2249

ATTACHMENT #2
PES # 521-79-5
Strengthening Health Services II (086)

PD-AAJ-660
ISN-1197

521-0086/17

HAITI MALARIA PROGRAM

Report of Evaluation Team

May 20, 1979

Prepared under contract with:	Agency for International Development
Contract Number:	AID/lac-C-1328
Project Number:	521-0086
Project Title:	Strengthening Health Services II
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CONCLUSIONS AND RECOMMENDATIONS

1. The anti-malaria program in Haiti has not succeeded in reducing the incidence of the disease to a fixed target level. This lack of success is attributable to many factors, one of which is the inadequate relationship established between the measures taken and epidemiological data.

2. Apart from technical and operational shortcomings in implementation, the program suffers from problems of goal identification. Although the program is identified as a long-range control effort to reduce malaria incidence below 500 cases per million, the proposed 1979 Plan of Action states that the goal of the program is short-term eradication. This conversion has not been discussed with AID, nor with the Ministry of Public Health and Population.

3. No program to achieve the goal of malaria eradication has been enunciated, nor have any tentative estimates of costs been proposed. It is apparent, however, that an eradication program would require financing in an order of magnitude greatly exceeding existing availabilities. SNEM has already spent or obligated over $522,000 for 145 tons of fenitrothion, an expensive, highly toxic insecticide, the effectiveness of which against the only incriminated Haitian vector remains unknown.

4. No decision may be made at this time as to the technical feasibility of an eradication program. Even if appropriately conducted tests of the insecticides under consideration demonstrate that an eradication program is technically feasible, a substantial range of additional constraints would have to be overcome, including staffing, training, and a substantially expanded advisory staff.

5. No source of financing of the proposed eradication program has been approached.

6. Pending resolution of the question of technical feasibility of eradication, the control effort should be continued, following the strategy proposed in this document.

Chapter VI, Recommendations, the final chapter in the Evaluation Team's report, lists in the sequence of coverage in this report the recommendations which emerge from the Team's examination of Haiti's antimalaria program. The recommendations are many and detailed; some are essentially technical, some call for organizational modification of SNEM, and some require policy decision and action on the part of the three long-term supporters of the antimalaria effort--the Government of Haiti, the Pan American Health Organization, and the Agency for International Development.

The following are the key recommendations concerning the Team-proposed plan of action for the balance of 1979 and 1980; the kinds of actions which may at a minimum determine the technical feasibility of malaria eradication, whatever may be other existing constraints against embarking on such a program; the kinds of action necessary to overcome such constraints; the staffing requirements to be met with respect to advisory staff; and the policy decisions to be taken by the members of the Executive Committee. In the judgement of the Evaluation Team, these recommendations require prompt consideration if the projected time targets are to be met.

The Evaluation Team stresses the need:

1. To conduct carefully planned, meticulously executed and fully evaluated field-research projects designed to determine the effectiveness of three residual insecticides--fenitrothion, malathion and DDT--in interrupting the transmission of malaria under Haitian conditions.

2. To suspend any extension of operational use of residual insecticides until the effectiveness of all three candidate insecticides has been fully field-researched and one (or more) found effective.

3. To recruit a highly qualified, experienced epidemiologist to plan, execute and evaluate the three field-research projects. He would report directly to the SNEM director, and would have full operational control over the planning, execution and evaluation. He would require support of the entomologist who serves as part of the PAHO long-term advisory staff, and the full-time service of a well-qualified sanitarian, also from the PAHO advisory staff, to supervise the day-to-day field implementation of the projects. Whether the field-research project director is to be supplied by PAHO or by AID should be resolved in terms of ability to locate and recruit the man, not by limitations prescribed in the present Memorandum of Understanding.

4. To adopt as the insecticide of choice the one which proves most effective for operational use under Haitian conditions. Should more than one insecticide prove to be capable of interrupting transmission, the least expensive should be selected.

