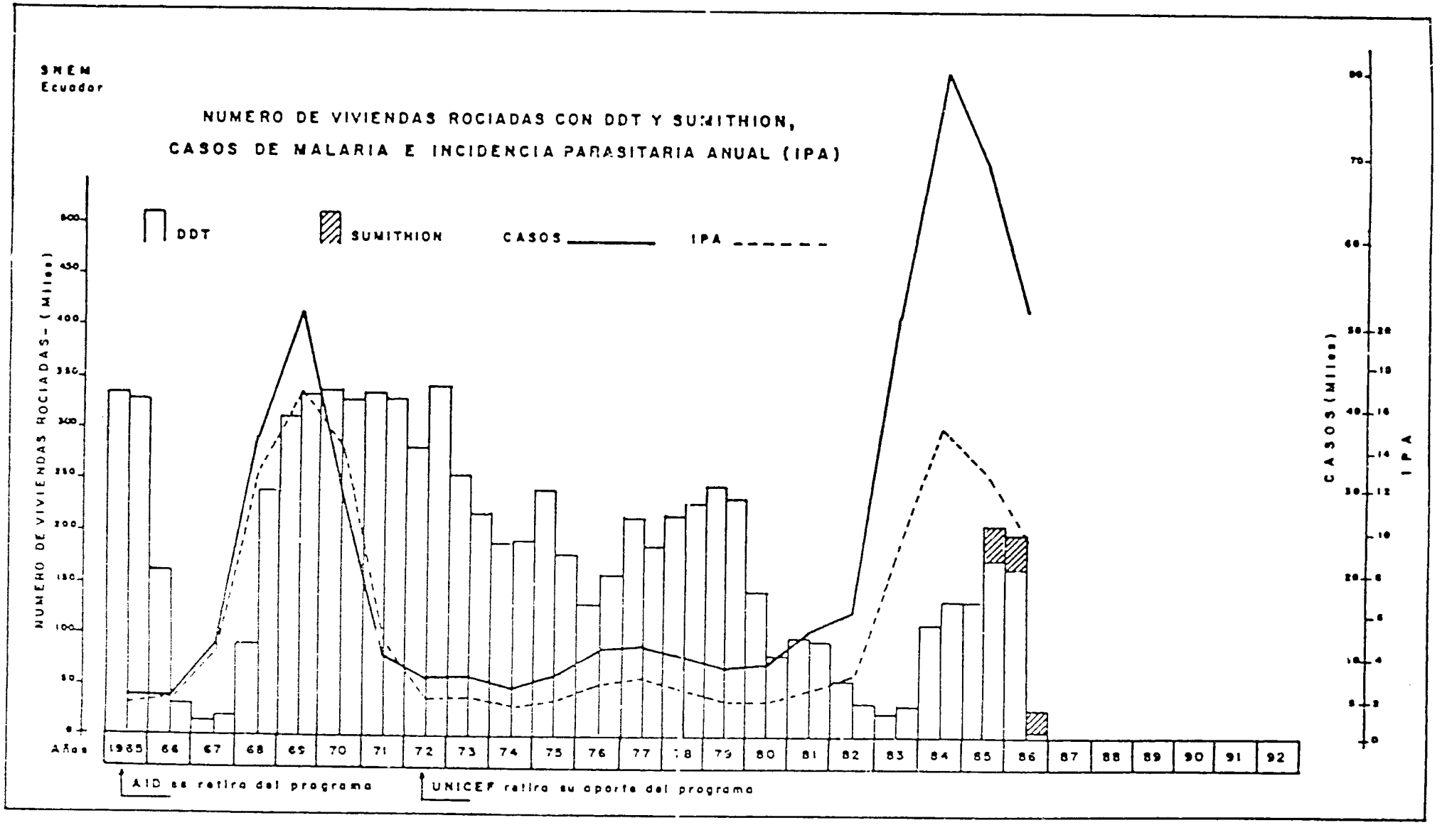
In general, SNEM is handicapped by its labor union which will neither permit the utilization of workers of one category in another, nor the transfer of personnel from one area to another. Example: In Esmeraldas, there is a need for additional evaluators and entomological aides to carry out the programmed work in these fields. Such workers exist in other areas of the country. In some cases they are under-utilized because this type of work is of lower priority there, but union regulations will not permit their transfer. In Esmeraldas itself, there are 22 Medicators on the SNEM payroll. The mass prophylactic drug administration project has long since been discontinued there because it failed to lower the malaria rates, but these personnel cannot be transferred elsewhere, cannot be switched to other duties within the zone, and cannot be discharged. In effect, these people are being paid for doing nothing while important work in that and other zones remains unaccomplished for lack of personnel.

The union has been beneficial to SNEM in that it has insisted upon the maintenance of the system of prompt payment of salaries and wages, and freedom from political harassment established by the former cooperative management -- advantages not shared by MOH employees of that period.

Unfortunately, however, the SNEM union agreement was designed to fit the vertical malaria eradication organization and could guarantee freedom from changes in work site and type of

FIGURE 1. GRAFICO DE LAS OPERACIONES DE ROCIADO
1965 - 1986
RELACIONADO CON LA INCIDENCIA MALARIA

(prepared by SNEM in 1986)



work to be performed without harming the program. Under the diversified malaria control program, however, SNEM must have the flexibility to pinpoint the areas of highest infection, and to concentrate various methods of attack on these areas, or it will fail. To operate in this fashion requires the ability to shift personnel both geographically and functionally, which is impossible under current union regulations.

b. Loan Funded Supplies and Equipment

General: As may be noted in the appended list of dates of receipt of materials by SNEM (Annex I), nothing was transferred to SNEM until at least 13 months after the signing of the project paper in January 1985. Part of this delay may be attributed to normal purchasing procedures, but this explanation is not tenable for such standard items as vehicles, nor for such items as anti-malaria drugs or laboratory chemicals, which have a limited number of suppliers.

Some complaints were voiced by SNEM personnel with reference to what they see as a lack of on-the-spot USAID administrative assistance, particularly in the supply area. It was pointed out to them that this was not part of the responsibility of the LTA, who must concentrate on technical matters, but they still felt that a closer administrative liaison should be maintained between SNEM and USAID.

A specific complaint was that SNEM, rather than USAID, was charged with clearing commodities through customs when this could be more readily and quickly accomplished by USAID.

Another SNEM complaint in this area was that without a day-to-day administrative contact with USAID, it was impossible to maintain a running account of the balances in the various A.I.D. grant fund accounts. Such data could be obtained through the LTA or from Quito, but this would entail some delay and add to the workload of the LTA.

c. Transport

Lack of transportation was one of the major constraints of the pre-program SNEM, and was an area in which the impact of the project could be most quickly and concretely demonstrated to the SNEM staff. Unfortunately, the project-funded vehicles did not arrive until more than a year after the agreement was signed, and apparently SNEM was not consulted as to the size and types of automobiles required.

A great deal of discontent has been registered at all levels in SNEM over the 30 Ford pick-up trucks provided. These are at least twice the size required and are correspondingly hard to handle on the country's rural roads, and are expensive to operate in terms of fuel, oil, and other supplies. The project loan provides some funds for repair parts for these vehicles, but it is doubtful, once these are expended, whether SNEM will be able to afford to maintain these vehicles and keep them in service.

Compact 4-wheel-drive vehicles made in the United States would have cost less, served their purposes better, and lasted longer.

d. Microscopes

The project paper called for the purchase of 20 clinical microscopes (compound, binocular, with built-in lights). Those which arrived were monocular models with mirrors for using the sun as a light source. The latter served for intermittent use in the field, but for continuous use in the laboratory, the binocular model, with light, is required.

These should not have been accepted, but were because of the pressure to implement the plan to increase the number of laboratories in the country and to reduce the time between blood sampling and diagnosis -- with trained microscopists waiting to go to work. They were distributed to the laboratories and put into use. The supplier has since offered to exchange them, but cannot accept the now-used instruments.

e. Insecticides

According to the project agreement, the GOE is obligated to budget $2.9 million equivalent for the purchase of DDT to be used for intradomiciliary spraying, while A.I.D. loan funds include $3.5 million for organo-phosphorus insecticides and application equipment. The latter are to be used in ULV space spraying as well as experimental intradomiciliary residual applications.

The malaria vector is susceptible to DDT at the standard 2 $gm/m^2$ application rate in all parts of the country. Since DDT is safer, less expensive, and costs only half as much to apply as the organo-phosphates, (DDT provides an effective residual effect for at least six months while the OP's are, at best, effective for only three months), DDT should be the insecticide of choice for house-spraying. However, the previous Minister of Health, apparently wary of possible reactions from environmental groups, referred DDT purchases to the Subsecretary of Health, who was willing to approve them but whose general purchasing authority has limitations. SNEM, therefore, has been able to purchase DDT

only in small amounts insufficient to meet the project needs. To meet this shortfall, at SNEM request, A.I.D. has purchased more than the planned amounts of organo-phosphates, using unobligated project funds.

3. Project Management

a. USAID/Ecuador

USAID/Ecuador has probably done more in administrative management of this program than might reasonably have been expected, but the geographic separation of the mission from SNEM's operations, and the fact that the backstop officer in Quito was also responsible for a number of other unrelated projects resulted in a number of deficiencies in the field.

This project is necessary to re-vitalize SNEM and to assist it in its shift away from a vertical malaria eradication organization and toward the flexible multi-method malaria control organization which will be required in the future. During this transition period, SNEM needs the injection of extra funds, operational research, training, and technical assistance which the project provides in order to overcome the inertia of 20 years of relatively ineffectual repetition of the old system. With this initial push, GOE/SNEM should be able to continue an effective program with their own resources.

There have been some complaints on the part of the SNEM that it has not had sufficient input in the preparation of research protocols carried out by CDC under the project, that it is not receiving the results of these investigations, and that, once completed, the investigations do not leave behind Ecuadorian professionals or semi-professionals trained in the research techniques employed. SNEM does not have extra personnel at this level to assign to these projects, but the Director of SNEM suggests that if such people were hired with USAID contract or PASA funds, that he could probably establish positions for them in SNEM once they had been trained and the investigation completed.

In making the shift to the more flexible requirements of a control program, the administrators as well as the technical staff are going to require somewhat broader training than they do at present. The LTA indicates that there are, or will shortly be, courses in administration in Guayaquil. These will be available to middle management personnel. The training should be pursued and project funding provided.

b. GOE/SNEM

GOE/SNEM, with one conspicuous exception, has performed well in management of this project. All conditions precedent were met, and GOE budget funds allocated as programmed. The one criticism is in regard to its refusal to purchase the agreed quantity of DDT. This failure resulted in A.I.D. having to provide more than the programmed amount of organo-phosphate insecticides as a substitute. Even with this extra material, SNEM has been unable to spray the programmed number of houses. Other problems, not directly attributable to GOE/SNEM, are constraints associated with the labor union.

Both the DDT and labor problems are soluble by GOE/SNEM; recommendations regarding these matters are included further in this section of this report.

c. Contractor

Management is probably the weakest point of this project and is responsible for many of the shortcomings and discrepancies described throughout the administrative section of this report.