5. During the period of recruiting, direction, planning, execution and evaluation of the three field research projects (fifteen months from the time the project director reports for duty), to classify the country into homogeneous eco-epidemiological strata, on the basis of epidemiological, entomological and parasitological data already capable of being developed from SNEM records or to be developed. Such stratification will specifically identify areas of high endemicity which require most urgent attention, and will

permit pre-selection of intervention measures most likely to meet success. Such measures would then be subjected to field testing to evaluate their effectiveness under operating conditions.

6. To recruit without delay qualified successors to the departing senior members of the SNEM's PAHO advisory staff, the chief of party and the sanitary engineer. Advisory requirements call for an experienced epidemiologist and an equally experienced sanitary engineer.

7. To use these 15 months of testing to initiate the training, inside and outside of Haiti, of SNEM staff members to create a body of manpower capable of conducting, monitoring, measuring and evaluating a well-planned anti-malaria program, whether it is designated as control or eradication.

8. To continue during this period to protect the population of rural Haiti against malaria-caused morbidity and mortality through the distribution of drugs; by choice, the distribution of the presumptive treatment of simple chloroquine, which has been shown to be very effective against the parasite found in Haiti, Plasmodium falciparum. (The body of the report contains recommendations for streamlining and reducing the present surveillance and drug distribution system).

9. Through the field testing of intervention measures proposed under Recommendation 5, to secure a firm judgment on the effectiveness of two apparently wasteful activities; in the absence of a clear demonstration of operational effectiveness, to terminate the use of thermal fogging (except as an emergency measure during periods of epidemic) and sharply reduce the program of larvicidding by limiting its use to the areas where it has a chance of operational effectiveness.

10. Continue to utilize the techniques of source reduction (environmental management) and biological measures (use of larvivorous fish) as a means to reduce the production potential of the foci of the mosquito vector, Anopheles albimanus. Source reduction, which like all other intervention measures requires testing and evaluation, should be sufficiently concentrated to have a measurable impact on the mosquito production potential of an area. The body of the report contains recommendations concerning the stimulation of participation in this form of activity (which may be considered a capital investment as well as an anti-vector measure) by other entities, public and private.

11. In view of such imminent problems as advisory staffing, potential funding requirements and extent and duration of commitment to the anti-malaria effort, to consider the need for modification of the Tripartite Memorandum of Understanding among the present supporters of the Haitian malaria program--GOH, PAHO, AID.

Concerning the alternate strategies outlined in Chapter V, no recommendation can be made pending conclusion of field-research projects to determine whether eradication is at least technically feasible, and, following such a determination, if it is favorable, that the many additional constraints to eradication have been faced. These constraints include but are not limited to qualified staffing, advisory support, preparation and evaluation of a costed, internationally approved plan, and, perhaps most important, a firm decision by the Government of Haiti to pledge its maximum financial commitment to the malaria program and

assurance of its established priority in overall development planning. Such a plan could then be brought before potential donors to enable the identification of sources of financing. Multilateral contributions to such a plan would be appropriate.

Malaria control is an alternative to an eradication effort which might be beyond technical feasibility, implementational capability or financial availability. Its annual costs would be lower than the estimated $10 million annually over a six year period for a fenitrothion-based country-wide eradication effort; they may be expected to produce less dramatic results, over a considerably longer period of time. The goals expressed in the Five-Year Plan are macro-targets which fail to reveal how concentrated Haiti's malaria really is. Throughout much of the country, malaria may be reduced to the zero case level; in areas of perennial transmission, a target of not more than 10 cases of malaria per 1,000 population is realistic, and better defines the effort. This goal will not be achieved within the time frame of the Five-Year Plan. Externally supported financing at or near the annual level projected in the Five-Year Plan will be required for four or more additional years if one of the cheaper insecticides on trial proves effective in interrupting or seriously reducing malaria transmission. Without an effective insecticide for use as a residual spray, malaria control at a level to be defined as tolerable by GOH itself appears to be a possible but distant prospect.

Geography and Geology*

The Republic of Haiti occupies the western third of the second largest island of the West Indies--the other portion constituting the Dominican Republic. The island is situated between 18 and 20 degrees north latitude and between 71 and 74 degrees west longitude, approximately midway between Cuba and Puerto Rico. The maximum length of Haiti is about 180 miles; and the width along the Dominican border is 110 miles. Its land area, including the four largest island dependencies, is only slightly more than 10,000 square miles. This is due to the fact that the Gulf of Gonave almost bisects Haiti into two narrow peninsulas--the northwestern and the southwestern.

The country is chiefly mountainous, steep slopes rising directly from the coasts except at the infrequent intervals where wedges of plain extend into the mountain masses. Elevated plateaus as seen in Central and South America are not a feature of Haiti. The highest ranges attain up to 8,000 feet of altitude and consist for the most part of masses of limestone. They are frequently scarred by cliffs and intricately dissected by erosion.

Only one considerable river exists, the Artibonite with its large tributary, the Guayamouc. It is navigable for only the few miles where it is tidal. The total length of this river system is about 145 miles, and its watershed comprises almost one third of the country. A few short rivers in various parts of the Republic maintain a steady flow throughout the dry seasons; but the great majority of the streams are intermittent in character. Practically all of them are blocked at the mouth by bars

*This section has been extracted from the National Malaria Society Journal; 5-6, 1946-47, pp. 41-67.

of sand or gravel thrown up by wave and wind action, forming lagoons which offer ideal breeding places for anopheline mosquitoes. Since the principal human settlements are located along the coast in the vicinity of these streams, few are beyond the flight range of insects developing in these blocked outlets.

Haiti has several lakes and ponds. The largest of these, Etang Saumatre, has an area of 70 square miles, and its water closely resembles that of the sea in composition. Etang de Miragoane, the second largest, contains fresh water and discharges into the sea through a subterranean channel in a rocky ledge. The prolific breeding of mosquitoes along its grassy margins has been notorious since colonial times. Most of the other lakes and ponds are ephemeral and occupy sinkholes in limestone.

The geological nature of the island gives rise to many peculiarities of water distribution in addition to extensive underground drainage. Among these should be mentioned the appearance of innumerable springs and seepage areas at tidewater. These assume particular importance in the malaria picture, since coastal highways have been built at beach level without sufficient provision for carrying this perennial water to the sea. One therefore finds in many localities a continuous mosquito breeding area, miles in extent, along the shoreward side of the highways. The same situation develops where roads are built across irrigated alluvial plains and act as unintentional dams to the runoff of surplus irrigation water.

Haiti has a warm and notably equable climate. Temperature records do not exist except for a few towns situated at or near sea level, where annual means vary from 77 to 81 degrees Fahrenheit. There is usually a

difference of about 10 degrees between the highest and lowest mean monthly temperatures, which is only about half the value of the mean diurnal difference between maximum and minimum. A few observations made at points above sea level would indicate that there is a drop of approximately 4 degrees Fahrenheit for each thousand feet of increasing altitude. Ice and frost have never been reported, even on the highest peaks.

Unlike the relatively uniform temperatures encountered in various parts of the Republic, the rainfall shows great irregularities in its distribution by season and locality. This is to be expected from the mountainous nature of the island and from the influence of the northeast tradewinds. There is hardly a region of the country where one may not travel in a few miles from a humid to an arid climate zone. This effect is very apparent when viewing the country from an airplane when extreme contrasts in types of vegetation are displayed below.

Local variations in precipitation being so characteristic, it will suffice to say that for the majority of stations there are two well-defined rainy seasons. One occurs in the spring; and the other in the fall--dates varying from place to place and from year to year. In these zones the winter dry season lasts from December to March; while the summer one is rarely so pronounced and is generally of but one month's duration. Table 1 and Map 1 summarize the monthly and total annual rainfall for ten stations in widely separated areas of the Republic. Figure 1 plots the data for the first three towns of the list and shows the May and November maxima. Towns with low total annual rainfall usually show a single long season of precipitation, extending from April to November--the balance of the year being practically devoid of rain. Towns with very high total values likewise fail to show a pronounced summer dry season.