From all reports, communications with the contracting company, United Schools of America (USA), are difficult. For example, letters and queries often go unanswered; the long-term technical advisor may not receive his salary, allowances, and per diem in a timely manner or in correct amounts; delays in payment of fees and expenses of short-term technical advisors are unreasonably long. The company is unable to provide short-term advisors as required (e.g., it apparently could not find a Spanish-speaking mechanic in Miami to train SNEM personnel).

The long-term advisor hired a driver, to be paid with contract funds under the project agreement, but his experiences in getting the man paid on time by USA (often requiring that the LTA pay him with his personal funds) have led him (the LTA) to refuse to attempt to hire the administrative assistant and bilingual secretary who were also to be provided for under the USA payroll.

The lack of an administrator working in the contractor's office at SNEM has forced USAID to assume more than its share of administrative functions, diverted the LTA from his technical duties and still left SNEM feeling that it was being neglected in this area.

4. Recommendations

- It is recommended that at the time of the negotiation of the next union/SNEM general labor contract, the subject changes in the character of SNEM operations be pointed out to the union officials in an effort to permit more flexibility.

- Closer cooperation between USAID and the users in the preparation of specifications for equipment to be supplied by or through USAID is recommended. The 30 pick-up trucks are a case in point, but the principle applies to open commodities.

- If funds become available in one of the other commodity funds of the project, they should be transferred. A second purchase of microscopes should be made, and the monocular scopes diverted to research use.

- As pointed out by the Director/SNEM, the GOE/USAID agreement calls for the provision, by USAID from grant funds, of a staff of Ecuadorian personnel (administrative assistant, bilingual secretary, and driver) to assist the USAID long-term technical advisor. Except for the driver, these positions have not been filled, and the project has suffered as a result. It is recommended that these positions be filled ASAP with qualified personnel.

- It is further recommended that there be a greater degree of cooperation with SNEM in preparation and implementation of project-sponsored operational research projects; and that the question of administrative training for SNEM middle-management personnel be pursued.

- USAID should insist that the GOE meet the obligations to which it has agreed, and purchase the DDT necessary for the intradomiciliary spray program planned by SNEM. A.I.D. should discourage the use of unprogrammed insecticides as substitutes for DDT.

- The project paper states that "technical assistance will be provided under a master contract negotiated by the mission in accordance with competitive A.I.D. procedures, with a capable U.S. firm or institution." It is recommended that USAID/Ecuador review the performance of the contractor for compliance and take necessary measures to bring contractor support of this

project to a level acceptable to USAID/Ecuador, GOE/SNEM, and the LTA.

B. Epidemiological Surveillance

1. Background

Approximately 60% of the total surface of the country is considered a potentially malarious area, housing around 5.7 million inhabitants (1987) at risk of contracting malaria. The risk varies with the ecological and socioeconomic characteristics of the three principal geographical regions: the Coast, the Amazon Region, and the inter-Andean valleys of the hydrographic slope of the Pacific Ocean and the Amazon River. During the eradication program, DDT was the principal insecticide used to interrupt the transmission of malaria. DDT was applied throughout the malarious area without regard to areas with different malariogenic potential. The result was satisfactory and for 17 of 23 years (1959-1981), API in the country was maintained below 1.5 cases per 1,000 population. The anopheline vectors still have not developed resistance to DDT, which continues to produce high mortality rates in mosquitoes. The insecticide still has an evident impact on transmission of the disease. For various reasons, between 1966 and 1968 the number of sprayings was reduced and an epidemic was triggered that lasted until 1971. Application of DDT was reestablished and the malaria incidence was again reduced. However, the number of sprayings diminished in 1980, and together with above-average torrential rains, and administrative and labor problems, another epidemic began in 1981 and still continues to cause high morbidity and mortality, especially in the Province of Esmeraldas.

Cases of malaria increased from 8,748 in 1980 to 78,599 in 1984 and since have diminished to 68,989 in 1985 and 51,430 in 1986. In the period from January to March 1987, 13,757 cases were reported, compared with 14,890 cases in the same period in 1986. These figures do not reflect a significant reduction.

Historically, malaria in Ecuador has been responsive to the application of DDT when carried out in a continuous manner. Nevertheless, effectiveness has required extensive applications throughout the entire country. The expense precludes such applications as a preventive measure. On the other hand, the different levels of prevalence of malaria, in various geographical and ecological areas, do not justify generalized measures of equal intensity. Therefore, it is necessary to adapt the information and surveillance system to obtain epidemiological information for classifying the problem and stratifying the malarious area in order to apply integrated control measures to produce permanent results at a reasonable cost. The use of

insecticides can then be improved by limiting their application to specific areas of epidemiological priority where it has been demonstrated that this method is efficacious.

The intent of the project is: (a) to control the current epidemic state of malaria; (b) to investigate the resistance of the mosquito vector to insecticides and of P. falciparum to antimalarial drugs; (c) to maintain the disease under control at the national level within levels of incidence that do not represent a public health problem or interfere with the development of the country; and (d) to develop institutional capabilities to maintain such a level of control once it has been reached.

This means that there is a need to study and establish levels of malaria incidence that are compatible with development without representing a public health problem at the local level. Governmental health institutions should participate in the effort to maintain the incidence of malaria below that level and be able to identify and evaluate it so that the necessary control measures are carried out at the first sign that the level has been surpassed. In accordance with the endemicity levels of the disease in each area or region. a certain number of cases of malaria could persist, but mortality from malaria must not exist. As a strategy to attain these objectives, it will be necessary to adapt the information and epidemiological surveillance system and to structure the service responsible for control so that it effectively ascertains the malaria situation and the levels of incidence and to carry out appropriate actions to control epidemics at the local levels. In developing this integrated system, the resources of the health structures of the country and the community should be incorporated.

The terminology used in eradication programs defines as individual surveillance functions "the detection of cases, parasitological examination, treatment with antimalarial drugs, epidemiological research, entomologic research, the elimination of foci either through application of residual insecticides or collective administration of drugs, and follow-up of cases and of the community." The final objective of surveillance was to verify interruption of the transmission of malaria.

In programs for control of malaria, the functions of surveillance may be the same, but the objectives, intensity, and frequency with which actions are carried out to obtain information on morbidity indexes and the trend of malaria are different. The design of surveillance should vary in each country in accordance with the needs imposed by the characteristics of malaria at the local level.

Epidemiological surveillance in Ecuador has been carried out in accordance with the scheme designed for the programs for eradication. For those programs, the malarious area was divided into attack-phase areas and consolidation-phase areas. Case detection was made in active form (ACD) through household visits throughout the malarious area and through passive search (PCD) through a network of Notification Posts (NP) under the responsibility of Voluntary Collaborators (VC). The remaining activities have also been carried out in accordance with eradication standards.

2. Findings

The malaria control program in Ecuador, in accordance with the purpose of the project, is initiating the transition phase between eradication doctrine and strategy and that of control with a view to organizing a program of prevention, surveillance, and control of malaria based on the epidemiological approach and the incorporation of some activities of the antimalarial program into the programming of the General Health Services. Nevertheless, it is still necessary to continue to enhance the epidemiological approach of the control program, to distribute available resources according to epidemiological priorities and socioeconomic conditions and to mobilize the resources provided by other institutions and the community itself in order to coordinate malaria control with the strategy of Primary Health Care (PHC). In order to carry out such a program, it is necessary that the administrative structure reflects the permanent and integrated actions required for control. Principal observations are as follows:

a. Report Network of Cases of Malaria

Malaria case detection has centered around collections of blood samples exclusively through a report network made up of personnel representing:

| | |
|---|---|
| Health services | |
| Health center and subcenters | 360 |
| Other health centers | 365 |
| Hospitals | 84 |
| Subtotal | 809 |
| Voluntary collaborators | 6,332 |
| Total NP | 7,141 |

The 7,141 NP are installed in 5,466 localities that represent 51.8% of the 10,560 localities identified in the malarious area.

The report network should be served by Evaluation Auxiliaries to carry out supervision and retraining, collection of blood samples taken, and replacement of materials. It is estimated that 130 Auxiliaries are required. Nevertheless, administrative and logistics problems prevent visits being made to all the NP with the regularity and frequency established for each area, thereby leading to insufficient information and considerable delay in timely examination of blood samples, in addition to a lack of attention, supply, and stimulus to the VC. Delay in the availability of epidemiological information prevents timely evaluation of the trend of malaria. Such evaluation is required if remedial action is to occur.

With support of the project, materials and transportation equipment have been acquired for supplying NP and providing assistance to the network. However, operational deficiencies prevent the programmed goals from being fulfilled. In the Province of Esmeraldas, for example, during the months of January to March 1987, there is no evidence that the notification network has been served, in accordance with Form OC 26, Monthly Report on Production of Evaluation. In January and September 1986, no activity was reported. In the other months of 1986, the average number of VC's visited was only 30% (14-62%) and this was reported in only two (Quinindé and Esmeraldas) of the five cantons in the Province. In the part of the network classified as "others," which includes the public health establishments, the percentage of visits averaged 33% (8-80%) for over 10 months in 1986 in the same two cantons.

The Plan of Operations of the Program shows that the 7,141 NP are installed in 5,466 localities, which represent 51.8% of the 10,560 localities identified in the malarious area of the country. If this notification network were appropriately maintained to supply constant information, and the SNEM had the capability to service, supervise, and supply it -- the collected information on morbidity from malaria would be almost sufficient to determine the trend of transmission and would be an appropriate index for carrying out spatiotemporal surveys and supplementary epidemiological studies in terms of need.

b. Diagnosis and Treatment of Cases of Malaria

The notification network will be served by 33 laboratories of the SNEM with 46 microscopists who will carry out parasitological examination of the blood samples taken by members of the network. The laboratories in turn take and examine blood samples

at the request of the population requesting this service. A project exists to increase the laboratory network by hiring 27 more microscopists who would be distributed in 24 localities of the seven areas into which the SNEM is divided. The laboratories will be located in the operational units of the Ministry of Health.

Rapid diagnosis of malaria cases for timely treatment is an essential factor in controlling the epidemic state of malaria and maintaining control of the disease, both principal objectives of the project.

Diagnosis should be followed by treatment of the cases. Treatment should be administered by one who is familiar with the diagnosis (microscopist), by the one who ordered the examination (physician or personnel of the Health Service), or by the one who took the blood sample (Voluntary Collaborator).

With respect to the project, specific progress has been achieved. The location of the microscopists has been decentralized at the area level, especially in Esmeraldas, and it has been ordered that treatment be provided as soon as the diagnosis has been made. Responsibility for antimalarial treatment has been given to the various health units in order to treat discovered cases. The VC will continue to administer presumptive treatment upon taking the blood sample and radical treatment once the diagnosis is confirmed.

c. Therapeutic Schemes

The antimalarial treatment schemes currently used by SNEM are the same as those designed during the eradication period.

(1) Presumptive treatment with chloroquine when the blood sample is taken

(2) Radical treatment of P. vivax and P. malariae infections with chloroquine for three days and primaquine for 14 days after confirmation of microscopic diagnosis

(3) Radical treatment of P. falciparum infections with chloroquine for three days plus a dose of primaquine (15 mg dose for adults) the first day

(4) Treatment of P. falciparum infections resistant to chloroquine with Fansidar the first day and 45 mg of primaquine the second day (dose for adults); and

(5) Chemoprophylaxis provided individually only to persons who request it.