TABLE 1

Mean Monthly and Annual Precipitation in Inches for Ten Towns of Haiti

TOWN	YEARS OF RECORD	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	MEAN ANNUAL RAINFALL
Port de Paix	30	5.1	3.4	2.3	2.5	3.5	3.2	2.3	3.4	4.6	4.9	3.4	5.0	49.0
Limbé	16	5.7	5.4	6.6	6.5	9.6	5.3	4.4	4.6	6.1	3.1	11.2	7.1	83.9
Cap Haitien	10	4.0	4.5	3.7	3.1	9.1	4.8	1.2	3.0	5.2	6.2	15.4	5.9	66.3
Gonaives	47	0.2	0.5	0.6	1.1	3.3	3.9	2.8	2.7	3.3	2.3	1.1	0.4	22.2
Mirebalais	14	1.3	2.2	3.9	9.1	11.6	13.0	12.4	15.4	15.2	11.9	5.5	2.1	103.5
Port-au-Prince	74	1.3	2.4	3.6	6.3	9.4	4.1	2.3	5.7	7.1	6.6	3.3	1.3	53.9
Jacmel	31	1.5	1.3	3.5	5.0	7.3	4.6	3.0	5.1	5.4	6.7	3.2	1.0	48.6
Petit-Goave	31	0.3	1.9	2.1	4.6	7.4	5.0	4.3	5.8	5.5	4.3	2.3	0.7	45.9
Cayes	32	3.0	3.4	4.3	7.1	11.7	7.0	4.9	3.7	9.0	14.5	7.0	2.6	83.3
Jeremie	31	2.7	3.1	3.3	3.9	6.1	4.4	3.5	3.0	4.0	5.4	6.5	3.5	50.6
Mean Annual Precipitation for Ten Stations														60.7