The need to review the policy of antimalarial treatment in accordance with parasitic species and with their response to the therapeutic schemes employed is discussed below.

d. Reaction of Plasmodium Species to Antimalarial Drugs

The malaria parasite prevalent in Ecuador is P. vivax; however, the number of infections by P. falciparum in the last four years has been sustained at more than 10,000 cases per year, which represents a relative frequency for the entire country that ranges from 40% in 1983 to 23.3% in 1986. An analysis by province shows that in 1986 the relative frequency for Esmeraldas was 33.9% and around 23.0% in Carchi and Guayas, while in Manabí and Pichincha it was around 15.0%; in the rest of the provinces it was lower than 9%. There are also reports of strains of P. falciparum resistant to chloroquine in Esmeraldas but information is lacking on the geographical distribution, intensity, and frequency of resistance as well as on the reaction of the strains to other antimalarial drugs. This information is essential in order to establish a policy for treatment of these parasitic species.

In the city of Esmeraldas the project is carrying out tests of susceptibility of P. falciparum to chloroquine through in vitro tests. Sensitivity to antimalarial drugs other than chloroquine is being studied through in vitro tests. Administrative difficulties prevented studies in San Lorenzo. The in vitro tests are progressing satisfactorily with around 40 cases enrolled in the study. Some difficulties inherent in the in vitro tests have occurred but the studies are continuing.

A question that should be clarified during the malaria control program is the response of the local strains of P. vivax to different systems of treatment with primaquine. Treatment for 14 days with a 15 mg daily dose (for adults) may not be required as it was during the eradication program. Different systems used in other countries -- e.g., that of five days and that of three days (15 mg of primaquine per day, dose for adults) and the combined single dose of chloroquine (450 mg) plus primaquine (45 mg) -- could be evaluated with technical advisory services provided by the project to indicate their usefulness in the various epidemiological situations existing in Ecuador.

e. Epidemiological Investigation of Malaria Cases

Epidemiological investigation of cases is usually not carried out, or has been restricted to areas of low incidence that previously were considered in the consolidation phase.

Although epidemiological investigation of cases may not be indispensable as during the eradication program, the investigation of cases is valuable in epidemiological surveillance, especially for the following purposes of stratification:

(1) In urban areas such as Guayaquil and other cities where there are large numbers of cases coming from outside areas which might give the impression that transmission of malaria exists in the city, and

(2) In rural areas where there are cases of malaria in localities of the inter-Andean valleys in borderline altitudes of the malarious area.

f. Entomologic Surveillance

Routine entomologic surveillance is currently concentrated on tests for susceptibility of the vectors to DDT, fenitrothion, and malathion, which continue to produce high indexes of mortality in mosquitoes without evidence of resistance. Entomologic surveillance includes a variety of studies on the feeding and resting habits of anopheline vectors, the degree of man-mosquito contact, the reaction to insecticides, the monitoring of anopheline densities throughout the months of the year in relation to climatic and seasonal variations, and evaluation of the residual effect of insecticides and their impact on control of the disease. The project is promoting further training of entomology personnel to supplement the basic training given them at the national level in past years. The Chief of the Entomology Section and three entomology aides received training in 1986 at the University of South Carolina. The three aides also received training from (at) the University of Panama, and the chief of the section had a work/study tour in the Smithsonian Institution in Washington, D.C. Administrative difficulties and logistics problems at the area level have limited fulfillment of the work plans and of the surveillance activities that should be carried out.

g. Information and Dissemination Systems

In January 1986, it was established that tabulation of examined blood samples would be made in accordance with the date on which the sample was taken and not with the date of

examination. Slides that arrive at the laboratories with a delay of more than two months are discarded. This provision has made it possible to have a clearer idea of the time in which the transmission of malaria occurs.

With support of this project, study of the information system has been initiated so that the collection, tabulation, analysis, and dissemination of statistical data will be timely and appropriate for decision-making. The final objective is the establishment of a computerized information system. Technical assistance is provided by an expert contracted by the project who visited the country and initiated the process with the permanent cooperation of a staff member of the Health Department of Area II; three persons from the SNEM are in training. This activity also includes the collection of information for stratification of the malarious area.

h. Antimalarial Surveillance by the Health Services

With support of the project, the participation of the General Health Services in antimalarial activities is being increased through the following actions:

(1) Training of laboratory technicians of the health units and provision of materials and equipment to train them in microscopic diagnosis of malaria;

(2) Placement of microscopists of the SNEM in hospitals and health centers in the entire country, but especially in the hyperendemic area of the Province of Esmeraldas. These laboratories will be monitored by the respective authority, but administratively, and as far as standards are concerned, they will continue to depend on the SNEM. New laboratories will be installed, under agreement with the Provincial Health Department, in the units requiring and meriting laboratories;

(3) Designation of the responsibility for antimalarial treatment to the hospitals and health centers and subcenters for cases of malaria detected in such services. In operational units without a permanent physician, blood samples will be taken, presumptive treatment will be administered, and the sample will be collected by the SNEM. After diagnosis, radical treatment will be given; and

(4) Increased participation of the General Health Services in collection of blood samples for case detection.

i. Coordination and Intersectoral Cooperation

The National Committee against Malaria has been established, and is comprised of the National Health Director, the Technical Director of the Department of Health Region II, the Director of Military Health, the Delegate of the Ecuadorean Institute of Social Security, the Malaria Advisor of the USAID/GOE Project, the Representative of PAHO/WHO, and the Director of the SNEM. Through this Committee, it is hoped that it will be possible to coordinate health actions for control of malaria with other institutions that should participate in the campaign against the disease.

j. Stratification of the Malarious Area

The geographical peculiarities of Ecuador determine the existence of various ecological niches in which the epidemiological factors underlying malaria transmission are of variable intensity and frequency, thereby giving rise to varying degrees of malariogenic potential. In malaria control programs, stratification of malarious areas in accordance with their malariogenic potential is the basis for planning the control measures necessary for each homogeneous area or region. The control measures applied are those available and considered appropriate to local conditions and resources. Control priorities are determined by a combination of several factors such as malaria prevalence, socioeconomic conditions, applicable technology, and available resources.

Stratification of the malarious area of the country has begun by using the parameter of Annual Parasite Incidence (API) per 1,000 population. The country has been divided initially into three areas in accordance with the degree of transmission--high, medium, and low -- grouping one or several cantons by stratum. The SNEM considers that the indicators used now are insufficient and consequently plans to expand and intensify the process.

The process of stratification should be continued with the support the project is giving through the study and collection of information relative to the different parameters that influence the transmission of malaria at the local level of the epidemiological unit. It appears that a unit smaller than the canton would be more appropriate. The parameters to define, among others, would be geographical, ecological, parasitological, entomologic, anthropologic and socio-cultural, morbidity and mortality, and the response of malaria to control measures. The infrastructure of the health system should be studied.

Meanwhile, a workshop or seminar for reorientation of SNEM personnel at all levels, beginning at the central level, is essential. The workshop should cover the doctrine and strategy of malaria control, the concept and methodology of epidemiological and operational stratification, and the policy, planning, and execution of malaria control within the strategy of Primary Health Care. The project has resources to provide technical and operational assistance to the process of stratification and to the task of reorienting and training the personnel of the SNEM. Corollary operational research would be desirable to develop collaboration and exchange of technical information with malaria control programs in Colombia and Peru with reference to the methodology and process of stratification.

k. Epidemiological Surveillance in Zone VII, Province of Esmeraldas

Of all the cases of malaria detected in Ecuador in 1986, 50.5% were in the Province of Esmeraldas. This province has a population of around 327,000 inhabitants, which represents barely 5.9% of all the population of the country exposed to malaria. The number of deaths attributed to malaria in Ecuador in 1985 was 64, of which 59 had confirmed diagnoses. Of the 64 deaths from malaria, 25 occurred in Esmeraldas (39.0%), of which 14 occurred in the urban area (56.0%) and the 11 remaining in the rural area. Other provinces with mortality from malaria in 1985 were: Cotopaxi and Los Rios, 8 deaths in each; Manabi 7; Pichincha 5; Guayas 4; Napo 2 and 1 in each of the Provinces of Morona, Loja, Azuay, Cañar and Chimborazo.

Zone VII, Esmeraldas, does not have an epidemiologist; it has only a physician who is the Chief of Zone. The Department of Epidemiology in collaboration with the Zone Authority of Esmeraldas has prepared the "Programming of Epidemiological Activities of Zone VII, Province of Esmeraldas." An attempt is being made to obtain monthly information on more than 80% of the existing localities, through 555 VC and 109 Health Units distributed in 15 Epidemiological Evaluation Areas, in order to obtain better knowledge of the real malarious situation in the five cantons of the Province as a basis for adequate and timely antimalarial treatment.

Programming, in general, is structured on the concepts of epidemiological surveillance for a malaria control program. This design can serve as a model for study and the complete and timely implementation of the program can serve as a basis for evaluation of the surveillance system. It will also make it possible to make corrections and adjustments until the most appropriate design is achieved for hyperendemic areas such as Esmeraldas.

Administrative and managerial factors have impeded implementation of the plan. The project provides technical assistance and financial support.

3. Recommendations

- The SNEM needs to test a model for epidemiological surveillance in the malaria control program. The hyperendemic areas of the Province of Esmeraldas produced more than 50% of all the cases of malaria in Ecuador in 1986. The Department of Epidemiology has prepared the "Program of Epidemiological Activities of Zone VII, Province of Esmeraldas." In view of the importance of epidemiological surveillance in control of malaria, it is recommended that the program of epidemiological activities of Zone VII, Province of Esmeraldas, be implemented as operational research, subjecting it to monitoring and evaluation for at least one year of complete and continuous operation in order to establish its effectiveness and make necessary adjustments.

  At the same time, it is recommended that the SNEM consider increasing the number of professionals, especially medical professionals, in Zone VII, Esmeraldas.

- The SNEM should identify a person at the central level who would: (a) prepare a plan to revive and reactivate the notification network of cases of malaria and maintain it in an optimum state of operation; (b) review the geographical distribution of the NP and plan the relocation of the NP if necessary so that their locations are in line with epidemiological considerations; (c) plan, direct, coordinate, supervise, and evaluate the retraining of the collaborators. The training should be provided in each area of operations under the responsibility of the medical Chief of Zone; (d) review and analyze the statistical data corresponding to medical visits and the productivity of the report network; and (e) analyze the epidemiologic information obtained in order to make the necessary decisions.

  The project has resources to conduct the training of informants and to complete the provision of equipment and materials for the NP.

- It is necessary that technical personnel of the SNEM be commissioned to work together with the team of short-term experts contracted by the project in order to receive the transfer of technology to permanently strengthen the technical-operational capacity of the SNEM. In the case of the study on sensitivity of P. falciparum to antimalarial drugs, once trained, national personnel could continue to study the behavior of P. falciparum in other geographical areas with greater prevalence of this species, accelerating the research process.