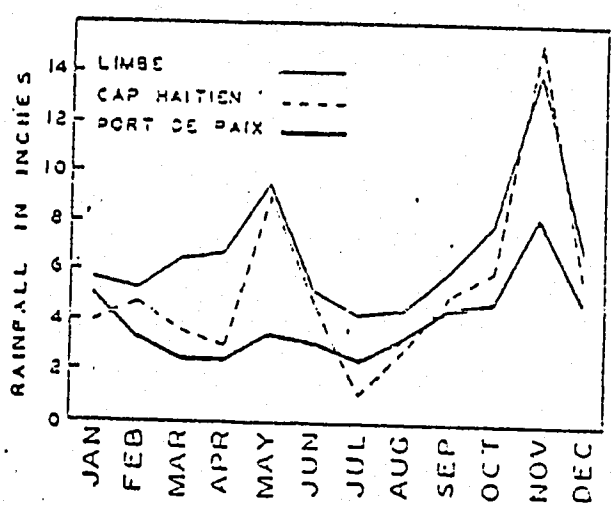
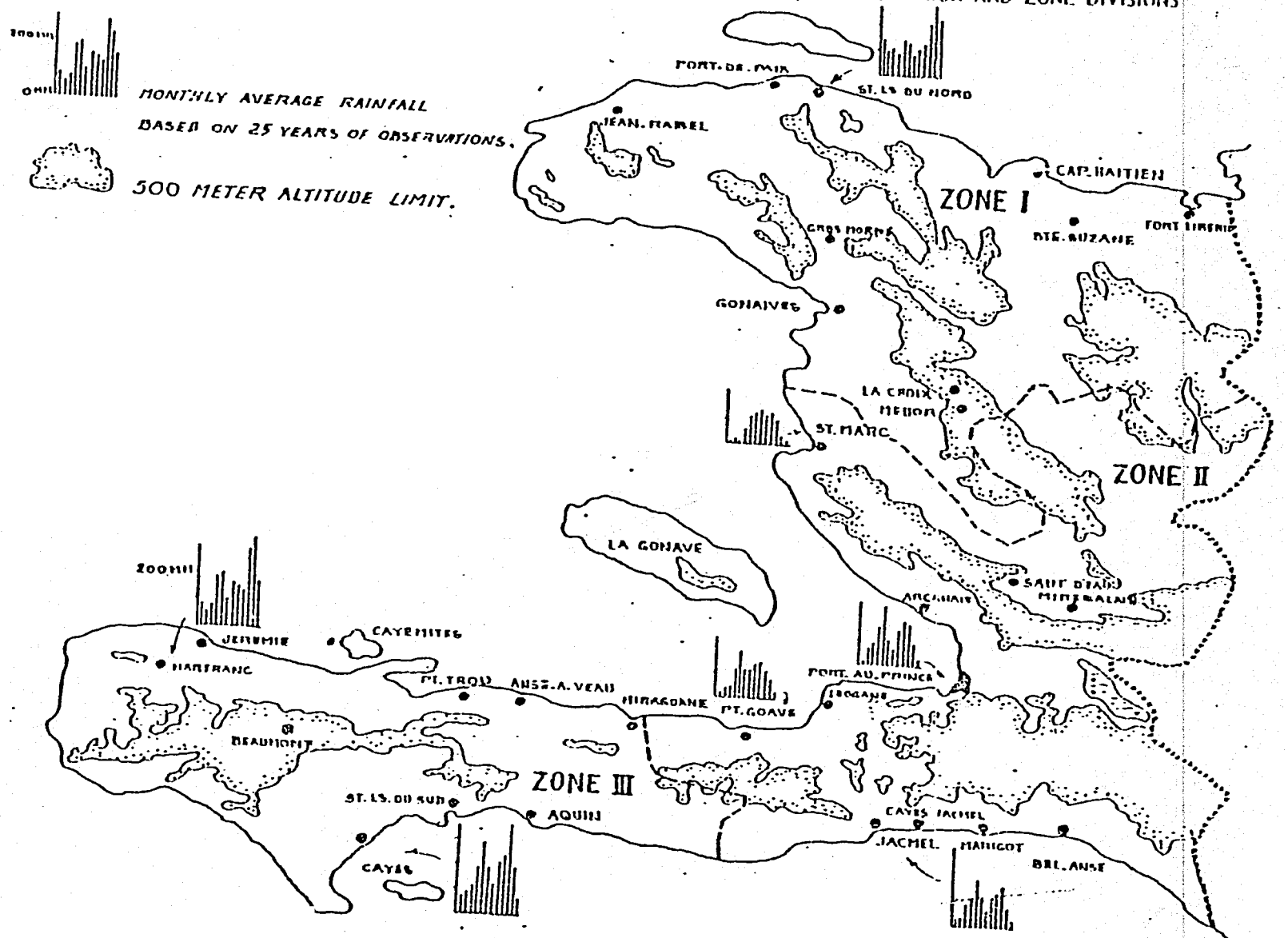


FIG. 1. MEAN MONTHLY PRECIPITATION FOR THREE TOWNS OF NORTH HAITI

MAP I MAP OF HAITI SHOWING MONTHLY AVERAGE RAINFALL, 500 m CONTOUR AND ZONE DIVISIONS



H A I T I M A L A R I A P R O G R A M

Report of Evaluation Team

May 20, 1979

Prepared under contract with:	Agency for International Development
Contract Number:	AID/lac-C-1328
Project Number:	521-0086
Project Title:	Strengthening Health Services II
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Another characteristic of the precipitation is that it falls in sudden storms; so that a major part of a month's rainfall may be accounted for in a few rains of only a few hours' duration. However, along the north coast and on the northern edge of the southwestern peninsula, winter precipitation may take the form of a light drizzle that continues for days at a time.

Violent storms are usually confined to the drier regions of the Republic. On infrequent occasions, destructive hurricanes have swept the south coast. Hail is sometimes reported as an accompaniment of summer thunderstorms.

Observations on relative humidity are lacking except for the station at Port-au-Prince, the capital. Here, the yearly average is about 70 per cent, with monthly averages ranging from 63 to 75 per cent. Daily fluctuations are more marked, a range of 30 being normal between a high of about 80 per cent at midnight and about 50 per cent at noon. Haiti thus has a less oppressive climate than that found in many other countries with the same temperature levels. The great regularity of the daily land and sea breezes throughout most of the year also mitigates the tropical heat in almost all the towns of the Republic.

Chapter I. Introduction

The history of anti-malarial effort in Haiti over the period of the past 19 years provides a remarkable record of continued recognition of malaria as a serious problem, a determination by the Government of Haiti to take steps to tackle the problem, and a notable and uninterrupted willingness of external sources of assistance to provide their financial, technical and managerial help.

The problem, to be sure, is agreed: the impact of malaria on the health of the people of Haiti, and the degree to which malaria thwarts economic development, reduces national income, burdens the national budget (and the budgets of individuals), and diverts funds from otherwise attainable socio-economic goals. What has not been agreed is the approach to the problem. In fact, there is at this time no decision regarding short-term and intermediate goals, although it is agreed that the final objective remains eradication.

The anti-malarial effort is carried out by a semi-independent service of the Ministry of Public Health and Population, the Service National des Endémies Majeures (SNEM), previously known under the name of Service National d'Eradication de la Malaria.

SNEM's proposed program and plan of action for 1979 envisages a departure from the pattern of malaria control set forth in the 1978-1982 Five Year Plan, a document which had been the basis of the 1978 plan of action and budget, and which had been expected to provide the base for subsequent annual plans. The 1979 SNEM-proposed plan of action asserts the need to convert the antimalaria program to one of eradication.

The SNEM Executive Committee* did not approve the 1979 proposed program and plan of action.

Similarly, examination of the expenditure data on the program implemented in 1978 reveals substantial divergence from what is set forth in the approved plan of action, nor do these records, maintained by line item only, make it possible readily to determine the cost of any element in the field operation. There is no way to determine the cost-effectiveness of intervention measures applied either singly or in combination.

In the absence of Executive Committee approval of the 1979 proposed plan of action, SNEM is operating under an interim approval which permits continuation of the courses of action carried out in 1977 and 1978 and expenditure at the rate established in 1978, but does not allow the goal modification and budget increase (by nearly 20%) proposed by SNEM.

The continuing program, it is to be repeated, is a program of malaria control, keyed to a long-term projection of operations--the Five Year Plan noted above. This document was prepared in 1977 at the request of the Agency for International Development. As noted above, PAHO continued to provide technical advice to SNEM, and UNICEF, formerly associated with the program, made its terminal contribution in 1973.

In previous years, SNEM had operated under annual plans and annual budgets, supported by minor elements of GOH financing and substantial but irregular AID support, each tranche of which was made available as a separate action which provided no assurance of long-range continuity.

*This Committee is composed of the Secretary of State for Public Health and Population, representing GOH, the Representative of PAHO, which has supplied technical advice to SNEM; and the Director of the USAID Mission to Haiti.

In point of fact, AID support of the malaria program has been uninterrupted since its inception in 1961. Nevertheless, the combination of discrete annual planning, annual injections of external financial support without the assurance of long-range continuity, the extremely low level of GOH financing of the program and the release of such GOH funds to SNEM on a scheduled monthly basis had caused irregular patterns of implementation, in some measure a function of delays in procurement action (pending availability of funds) which had inhibited timely delivery of insecticides--and which had drawn the unfavorable attention of the 1970 Malaria Eradication Strategy Review Committee.

The Five Year Plan of Operations was needed for program implementation during the period 1978-82, but also to support a request to AID for a major, multi-year funding grant. The expenditures envisioned under the plan were defined in the budget by activity; the document was reviewed by PAHO Headquarters and AID/Washington, and was approved by the SNEM Executive Committee. Subsequent to plan approval, AID made a terminal grant of $6 million covering the anticipated life of the project. Taken together with a GOH commitment to step up its support of SNEM to some $5.6 million over the five-year planning period, the anti-malaria program had, for the first time, assured funding of over $11.6 million--precisely the kind of long-range availability essential for timely implementation of plans of action.