- The project should continue to support and intensify studies on the behavior of P. falciparum strains resistant to chloroquine and also should initiate studies on the response of P. vivax to different therapeutic schemes with variable doses of primaquine. The objective of the studies will be to define the epidemiological characteristics of the resistance of P. falciparum to antimalarial drugs and the reaction of infections of P. vivax to different schemes of treatment. These studies will facilitate formulation of the policy and strategies of antimalarial treatment in Ecuador for the purpose of preventing and avoiding mortality from malaria and diminishing morbidity.

- Related operational research should be conducted on the chloroquine-pruritus syndrome in communities of different ethnic origins.

- The project should promote and support a program to disseminate knowledge in the medical community and to update knowledge of the management and treatment of acute, serious, and complicated cases of malaria, especially at the hospital level, in order to avoid mortality from this disease.

- Decentralization of diagnosis for timely treatment of cases of malaria should be accelerated by locating laboratories in the hospitals and General Health Services. The laboratories and the Health Services should have an adequate stock of antimalarial drugs, including quinine, and instructions for their administration. Timely and sufficient supply should be ensured by administration and supply services, whether of the SNEM in particular or of the Ministry of Health.

- It would be desirable to organize seven entomology teams based on the seven existing Aides and to distribute the teams in accordance with the epidemio-

logic strata defined, assigning more than one team, if necessary, to hyperendemic and priority areas. Each team could be made responsible for specific tasks and the sum total of activities would lead to early knowledge of important parameters of immediate interest. Each team should be independently mobile in accordance with the type of transportation necessary in the area of its work. Facilities should also be provided in the physical installations at the work headquarters.

- The project should promote simplified epidemiological investigation of cases of malaria as part of epidemiological surveillance and the process of continued stratification for orientation of the control measures necessary in the different strata.

C. Operational Research

1. Background

Operational research is one of the principal components of USAID/Ecuador assistance under the project (program management, operational research, training, evaluation and community support), each of which is programmed to accomplish the project purpose, viz., to develop the institutional capabilities of SNEM in such a way as to bring the current malaria epidemic under control, reduce the nationwide malaria incidence and maintain control over incidence levels.

The project provides $535,000 of grant funds to support operational research in vector ecology, insecticide testing, computer-based analysis of surveillance data associated with stratification, explorations of fruitful interventions in health education, and baseline prevalence studies of other vector-borne diseases. The operational research component will necessarily benefit from and contribute to the training component, which is supported by $900,000 of grant funds for SNEM training at all levels. Additionally, the project provides grant funds of $1,365,000 in long- and short-term technical assistance to strengthen the SNEM malaria control operations in the areas of program management, epidemiology, surveillance, drug sensitivity, and insecticide resistance and analysis. Research program reviews by U.S. malariologists are financed with $200,000 of grant funds. In the broad sense, operational research would be expected to benefit directly or indirectly from the entire package of $3,000,000 in grant funds.

Because of the impetus created by the infusion of $9,500,000 ($6,500,000 in loan funds; $3,000,000 in grant funds) from this project, opportunities for operational research have attracted extramural "buy ins," principally by CDC in the form of a Participating Agency Service Agreement (PASA) between USAID/ Ecuador and CDC in the amount of $200,000 to provide funding for their technical services in entomologic investigations, malaria therapy policy, urban mosquito control studies, studies on other vector-borne infections and a workshop on operational research. The funding period for the CDC/PASA is May 1, 1986 through September 30, 1989. The CDC/PASA would seem to meet a number of the most pressing needs of SNEM as well as some important long-term development needs in the integrations of operational research activities into the overall malaria control and general health programs of Ecuador. The malaria control project has also attracted outside interests in other areas, including that of VBC in computerization of the malaria data system in Ecuador, perhaps as a basis for extension to other malaria programs and to a broader use in the overall in-country health scheme.

While the principal source of operational research funding comes from the specific allocation of $535,000 under this project, other project components and extramural sources will significantly contribute to the success of the project.

Essential to the development of operational research activities and their ultimate application to SNEM malaria and vector-borne disease control programs is the continuing presence of an involved long term advisor.

2. Findings

a. Workshop on Operational Research

The CDC/PASA supported a three-day workshop, August 14-16, 1986, on operational research in Guayaquil in cooperation with SNEM and the Subsecretariat of Health. The workshop covered research input in essentially all of the operational research topics of this report. International and national specialists covered vector-borne diseases including malaria, leishmaniasis, onchocerciasis and Chagas' disease. Participants included all zone chiefs and the principal staff of SNEM, professionals from the Institute of Hygiene, the University of Guayaquil School of Medicine, and the Subsecretariat of the Ministry of Health.

Orientation of the workshop was toward developing an attitude that operational research could and should begin at home, that it should not be expected to be initiated from outside sources and that much could be accomplished within local resources to form a basis for outside participation.

This workshop was a prime example of the kinds of things being done, largely attributable to the impetus of this project, to establish research priorities and stimulate collaborative research necessary to the Ecuador malaria program.

b. Computerized Malaria Information System

At the time of the evaluation in May 1987, considerable progress had been made on the development of a computerized information system, largely through the technical assistance of VBC.

As early as June 1986, a document entitled, "Example of how a computerized malaria information system might function" was prepared by VBC and represents the beginning of a rapidly advancing progress. This document was followed by another, again developed by VBC, entitled, "Technical assistance in developing a computerized malaria information system." The document was transmitted to Mr. Herbert Caudill on August 13, 1986. During the period March 8-19, 1987, Dr. Stanley Terrell, Tulane School of Public Health and Tropical Medicine, began what is to be a series of trips to Ecuador, under the aegis of VBC, designed to implement the computerization systems for Ecuador. His trip report entitled, "Computerization of malaria data system/Ecuador" covers the plan to date. There appears to be a determined effort on the part of VBC, USAID/Ecuador and SNEM to implement the system. If developed as planned, the system would be useful in other areas within the MOH. VBC has exhibited a strong interest in extending such a system to other malaria programs.

The goal of the computerization project is not only to computerize the current malaria information system, but also to perform a thorough analysis of the program's management and surveillance information in light of objectives, strategies and resources.

As part of the effort to keep this project on course and on schedule, SNEM program directors were to complete parts 1-3 of the "guide" developed by Dr. Terrell in time for presentation to this evaluation team in May 1987. The evaluation team found that SNEM, under the Subsecretary of Health, Zone II, has completed the document entitled, "Modelo conceptual del sistema de informacion de malaria." The document was made available to the team and covers the areas of entomology, epidemiology, insecticide spraying and field operations. In turn, each of these areas includes parts 1-3 of the guide as requested by Dr. Terrell, viz., (1) list of formulations and products used, (2) description of the flowchart, and (3) elements of the information system. In each area, all program components lending themselves

to the system seem to be included and in a manner consistent with the requirements of the project.

It is the considered opinion of the evaluation team that development of the computerized malaria information system is on course and shows every promise of meeting the expectations of program participants.

c. Stratification

The objective of "stratification" of malaria to meet the needs of a control program is obvious. The professional staff of SNEM appears to be committed to the development of a more precise stratification system. An evaluation of progress in the development of stratification for the malaria control program in Ecuador parallels the development of the computerization project. Fortunately, work toward the computerization of the malaria data system is progressing rapidly and soundly. The data gathering requirements of the computerization project and the data producing system of ongoing and projected malaria and vector surveillance activities of the program act reciprocally to enhance the development of stratification. Even at this early date, it appears that a malaria stratification system has an excellent chance for realization in Ecuador.

d. Sensitivity of *Plasmodium falciparum* to Drugs

This study, being conducted in Esmeraldas Province since August 1986, under the CDC/PASA, is designed to (1) determine the sensitivity of *P. falciparum* to chloroquine by *in vivo* and *in vitro* tests, (2) train SNEM personnel in drug sensitivity testing, and (3) develop guidelines for treatment of malaria infections by SNEM and the general health services based on results of drug sensitivity testing. The protocol for the study was made available to the team, and two CDC technicians were working on the project at the time of this evaluation. All indications are that the investigations are on target and that the activities blend well with the urban malaria objectives of the program.

e. Anopheles Vector Incrimination

VBC has defined a study and offered technical assistance for the incrimination of malaria vectors in eastern Ecuador. The work is scheduled to be accomplished by a VBC consultant for about four weeks in June 1987. The project is designed to involve SNEM counterparts and will include a wide range of established vector incrimination techniques, e.g., dissection for parasites, parity, associated ecology, community characterization, taking of voucher specimens, associated blood parasitology,

etc. The project allows for ELISA testing in the United States should this be necessary. This work involves a specific target area where little is known of the vector status of anophelines and will complement ongoing work of the SNEM entomologist and the CDC/PASA team.

It is evident that both Dr. Hobbs, the Long-Term Advisor (LTA) to the project, and Dr. Alercon, SNEM entomologist, are already seeking answers to vector incrimination problems. Work began in September 1986 and it has been determined that Anopheles punctimacula in parts of Ecuador might be a complex of several species. Early in their studies, subject specimens sent to U.S. specialists for identification were not identified as An. punctimacula, making it clear that a high priority would be given to the elucidation of the taxonomic status of vector anophelines in Ecuador, beginning with the entity known as An. punctimacula. Accurate identification of vector species is critical to the success of the vector control program. The CDC/PASA supported travel of Dr. Alercon to work with Dr. Darsie of "The Wedge" and with specialists of the U.S. National Museum in Washington during January and February 1987 to develop a key which now allows accurate identification of An. punctimacula. The SNEM entomologist will continue to submit material to U.S. specialists to help further clarify the taxonomy of anophelines in Ecuador. Accomplishments in this area exemplify the realization of an operational research objective through the cooperative efforts of several organizations and individuals.

A potentially important aspect of vector incrimination has been considered by SNEM -- the possibility of "selective trapping." Although An. albimanus is considered the dominant vector in many situations, including the heavily targeted Esmeraldas area, is it possible that it is being selectively trapped? Could An. punctimacula be important but not well represented in traps? If not well represented in trap collections, is it biting humans? Such questions are an inevitable part of vector incrimination studies, and indeed are being actively pursued under this project.

A VBC study in vector incrimination is planned for eastern Ecuador. Present in this area is An. rangeli, a near relative of An. trinkae. The latter species was only recently described from the eastern slopes of the Andes, but is a species which has received considerable attention in the recent past because of its occurrence where there is malaria transmission in the absence of historically better known species of Anopheles. This topic was detailed in a recent VBC project completed in Bolivia. In Ecuador, Dr. Hobbs, the LTA, posed a sound question -- "Do you find malaria in the absence of An. albimanus?"

Because the changing objectives of anti-malaria programs require multi-faceted approaches, the reassessment of vector status in a horizontal structure has become urgent. It appears that SNEM/Ecuador is making substantial progress in this area of operational research.

f. Urban Mosquito Control Studies

Operational research in urban mosquito control has been conducted or is planned for the cities of Guayaquil and Esmeraldas with broad-based interest of several entities including CDC through the PASA, VBC through its technical assistance program, and SNEM through ongoing activities. The impetus results from conditions brought on by "El Niño" in the early 1980s. Essentially, rains continued throughout 1982-83. Much of the resulting malaria was urban and prompted increased house spraying and the importation of ULV equipment and the use of ULV sprays. Along with such action came increased surveillance in urban areas. "El Niño" spawned malaria rapidly until the disease became the number one public health problem in Ecuador attracting considerable assistance and probably provided the impetus for the malaria control project currently being evaluated. Because the problem was largely urban, there was a corresponding focus on the problem of Ae. aegypti in urban areas.