The Five Year Plan of Operations, clearly identified as a malaria control effort, envisioned a reduction in malaria incidence to or below a level of 500 cases per million of population at malaria risk. The remaining anti-malaria functions were thereafter to be transferred to

the newly created Rural Health Delivery Service within the Ministry of Public Health and Population, which by 1983, it was anticipated, would be capable of maintaining this level of control.

Since 1960, the financial contributions of GOH, UNICEF and AID to the anti-malaria effort have totalled $30.1 million ($23.6 million from AID), exclusive of AID and PAHO contributions to SNEM of $5.3 million in technical assistance. Averaging $1.67 million annually from 1961 onwards, funding availabilities were nearly $1.9 million in 1967, over $2.4 million in 1968, and (under the Five Year Plan) are projected at over $2.5 million in 1969. These figures are far below the requirements for an eradication program (estimated as high as $10,000,000 per year), but are of the order of magnitude required for an acceptable level of control.

Yet the SNEM program is not succeeding in controlling malaria to the prefixed target; however, in the absence of antimalaria activities, malaria incidence would be very much higher. Short-falls in target achievement are a cause for concern, but in no sense constitute a reason for abandonment of the control effort.

In Haiti falciparum malaria responds well to a single dose of 4 amino-quinoline. Untreated falciparum malaria may result in considerable mortality among non-immune populations. In the absence of diagnosis of cause of death in rural areas, the statement made by SNEM personnel, that malaria control activities have succeeded in totally preventing mortality due to this disease, remains to be proved.

The Evaluation Team has had the benefit of the conclusions of previous evaluations, strategy reviews and consultant reports. These

conclusions and recommendations provide some strongly held and widely differing views--some of which SNEM has accepted, in whole or in part. In fact, SNEM can point to expert external advice as the source of some of the technical defects in the program to which the Team draws attention. In the main, however, previous reviews have identified patterns of sub-standard performance which demanded attention. Many of these have not received adequate attention, and still persist.

As is noted above, the Evaluation Team considers the present situation serious--but not beyond containment. Its constructive proposals are advanced in the belief that prompt and decisive action can reverse the present trend; that reversal of the present trend is imperative, not merely for the health of the people of Haiti, but for the progress in the field of socio-economic development in which Haiti and external agencies have invested and are continuing to invest large sums of money.

The first step toward this reversal of trend is a common acceptance, of the goal of the antimalaria effort. Thereafter, it should be possible to project levels of achievement which are attainable through application of effective methods of attack; the courses of action necessary to identify the most cost-effective methods; and, within limits, the time-frame of attainment possible at given levels of funding, staffing, training and effectiveness of administration.

The large number of variables makes precise projections of time-frame difficult, but the Team sees no likelihood that the desired level of control is attainable within the time-frame and financial availabilities of the Five Year Plan. Even if a combination of improved

technique selection and program implementation were to bring the goal within reach, the possibility of transferring malaria control functions to RHDS has been adjudged to be out of the question for 1983. (See the report of the recently completed evaluation of Project 091). A separate, semi-independent SNEM will be required for at least several more years, although gradual if partial integration of SNEM and RHDS is considered both possible and desirable.

The Evaluation Team is conscious of the gravity of the situation which cannot be ignored by those responsible or associated with the antimalaria program in Haiti.

Chapter II. Evaluation of the Antimalaria Program

Section I. Background Information

The history of malaria in the country has been described in the reports of previous external evaluation teams. The main epidemiological features, however, are outlined below to give a better understanding of the malaria situation and its response to intervention measures.

Prior to the large scale antimalaria measures, initiated in 1962, parasite prevalence rates up to 31% were reported by J. Harland Paul and A. Bellerive (1946)[1]; the areas considered to be the most malarious were Petit Goave, Miragoane, Aquin, Jacmel, Leogoane, Cayes, La Coma. The malaria transmission was perennial in those coastal areas where receptivity was, and is still, high throughout the year due to permanent breeding sites and favorable climatic conditions. Higher peaks follow the periods of maximum rainfall which vary geographically during the rainy season (April to December). Epidemic exacerbations have been experienced following hurricanes and heavy rainfalls in areas where the malaria transmission potential is usually low and seasonal, as well as in those with perennial transmission. Mason[2] (1968) reported that "the considerable amount of internal population movement provides the means of introducing gametocyte carriers into previously clean but potentially malarious areas"; however, this phenomenon has never been fully investigated.