Guayaquil has been the main focus of urban mosquito control projects since the beginning of the 1986 rainy season. A number of projects have been planned and some have already commenced. Work in mid-April was extended to Esmeraldas because of a rapid rise in the number of malaria cases. The Esmeraldas work is being conducted mainly by a CDC/PASA team of technicians supported by SNEM personnel.

g. Technical Assistance in the Control of Aedes aegypti in Guayaquil

This is a VBC Project activity planned for implementation in the short term. The objective is to provide technical assistance to review the present system of Aedes surveillance and control, to evaluate the techniques currently used, to simplify and systematize essential data collection, and to develop a cost-effective integrated urban mosquito control system in Guayaquil and perhaps in a smaller community. An entomological urban vector control consultant, Mr. Edgar Bordes, is expected to make the first of two three-week trips to Ecuador for this activity in late May 1987. The entomological work will be complemented by a social anthropologist, Dr. Thomas Schorr. To date, there has been no activity in this area. Mr. Bordes, however, is scheduled

to make his first visit in late May 1987, shortly following that of the evaluation team.*

h. Development of an Urban Anopheline Surveillance System

This is a CDC/PASA-supported project which began in June 1986 and continues. The objectives are (1) to develop an urban vector surveillance system which will serve as a model for other cities in the identification of species present, their seasonal density changes and their role as vectors of malaria; and (2) to provide SNEM with entomology information that can be used to aid in the planning of malaria control activities on a timely basis. Emphasis is on the evaluation of battery-operated light trap models. The successful establishment of a system of adult surveillance based on light trap collections will increase efficiency and standardization.

i. Block Surveys to Determine Premise Breeding and Aedes aegypti Larval Densities in Ecuador

This study is planned for the latter part of the 1987 rainy season. The objectives include (1) a survey for Ae. aegypti of a statistically significant number of blocks representing varying socio-economic areas in Guayaquil; (2) the collection and enumeration of all Ae. aegypti aquatic stages in containers on each premise; and (3) the determination of larval densities according to the type of container as related to socio-economic area. The successful definition of container types as related to the delineation of targeted treatment areas is essential to a successful SNEM program in Aedes aegypti control.

j. Insecticide Testing

The various insecticides (DDT, malathion, Bendiocarb, Fenitrothion, Abate, etc.) used by SNEM as residual wall sprays, space sprays or larvicides require systematic testing for quality, storage life, suspensibility, etc. SNEM has a system for collecting samples of insecticides from storage facilities for sending to CDC in Atlanta for the required testing under the CDC/PASA. The plan calls for the processing of approximately four samples per year for four years. SNEM does its own suspensibility tests for DDT. Malathion and Fenitrothion will be tested only if in storage for more than one year, a condition not expected to occur in Ecuador. The testing program for insecticides appears to be adequate and reasonable.

*Note: This activity has been cancelled. USAID/Ecuador notified the VBC Project that "alternate arrangements have been made for this work by SNEM" - editor.

In addition to the laboratory testing of insecticides, SNEM conducts field bio-assay tests of sprayed surfaces to determine the effectiveness of residual deposits of insecticides and their performance in terms of specifications.

SNEM also conducts insecticide tests of materials used in the control of Aedes aegypti, both adulticides (Fenitrothion, malathion, DDT) and larvicides (Abate, Fenitrothion, Dromofos). Tests are to determine the optimal formulation, dosage and application methods for control operations.

Together, the CDC laboratory tests, the SNEM field bio-assays, and the resistance tests, described under that heading, represent a substantial body of operational research that should assure maximum effectiveness of chemical control applications.

Newer larvicidal materials to control An. albimanus in Ecuador will be tested in field trials under the CDC/PASA. The objective will be to evaluate the effects of various formulations of Bacillus thuringiensis serotype H-14 (B.t.i.), and mono-molecular surface film on natural populations under field conditions.

Insecticide tests involving both Altosid (an insect growth regulator) and Abate as larvicides for the control of Ae. aegypti in Guayaquil are scheduled to begin in May 1987. These compounds have proved to be safe, effective and economical in urban situations worldwide, with substantial use in the southern United States. These trials overlap the interests of CDC, VBC and SNEM in the area of insecticide testing, urban mosquito control studies and control of Ae. aegypti in Guayaquil.

The insecticide testing program represents a substantial portion of the overall work of SNEM entomology and is absolutely essential to the efficacy and cost effectiveness of insecticide application systems.

k. Insecticide Resistance Studies

During 1986, SNEM conducted a variety of standard WHO tests to determine Anopheles susceptibility levels to the insecticides being used in SNEM operations. Results from 45 tests representing five provinces (Zone II-Oriente, Zone IV-Loja, Zone V-Rios, Zone VI-Manabi, and Zone VII-Esmeraldas) showed no indication of developing problems with resistance to DDT among An albimanus, An rangeli, or An. punctimacula nor to Fenitrothion among An. punctimacula, An. albimanus or An. pseudopunctipennis nor to malathion among An. punctimacula, An. albimanus, or An. pseudopunctipennis. It is believed that the tests are sufficiently representative for early detection of incipient

development of resistance and for monitoring susceptibility levels of mosquito populations.

The successful administration of standard WHO insecticide resistance tests requires strict adherence to protocol. The tests require relatively large numbers of mosquitoes representing homogenous populations and physiologic states. Under the CDC/PASA, SNEM may avail itself of newly developed biochemical techniques for detection of resistance in mosquitoes--techniques that do not require large numbers of specific types of living specimens. The PASA's call for the training of SNEM entomologists in the techniques is a good example of the project's contribution to institutional development.

1. Other Vector-borne Diseases

The workshop held in August 1986 in Guayaquil included attention to leishmaniasis (Dr. Ruebush, CDC); onchocerciasis (Dr. RiLazo, Univ. of Guayaquil; Dr. Tidwell, Univ. of South Carolina); and Chagas' disease (Dr. Defranc, SNEM).

Except for activities related to other vector-borne diseases associated with individual or institutional interests, most of the work is scheduled for the latter phase of the project. CDC, in consultation with SNEM, will provide epidemiologic and/or entomologic consultation for studies of the transmission and control of Chagas' disease, leishmaniasis, and potentially, onchocerciasis. The specific topics for CDC input have not been defined, but will be developed by consultation with SNEM, the senior malaria advisor and collaborating national institutions.

In January 1987, PAHO sponsored a course in Guayaquil entitled, "The isolation, identification, mapping and distribution of leishmaniasis causing human disease in Ecuador." The course included all of the groups attending the workshop in August 1986 plus the senior laboratory technicians of SNEM. Bryce Walton, who provided the training, is scheduled to return to begin work under SNEM grant funds in July/August 1987. His work in various parts of Ecuador will emphasize characterization of strains of leishmaniasis.

A three-month study entitled, "Biology of simuliids in Esmeraldas Province" by Paul Beech-Garwood was completed in early 1987. This study was supported by grant funds from the project and addressed breeding patterns, man- and animal-biting species, vectorial capacity and biting behavior. The results of the study, conducted on an opportunistic basis, will be a valuable base for future studies of onchocerciasis in Ecuador.

In other work pertaining to onchocerciasis, Dr. Manuel Arzube, of the Institute of Hygiene, was supported by project grant funds to work in the London Museum of Natural History with its specialist on blackflies. This work resulted in a manuscript, in press, entitled, "Monograph of blackflies of Ecuador with distribution maps of the vector species."

The SNEM epidemiologist, Dr. Defranc, is extremely active in research on Chagas' disease in Ecuador and has been supported by PAHO on a completed project on the distribution of Chagas' disease in the country.

The Institute of Hygiene, with its highly qualified professional staff, in proximity to SNEM and with responsibility for research in tropical diseases for the country, is a continuing source of help for project interests, especially in the area of diseases other than malaria.

Although work in vector-borne diseases other than malaria was programmed more for the latter part of this project, it is seen that much activity is ongoing and that there are many sources of local and outside interest.

m. Socio-cultural Studies

The operational research program in socio-cultural topics is making steady progress. The project calls for a series of KAP studies stratified by geographical, cultural and racial variables. The first of these has been completed in the coastal black villages in northern Esmeraldas, and the second and third are already planned for southern Esmeraldas and Manabi. Each area represents a different cultural group (sedentary vs. mobile; black vs. mestizo, etc.) and potentially different disease patterns since some areas are believed to have chloroquine-resistant malaria.

The project paper calls for a study designed to quantify migration in areas having differing malaria transmission levels. Although this study has not yet been launched, the A.I.D. advisor has identified studies which were done in Guayaquil by the Census Bureau on the origin of urban migrants. The Census Bureau has prepared high quality maps detailing the urban migration patterns.

The study of factors which influence the effectiveness of VCs in specific cultural or racial settings is pending the effective re-establishment and retraining of the VCs. It is recommended that this study be done toward the end of the project after the VC program has been effectively reactivated.

3. Recommendations

- Because of the diversity of research topics, organizational interests, funding and technical assistance under this project, it is recommended that SNEM designate a coordinator of research to work closely with the Long-Term Advisor.

- Even in the absence of a SNEM coordinator of research, it is recommended that a SNEM professional from the central office in Guayaquil be identified and actively involved with each definitive operational research project, on-site where practical, with the objective of professional growth and institutional development. If this is done, SNEM will be continually apprised of plans, activities, progress and results of specific investigative activities under this project.

- The following research topics are recommended for early implementation in conjunction with efforts to improve malaria control: efficacy of malaria surveillance using clinical indicators being applied by the voluntary collaborators (blood-filming of suspected cases); alternative therapeutic schemes for treatment of *P. vivax* infections; and evaluation of the alternative drugs, amodiaquine and Fansidar, in areas of documented chloroquine resistance.

D. Community Resource Mobilization/Health Education

1. Background

As stated in the project paper, the goal of SNEM's health education program is "to increase the understanding, cooperation, and participation of the people in the program at the community level" (p. 45).* Effective health education and community participation are critical components of low-cost, long-term malaria control. The movement away from vertical eradication programs and toward integrated control assumes a much greater reliance on human resources. "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" (p. 33). Greater community involvement is thus viewed as a cornerstone of the Ecuadorian Malaria Control Project.

*Unless otherwise indicated, all references refer to the project paper.

As part of its stratification efforts, the project recognizes the need for implementation of regional (area-specific) educational strategies and resource mobilization projects. Operational research projects focusing on knowledge, attitudes, and practices - KAP - will complement regional epidemiologic data in the design of regional programs. SNEM also plans to improve community participation in urban areas by working with a host of agencies. Among the institutions which SNEM plans to involve in urban malaria control are neighborhood associations and leaders, private doctors and medical laboratories, major employers, GOE service agencies, health centers and PVOs (p. 33). Particularly in urban areas, where the responsibility for public services is shared by a number of agencies whose communication is often only sporadic, community resource mobilization will be complex.

In order to promote malaria control effectively, SNEM recognizes the importance of coordinating with and providing training for other national entities. Thus SNEM plans to work with the local communities and municipalities, the private sector, the armed services, and schools and educational facilities. "This is particularly important since most of the public does not fully understand SNEM's malaria objectives and the ways in which their participation can accelerate achieving these objectives ... The first step is to develop an educational strategy which increases awareness of malaria control objectives, provides necessary information about malaria as a preventable disease, and targets messages and educational activities for specific key groups" (pp. 31-32).

The community education and resource mobilization efforts of SNEM are geared toward several general objectives:

(1) To increase the utilization of the voluntary collaborators (VCs) and primary health care (PHC) workers for rapid treatment of fever;

(2) Individual and collective self-help projects to reduce the risk of malaria (i.e., reduction of mosquito breeding sites, avoidance, contributions of labor and materials to community projects, etc.); and

(3) Cooperation with household spray teams and area fogging efforts.

In order to achieve these objectives and to improve public understanding of malaria transmission and control in such a way that will motivate changes in individuals' behavior and communities' responses, the project includes the following specific inputs (Annex A, p. 5):

(1) Three annual workshops completed and publicized;

(2) Appropriate information materials designed, printed and distributed to all malarious areas by the end of the third year;

(3) Appropriate educational presentation initiated in malarious areas;

(4) Sociological KAP (knowledge, attitude, and practice) research instituted in SNEM and completed by the end of the project; and

(5) Twelve or more annual media placements (in Spanish and/or local languages) for informing and educating the public.

To increase the potential impact of the health education efforts, the project paper emphasizes the need to involve every SNEM employee in health education (p. 45). As part of the general health education effort/training program, SNEM staff members are to be retrained in the techniques and skills necessary to achieve maximum public awareness and participation.

2. Findings

The SNEM health education program is beginning to emerge from a fairly long period of inactivity. SNEM employs one health educator, housed in the Department of Epidemiology in the Central Office. The A.I.D. long-term technical advisor is a strong source of assistance and moral support to the health educator who otherwise assumes sole responsibility for community education activities. The health educator feels somewhat isolated in his activities, and one has to question the seriousness of the commitment to health education given this staffing situation.

This evaluation is somewhat too early to judge the potential effectiveness of the HE program. Given several program inputs before the EOP, the HE effort may lead to demonstrated changes in individual behavior and community resource mobilization. These include: technical training of the health educator, effective reactivation of the VCs (the best potential link to the 5.5 million Ecuadorians living in malarious zones), and good technical assistance in materials development and mass media programs (it is hoped, to begin later this year).

In general, SNEM is experiencing predictable difficulties in making the transition from eradication to control. One of the keys to successful transition will be the incorporation of primary health care strategies at the community level. To date,

this effort is weak but shows promise of improvement. Technical assistance in planning and implementing a HE program should begin later this year and, one hopes, SNEM administrators and field staff will successfully motivate, retrain and provide adequate supervision to the network of VCs. The VCs must be perceived, trained, and supported as community educators and mobilizers.

Progress in each of the specific areas of the HE program is reviewed below.

a. Workshops

During 1985 and 1986, the health educator (with assistance from the A.I.D. advisor) completed several workshops on urban malaria control. The audience consisted primarily of representatives from various urban service agencies which cover the Guasmas neighborhood of Guayaquil in which some 400,000 people reside. Health promoters, cooperative and barrio leaders, and MSP professional staff attended 15 workshops. Additional programs were conducted for the Empresas Privadas de Fumigadores en Guayaquil, Damas del Voluntariado and the Department of Hygiene. This program was very much in line with the urban malaria control/community participation strategy. After a strong start during the first two years, the urban program has not been actively continued.

In 1987, the health educator will launch a program with the Instituto Ecuatoriano de Obras Publicas (IEOS) to train over 100 community promoters representing 20 provinces. These promoters are affiliated closely with community water/sanitation committees and offer a strong possibility for both education and action programs in rural areas.

b. Materials Development and Distribution

The full program of materials development has not yet been initiated. After a false start getting technical assistance from the Centro de Capacitacion, MSP, Quito in 1986-87, the A.I.D. technical advisor has been looking for a replacement agency. (The Centro did not understand the malaria control objectives of SNEM and the A.I.D. advisor decided to find another group.) The Academy for Educational Development, Inc. (AED) has been identified as a potential collaborator and discussion of the project will begin this month. AED has successfully completed a mass media malaria education campaign (including an evaluation component) in Honduras. With technical assistance from AED (or a similar agency) posters, slides, radio spots, videos and other materials will be developed.

To date, the health educator and the A.I.D. advisor have developed several flyers and guides for community education. These materials were printed in limited quantities (by the MSP) and used during staff training in Babahoyo and Esmeraldas in 1985 and 1986.

An educational module on malaria control, providing appropriate information and student exercises, has been designed for distribution to high school teachers. In some cases, high school students have elected to do their required senior project on community malaria education, using and/or expanding the SNEM guide. Student projects build on the efforts of SNEM.

c. Educational Presentations

So far SNEM's urban educational program has been stronger than its rural one. As noted above, a substantial effort has been initiated to sensitize a well-rounded group of appropriate persons working in economically marginal sections of Guayaquil. In theory, these groups acquire the skills to incorporate malaria activities in their efforts.

In 1985-86, SNEM had a modest program of presentations in elementary and high schools in Guayaquil, Babahoyo, Quevedo, El Empalme and Ventanas. Like other urban educational efforts, the school program got off to a good start but has declined in 1987.

The rural health education program will depend in large part on the efforts of SNEM zone staff and the VCs. Part of the staff training/retraining program is dedicated to sensitizing field staff about their individual responsibilities for mobilization of local resources. These zone training programs have been completed in Esmeraldas and Babahoyo. Depending on the content and effectiveness of the training of trainers (for auxiliaries) and training of the VCs starting later in 1987, rural education could substantially increase.

d. KAP Research (Knowledge, Attitude, Practices)

The KAP research studies offer SNEM the possibility of designing region-specific programs. The KAP studies will be done in different country regions to permit stratification by geographical, cultural and racial variables. The first three KAP studies have been planned for coastal areas: northern Esmeraldas, southern Esmeraldas and Manabi Province. These areas contain different cultural groups (black vs. mestizo) as well as different disease patterns (i.e., chloroquine resistance).

The design and implementation of the first KAP study has been completed in northern Esmeraldas by a team of short-term U.S. consultants and one Ecuadorian physician who was hired for six months to serve as field supervisor and interviewer trainer. The data have been analyzed (in the U.S.) and the results are expected to reach SNEM shortly. The content and quality of the data collection instruments were excellent and SNEM plans to use the information for the development of local educational programs.

e. Mass Media Presentations

To date, no mass media presentations have been launched. With appropriate technical assistance from AED (or a similar group), SNEM will initiate this effort in 1987 or 1988. The results of the regional KAP studies will provide current information on appropriate regional strategies and appropriate content of educational messages. Under consideration are radio spots, videos and brief films.

f. Armed Forces Collaboration

Presently, all control aspects of malaria within the army installations are being conducted by SNEM (Project Paper Annex N, p. 1). As part of its attempt to diffuse responsibility for malaria control to other appropriate agencies, the SNEM project is contemplating training army personnel in control techniques. It is believed that the army may have a role in malaria control on its own installations as well as in communities neighboring these installations.

As a first step in increasing army responsibility for malaria control, SNEM has included army physicians from two military bases in its courses on the clinical management of malaria. Through training activities, mosquito control can also be implemented on military bases.

g. Community Participation

The project paper concludes that as public awareness of malaria increases, local action will consequently increase. While this may be true in theory, communities will need supervision and support. The SNEM director is keenly aware of this issue and is dedicated to promoting community participation. Plans for technical assistance in designing a strong community program are underway. Many issues cloud the problem of local participation. Among these are the lack of a national primary health care program operating at the community level and the labor problems SNEM will have in transferring more responsibility to non-unionized, voluntary personnel.

Another potentially serious obstacle to community participation comes from the medical community. Graduating medical students are required to donate one year of service in a rural area following completion of their studies. Because the number of medical students has grown substantially, more and more placements are sought in rural areas. In some cases, these students are beginning to assume the role that the VCs once had in treating malaria cases. The students do not represent a source of continuity since they change every year, they are not always in the community, and they do not understand local realities.

3. Recommendations

a. The first institutional priority regarding health education should be the development of a plan of education for rural and for urban areas, particularly Guayaquil. The technical assistance of specialists should be sought.

b. Strong consideration should be given to the initiation of a small-scale, community-based malaria control project in a priority region of the country (e.g., a small group of communities in northern Esmeraldas Province). Since the Ministerio de Salud Publica (MSP) does not have an effective PHC program or a network of promoters, other potential collaborators, such as IEOS, which has an excellent promoter program, should be identified. A primary emphasis of the project should be to build on human resources and local participation.

The program should incorporate the principles of PHC, using appropriate educational interventions/mass media campaigns and providing adequate supervision and training. This program should adopt a phased approach and should include an evaluation component at each stage. Qualitative evaluation techniques, such as focus group interviews, could be used for rapid assessment/ feedback on the interventions. Individual behavioral change (such as rapid fever treatment and use of bed nets) combined with community action (such as source reduction) should both be emphasized.

As SNEM and other institutions master the issues of community participation and see the potential impact of this type of program for low-cost malaria control, the program can be carried to other priority areas.

c. The urban educational program (Guayaquil) should be reactivated so that the initial steps taken in 1985-86 are not lost. In addition, a study is needed to identify immigration patterns into Guayaquil and to identify those areas of the city

which have local malaria transmission and P. falciparum resistance to chloroquine. A KAP study of the city is also recommended.

E. Training

1. Background

A top priority of this project is to strengthen the technical and administrative capabilities of SNEM to institutionalize a malaria control program. In large part, this effort boils down to training. Thus, nearly 30% of all grant funds (a total of $900,000) have been allocated for training activities over the LOP. Training and/or retraining programs have been planned for all levels of SNEM staff as well as for the network of 6,000 VCs spanning the country.

The training assistance is aimed primarily at developing malaria control skills so that the national incidence can be reduced and maintained at low levels. Training in the control of other vector-borne diseases, particularly dengue and Chagas', is also planned. Seven major training areas are described in the project paper (p. 45). (See pp. 70-73 for the annual training schedule and budget allocations.) The areas are as follows:

(1) Up to 20 senior staff trained in vector-borne diseases including knowledge, alternative control methodologies, and operational research skills

(2) Up to five GOE/SNEM staff sent for M.P.H. degrees

(3) Study tours in Latin America and the United States for up to 31 participants

(4) Special courses in entomology and epidemiology

(5) Four training experiences in administration

(6) In-country training in the detection of chloroquine-resistant vectors

(7) Augmented training for the network of 6,000 VCs and a training of trainers (TOT) course for the "auxiliares de evaluacion" who supervise the VCs

In addition to the above-mentioned training activities, SNEM has initiated a computerization project. This effort has been designed to develop a simple, computerized data management system for running a stratified control program. Computer literacy is only one of the computer project goals; also included is a

review/analysis of the management and information needs in light of program objectives. Local personnel are involved in every step of the project from conceptualization, to planning and implementation. This project provides a good example of the involvement of SNEM staff in a long-term training exercise which will contribute to strengthened institutional capacity in both administrative and technical (computer) areas.

2. Findings

Overall, the project has maintained steady progress in its training program. The major focus of the program has been on in-country training of SNEM staff and GOE/MSP personnel. The SNEM Director and the A.I.D. advisor have given a priority to the training of General Health Services (MSP) physicians, nurses, auxiliaries and others in the diagnosis and treatment of malaria. Historically, only SNEM has been responsible for the treatment of malaria, with many MSP physicians and nurses unskilled in malaria case management. In the long term, to have successful, affordable malaria control, the MSP will have to assume greater responsibility for the clinical aspects of malaria control.

Thus, a joint effort has been underway with the Subsecretaria de Salud in Guayaquil to develop and complete a series of five-day seminars for MSP health professionals on the clinical management of malaria. Related topics in the course include other vector-borne diseases, tuberculosis and snake bites. This training program has been a very serious and professional effort. The courses have been completed in Loja, Zamora, El Oro, Guayas, Manabi and Los Rios. Each seminar was attended by 40 to 45 participants from the general health services representing facilities in both remote rural areas and larger communities. Also participating have been physicians from the Army and Marine Corps and Seguro Social Campesino. The training staff included six malaria professionals, four tropical medicine specialists, and a biologist. The production of course materials has been completed by a team of experts, and coordinated and printed by the Subsecretaria. A second round of courses is planned for Esmeraldas, Santo Domingo, Loja-Zamora, Canar-Azuay-El Oro, Los Rios-Guayas, Manabi, and two in El Oriente. Follow-up and supervision are included in current program plans.

The training of SNEM staff is also proceeding well. To date, 14 of the targeted 20 short-term participant training experiences have been completed. Topics of the training programs have included vector control, malariology, entomology, malaria immunology, and aedes aegypti control in emergency situations. Participants have been sent to the United States, Venezuela, Guatemala, Panama, and Brazil.

None of the long-term trainees has yet been sent for the M.P.H. degree. Because SNEM is an aging institution, it has been difficult to identify young candidates who are interested/able to leave for the degree program. The contract for technical assistance in training has been given by USAID/Ecuador to the local Fulbright Foundation. Fulbright's regulations require that participant trainees meet certain requirements, including an age requirement that they be under 35 years. Thus, SNEM itself has not been a good source for these candidates. The long term A.I.D. advisor has identified two candidates. One could be trained in computer information/epidemiology and the other is the hospital administrator from Quevedo. Since one of the major goals is to increase the administrative capacity of SNEM, some thought should be given to selecting at least one candidate for M.P.H. degree in administration.

Short term training of SNEM staff, particularly low level field staff, has not yet commenced. Because of the commitment of high levels of the SNEM administration, it is expected that training of VCs and auxiliares de evaluacion will include a strong component on community participation. The TOT for the auxiliares and the refresher/training courses for the 5,000 VCs will begin this year. To help guarantee long term, appropriate supervision and motivation of the field staff, a SNEM or GOE person should receive long term (M.P.H.) training in health education and community participation.

Summarized below is the progress SNEM has made in its in-country training activities as well as participant short- and long-term training.

| Type of Training | Target | To Date |
|---|---|---|
| I. In-country training of SNEM and GOE personnel | 500 | 414 |
| A. Clinical management of malaria and other diseases for General Health Services staff, Armed Forces physicians, etc. (described above) | | 230 |
| B. Retraining of mid-level supervisors (inspectors, brigade chiefs, etc.) | | 113 |
| C. Safe handling of pesticides for private pest control ope ators | | 10 |
| D. Safe handling of pesticides for new spraymen (Esmeraldas) | | 15 |
| E. Seminar/workshop in operational research in malaria and other vector-borne diseases | | 22 |
| F. Computer programming | | 1 |
| G. Refresher course for auxiliares de evaluacion (Esmeraldas) | | 20 |
| H. Outboard motor maintenance | | 3 |
| II. Long-term trainees (Master of Public Health degrees) | 5 | 0 |
| II. Short-term participant training | 20 | 14 |
| A. Vector control, University of S. Carolina | | 9 |
| B. Malariology, Maracay, Venezuela (9 months) | | 1 |
| C. Entomology, Panama and Guatemala (2 months) | | 2 |
| D. Malaria immunology techniques, Brazil (1 month) | | 1 |
| E. *Aedes aegypti* control in emergency situations (1 month) | | 1 |
| IV. Study tours | 31 | 1 |
| A. "The Wedge" Univ. of S. Carolina and National Museum, Washington, DC (3 weeks) | | 1 |
| V. Voluntary Collaborators | 5,000 | 0 |

3. Recommendations

a. SNEM should continue its joint training program with the Subsecretaria de Salud, Guayaquil on the clinical management of malaria for the General Health Services personnel and other professionals such as the Armed Services physicians. This effort is essential if greater rationalization of malaria control is to be achieved - with SNEM assuming greater responsibility for prevention and the MSP for curative/clinical aspects.

b. Effort should be made to bring the program of observational study and long-term participant training in line with the projected time line. To best meet institutional needs, it is recommended that one GOE/SNEM person receive an M.P.H. in health education and another in administration.

c. In order to initiate (and then institutionalize) a program of community participation/support in malaria control, SNEM should prepare a training plan for the VCs and their immediate supervisors, the auxiliares. In addition, short-term training for the SNEM health educator, currently scheduled for 1989 in the project time line, should be pushed up if at all possible. His skill development in the production of appropriate materials, social marketing, etc. can greatly improve community participation. And finally, training of SNEM personnel has been completed in two of the seven zones. Every effort should be made to provide refresher courses in the remaining five zones, including a module on methods of community education/participation.

F. Yellow Fever/*Aedes aegypti* Control

*Aedes aegypti*, the urban vector of yellow fever and dengue, was officially eradicated in Ecuador in 1958 by a program which had started in 1948. In 1974, SNEM was given the responsibility of maintaining a program designed to detect any return of this vector. During 1974-1984, four reinfestations were discovered in Manta and one in Portoviejo. All were quickly controlled by routine source reduction measures.

In 1958, the first new Ae. aegypti concentrations were found in Guayaquil. Increased inspections detected a number of additional sources. A surveillance program was initiated to determine the areas affected and to control the species. The targeted area has not been delineated, nor has a continuous control program been initiated. Control methods include the use of granular Abate as a larvicide, ULV adulticiding -- both outdoors in infested areas and indoors in houses in which adults have been detected, destru tion of unnecessary water containers, and health education.

Using malaria workers, when possible, to augment the relatively small force assigned to Ae. aegypti control, SNEM has done a creditable job in the city of Guayaquil. They realize that their efforts alone cannot eradicate the species, but they can provide early warning of any dangerous build-up in time to adopt emergency measures that might be required for disease control. CDC short-term consultants are attempting to develop an early warning system which requires fewer man-hours. The SNEM Ae. aegypti team has requested assistance with a health education program designed to encourage community participation in source reduction and acceptance of climate inspectors and spraymen and their work.

Jungle yellow fever is a relatively new problem for Ecuador. This is the same human disease and virus, but transmitted by a mosquito vector, other than Ae. aegypti, which normally inhabits the jungle canopy and feeds on monkeys, the reservoir/hosts. It only feeds on man during jungle-clearing operations, but can transmit the disease from monkey to man under such circumstances. It is then possible for the virus to be vectored to humans by the urbanized vector, Ae. aegypti.

Given the extent of the vector source and the small number of humans involved, the disease is best controlled, under such conditions as exist in the Ecuador's Oriente, by immunization. The vaccine is efficient, providing at least 10 years of protection; 50,000 doses are now available at MOH/Quito, and SNEM is preparing a program to vaccinate all of the current and future workers on the pipeline, oil wells, and the proposed road to Colombia. The Director of SNEM is anxious to learn whether the U.S. troops assisting with the post-earthquake rehabilitation work in that area have, or will be, provided with this immunization by the U.S. government, or whether he should plan on including them in his immunization program.

G. Effects of Recent Natural Disasters on Malaria and SNEM

The earthquake suffered by Ecuador in March of this year did virtually all of its damage in the mountainous parts of the country, in non-malariagenic areas -- and did not directly influence the country's malaria rates. There was, however, a secondary economic effect in that the scarcity and increase in cost of fuel has hampered SNEM's necessary mobility.

On the other hand, the extremely high rainfall and resultant flooding caused by the periodic changes in the Humboldt Current had, and are still having, a great effect on malaria production and SNEM activities. A review of rainfall data shows that the average rainy season lasts from December to March. The 1982-83

rainy season began in October and ran for a full year. No rainfall was registered in November 1983, and in December the normal rainy season pattern was resumed. During eight of the twelve months the rainfall was greater than for any normal average month and in each of six of these months the rainfall was greater than for any average year. The long-lasting deluge saturated the earth and caused the natural reservoirs and water-courses to overflow, expanding the existing malaria vector sources and creating innumerable new ones. The result was an explosive increase in the vector population. Also, flooding damaged or destroyed homes, forcing the inhabitants into closer contact with the vectors, thus nullifying the effect of SNEM's intradomiciliary house-spraying operations. This was followed by the migration of infected inhabitants to other areas of the country.

Thus, these rains increased not only the numbers of vectors, but the human - vector contact as well. They negated SNEM's control efforts through house-spraying, and caused a spreading of the parasites from their original areas. The resultant epidemic is partially reflected in SNEM's epidemiological figures, but because the floods also hampered SNEM's evaluation efforts, it is estimated that these figures only represent about one-fifth of the actual cases.

With the regression of rainfall to normal and the rebuilding of damaged or destroyed homes and roads, SNEM is returning to a normal operational pattern in these areas, but it will probably be another year or two before results are reflected in malaria case rates.

# VI. EVALUATION OF PROJECT ORGANIZATION

## A. USAID/Ecuador

### 1. Inputs

The USAID/Ecuador GOE/SNEM Malaria Control Project provides $6,500,000 in loan and $3,000,000 in grant funds to support SNEM in the areas of program management, operational research, training, evaluation and commodities under this project and has established a PASA with CDC in direct support of research. Also, USAID/Ecuador is actively involved in the procurement of services and supplies and has contracted for a long-term technical advisor (LTA) to administer the project. Project success to date has resulted largely from the ability of the USAID missions to assume many of the services expected from the contractor.

### 2. Outputs

The A.I.D. activities under the project and the various contracts and agreements have resulted in a marked reduction of malaria in six of seven provinces with significant reductions in urban areas, except for Esmeraldas. Because of continuing epidemic malaria in the Province of Esmeraldas, a concentrated anti-malaria program has been mounted, largely from the infusion of funds and technical assistance into this project, directly attributable to A.I.D. involvement. This activity is expected to result in an enhanced SNEM operation with strong institutional development of local resources.

The containment of the current epidemic, reduction of malaria incidence and levels of malaria, the principal objectives of this project, would not be expected to be accomplished without A.I.D. assistance, particularly in the coordination and promotion of projects through the LTA.

## B. GOE/SNEM

### 1. Inputs

The continuity provided by SNEM through its structure and function is the matrix for all of the activities under this project. SNEM field teams are in place to work with long- and short-term advisors and technicians. Any program element produced by the malaria control project involves SNEM. The GOE/SNEM has apparently met its obligations under the project agreement and indeed, seems to go "the extra mile" in accommodating project activities.

2. Outputs

The SNEM directorate is strongly supportive of the project and provides leadership and guidance in a variety of activities designed to attain a control strategy that might be incorporated into the general health services. Most of the projects described in this report involve active SNEM participation.

Other institutions of the GOE are frequently involved in the project, principally the Subsecretariat of Health in Guayaquil through training, equipping laboratories, and malaria surveillance activities; the Institute of Hygiene through the involvement of professional staff and shared missions, especially in vector-borne diseases other than malaria, principally leishmaniasis, onchocerciasis, and Chagas' disease; and the Institute for Water and Sanitation in community health promotions by training its staff in malaria control.

C. Contractor

1. Inputs

The contractor, United Schools of America, has contributed a long-term advisor (LTA) for the project and provides an amount of technical assistance. It is apparent, however, that the contractor is the weakest of the organizational components identified with this project. The contractor has not met the expectations of either USAID/Ecuador, GOE/SNEM, or even of its own LTA. The LTA reports a general lack of administrative support, a lack of technical competence in the field of malaria, and specific failures to respond to the most basic of project requirements.

The evaluation team reviewed documented evidence that contractor support of the technical advisor in both administrative matters and technical assistance is inadequate and, unless corrected, represents a serious impediment to attaining EOP objectives.

2. Outputs

The evaluation team concluded that the LTA is the catalyst by which project objectives are implemented and become workable. Thus, the contractor is providing an essential element; to maintain the level of accomplishments to date, improved support of the LTA by the contractor is absolutely necessary.

# VII. RECOMMENDATIONS

Recommendations resulting from the evaluation of the various project components, i.e., administration, epidemiology, operational research and community health, are contained in Section V. Recommendations from the evaluation of organization participation are contained in Section VII. Abbreviated recommendations pertaining to the overall evaluation are repeated in the executive summary.

# ANNEX I. SCOPE OF WORK AND SUPPORTING DOCUMENTS

The scope of work provided by the evaluation team members by VBC is as follows:

## Work Scope

This first field evaluation of the USAID-sponsored malaria control project (Ecuador #518-0049) will emphasize the following activities:

1. logistics* - the ordering, delivery, and setting in place of commodities; development of inventory procedures, in-country distribution of supplies, procurement procedures, etc.

2. surveillance - improvement of existing epidemiological surveillance procedures within the country, reflecting the project's objective, i.e., to move from the 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 based on stratification and a better use of the other sectors within the national capability.

3. operational research - development of such research in a wide variety of fields, including vector ecology, insecticide testing, development of computer-based analysis of surveillance and stratification, and exploration of fruitful interventions in the field of health education and community participation in malaria control.

4. Submission of an acceptable report.

## Supporting Documents

The basic supporting document used by the evaluation team was the project paper:

USAID Malaria Control Project Paper, Ecuador. (Project No. 518-0049) 92 pp. Annexes A, C-M. January 29, 1985.

*The term "logistics" used in the scope of work was used to include evaluation of administrative and management elements of the malaria project.

ANNEX I cont.

The documents listed in Annex IV were used to varying degrees by team members depending on the area of responsibility.

# ANNEX II. EVALUATION TEAM MEMBERS

Samuel G. Breeland, Ph.D., (Team Leader) is a consulting entomologist from Jacksonville, Florida. His former posts include: Director, Florida Medical Entomology Laboratory, Vero Beach; Chief, Medical Entomology Branch, Vector Biology and Control Division, CDC; Research Biologist, Tennessee Valley Authority; and Medical Entomologist, Panama Canal Zone Health Bureau. He has extensive experience in research and control of malaria and other vector-borne diseases, principally in the Americas.

Hernando Cardenas Gutierrez, M.D., M.P.H., was Epidemiologist-Malariologist of the National Malaria Eradication Program in Colombia from 1956 to 1965 and a PAHO/WHO staff member since 1966 with working experience in Malaria Eradication/Control Programs in WHO Regions of the Americas, Africa, and Asia. He is currently PAHO/WHO Regional Malaria Advisor stationed in Washington, DC.

Patricia O'Connor, M.A., A.B.D., is an Adjunct Research Instructor in the Department of Biostatistics and Epidemiology, School of Public Health and Tropical Medicine, Tulane University. She has consulted on various health education, primary health care and community development projects in Guatemala, Bolivia, Ecuador, and El Salvador. She is a member of the Board of Directors of the Behrhorst Development Foundation in Guatemala.

John Stivers, B.S., M.S., A.R.P.E., is a consultant in malaria and vector control. He has held operational and managerial positions with mosquito abatement agencies in New Jersey and California (1950-58). He was co-director for A.I.D. (CDC/PASA) of national malaria eradication programs of Nicaragua (1959-1961), Ecuador (1961-66) and Paraguay (1967-68), and Chief of the USAID malaria advisory team in Vietnam (1969-1973). He served as Western Hemisphere regional malaria advisor A.I.D./W 1973 to retirement in 1976.

# ANNEX III. PERSONS CONTACTED

USAID

Washington, D.C.
Victor K. Barbiero, Ph.D., Public Health Advisor

Quito (USAID/Ecuador)
Mr. Frank Almaquer, Mission Director
Mr. Scott Smith, Deputy Mission Director
Mr. William Goldman, Health Development Officer
Mr. Herbert Caudill, Jr., Project Officer

Guayaquil
Dr. Jesse Hobbs (LTA), Asesor Técnico en Malaria

Vector Biology & Control Project (VBC)

Andrew A. Arata, Ph.D., Senior Technical Officer
Barry A. Silverman, Sc.D., Biomedical Computer Specialist

SNEM

Dr. Victor Reyes Lituma, Director del SNEM
Dr. Francisco Vazquez B., Head of Epidemiology Advisor, A.I.D.
Dr. Joubert Alarcon, Head of Entomology Section, SNEM
Dr. Manuel Defranc, Medical Epidemiologist in Chagas' Program, SNEM
Dr. Renato Jimenez, Medical Epidemiologist, SNEM
Mr. Carlos Diez T., Financial Director, SNEM
Mr. Victor Bermeo I., Head of Field Operations, SNEM
Dr. Victor Gonzalez, Health Educator, SNEM
Dr. Jorge Moreira, Head of Section for *Aedes aegypti* Control, SNEM
Dr. Rodrigo Espinales, Administrator, SNEM

Guayaquil
Ms. Ida Andrad, Secretary/Statistician, Zone VII, SNEM
Ms. Jacqueline Mesias, Secretary/Statistician, Zone VII, SNEM
Mr. Juan Salazar Castillo, Head of Warehouse, Zone VII, SNEM

Esmeraldas
Sr. Cesar Maldonado, Supervisor of Zone VII (Esmeraldas), SNEM

ANNEX III cont.

Centers for Disease Control (CDC)

Dr. Edward Hayes, CDC Consultant
Dr. Jack Sexton, CDC Consultant
Dr. James Stewart, CDC Consultant
Dr. Bernard Nahlen, CDC Consultant

Subsecretariat de Salud, Ecuador

Dr. Roberto Mera, Medical Chief of Programming, Zone II, Guayas
Ms. Ana Maria Rugel A., Coordinator of Training, Zone II, Guayas

WHO/PAHO

Mr. Roberto Unda, Technical Officer

# ANNEX IV. DOCUMENTS REVIEWED

Beech-Garwood, P. A. 1987. Report on the biology of simuliids in Esmeraldas Province for USAID/Ecuador and SNEM Guayaquil.

Breeland, S. G. 1972. Observaciones y recommendaciones sobre el control de insectos vectores de enfermedades en relación con projectos de desarrollo en la cuenca del Rio Guayas en Ecuador. Consultant Report. 11 pp.

CDC/PASA. Project protocols and trip reports.

Cowper, L. T. Malaria control in Ecuador. Proc. N. J. Mosq. Control Assoc. (72nd Annual Meeting): 25-32.

Informe previo a la evaluación del programa del SNEM. Servicio Nacional de Erradicación de la malaria, Ministerio de Salud Pública, Republica del Ecuador. Guayaquil, May 1987.

Participating Agency Service Agreement. USAID/Ecuador and Centers for Disease Control, Malaria Control Project No. 518-0049.

Reyes, Victor M. 1986. Circular D-197-86. Normas para la coordinación de actividades entre el SNEM y los servicios generales de salud.

SNEM. Malaria Control Project outputs as of March 31, 1987.

SNEM. Mensaje educativa del rociador de brigado (Fenitrothion). 1 page copy.

SNEM. Resumen de actividades de educacion para la salud, 1985-86, 2 page copy.

SNEM. Proteja su salud. 1 page pamphlet.

SNEM. Ingreso a bodega central del SNEM de materiales y equipos. Proyecto 518-0049.

SNEM. Chart, datos pluviometricos de la ciudad de Guayaquil.

SNEM. Instructions for Sprayers (illustrated). "Siga estas instrucciones cuando recie."

Subsecretaria de Salud/SNEM. Control de paludismo. Educational pamphlet, 24 pp.

ANNEX IV cont.

Subsecretaria de Salud/SNEM. Guía para reuniones con la comunidad pamphlet. 8 pp.

Subsecretaria de Salud, Zona II/SNEM. Modelo conceptual del sistema de información de malaria. 13 pp.

Terrell, Stanley. Trip Report. Computerization of malaria data system/Ecuador March 8-19, 1987.

USAID Malaria Control Project Paper, Ecuador. (Project No. 518 -0049) 92 pp. Annexes. January 29, 1985.

USAID Malaria Control Ecuador. "Logical Framework."

VBC Project/USAID. Document unpublished. Example of how a computerized malaria information system might function (English and Spanish).

VBC Project/USAID. Document unpublished. 1986. Set of four documents outlining prospective studies for Malaria Control Project (518-0049). (1) Computerized Malaria Information System; (2) Control of Aedes aegypti in Guayaquil; (3) Incriminations of malaria vector(s) in eastern Ecuador; (4) First Annual Evaluation.

# ANNEX V. LIST OF ABBREVIATIONS/ACRONYMS

| | |
|---|---|
| ACD | Active Case Detection |
| AED | Academy for Educational Development, Inc. |
| API | Annual Parasite Incidence |
| EOP | End of Project |
| GOE | Government of Ecuador |
| HE | Health Education |
| KAP | Knowledge, Attitude, Practices |
| LOP | Life of Project |
| LTA | Long-Term Advisor |
| MPH | Masters of Public Health |
| MSP | Ministerio de la Salud Pública = MOH |
| NP | Notification Posts |
| OR | Operational Research |
| PASA | Participating Agency Service Agreement |
| PCD | Passive Case Detection |
| PHC | Primary Health Care |
| SNEM | Servicio Nacional Erradicación de Malaria |
| TOT | Training of Trainers |
| ULV | Ultra-low Volume |
| USA | United Schools of America |
| VC | Voluntary Collaborator |