1. J. Harland Paul and A. Bellerive. A malaria reconnaissance of the Republic of Haiti in the Nat. Mal. Soc. Journal; 5-6, 1946-47. pp. 41-67.

2. Mason, John. Development of the Haiti Malaria Eradication Programme in WHO/MAL/68-665.

According to available current information, the only malaria parasite actually found is Plasmodium falciparum, although in the past J. Harland Paul and A. Bellerive (1946 loc. cit.) found that P. malariae and P. vivax accounted for 8.9 percent and 1.9 percent, respectively, of the total infections.

Of the four anopheline species (Anopheles albimanus, A. vestitipennis, A. crucians and A. grabhami) recorded in Haiti, only A. albimanus, which can be easily identified by untrained personnel, is incriminated as a malaria vector both on entomological and epidemiological grounds.

In January 1962, DDT house spraying was initiated on a total coverage basis at 2 gr technical product per m^2, twice a year. For the first five rounds the coverage and quality of spraying operations were considered as satisfactory (Evaluation Report 1964); at that time, it was concluded that the persistance of transmission observed in some highly malarious areas could not be attributed to deficiencies in spraying operations. It was stated that the basic difficulty was the considerable exophily and exophagy of the principal vector A. albimanus, coupled, unfortunately, with the extra-domiciliary habits of the population. These phenomena require further investigation.

Starting in mid-1964, the interval between spraying cycles was shortened from six to three months (6th, 7th, 8th, 9th cycles) whereas the deposit of technical DDT was reduced from 2 to 1 gr/m^2. The report of the January 1966 evaluation team states that in most of the high incidence areas, DDT applied intradomiciliarily at three months or six months cycles did not interrupt transmission.

In the absence of data regarding the quality of the spraying coverage, this assertion could not be vindicated.

Regular DDT spraying, which covered up to 900,000 houses per cycle, was discontinued between July 1965 and mid-1970 and replaced by selective spraying. Mass drug administration (MDA) was initiated in September 1964 and was gradually expanded to cover 1.7 million people in May 1966. The records indicate that over 90% of the people under the MDA scheme were treated in each cycle. MDA was not carried out continuously and was discontinued in areas as soon as the population became negative for malaria parasites. Thereafter, the drugs were given only on a focal attack basis when and where malaria cases were again detected. It is stated in the January 1966 report of the Evaluation Team "that the MDA programme resulted in a dramatic drop in slide positivity rates (SPR) in treated areas while in the untreated areas the slide positivity rate rose very sharply during the second half of the year". In fact, the SPR in 1968 was reduced to 0.22%, the lowest figure ever recorded for Haiti. However, low level transmission continued in highly receptive areas; the SPR began to rise again, increasing by nearly twenty times (up to 4.2%) in the next three years.

Regular total-coverage DDT spraying on six month cycles and 2 gr/m^2 was resumed in mid 1970 and halted at the end of 1972; 800,000 houses were sprayed each cycle. Thereafter, until the end of 1977 and part of 1978, selective spraying was carried out together with other complementary measures in areas of residual high transmission.

The yearly number of cases reported by the SNEM for the period 1962 to 1977, together with the slide positivity rate and related intervention measures are summarized in Table 2.

Table 2. Malaria cases per year, slide positivity rates and related intervention measures

Year	Number of Cases	Slide Positivity Rate	Intervention Measures	
1962	4,033	3.6 %	DDT total coverage	
1963	6,340	1.67%	"	
1964	19,169	4.04%	"	
1965	10,304	1.37%	DDT selective coverage	MDA (Sept. 1964)
1966	8,378	0.37%	"	"
1967	4,871	0.36%	"	"
1968	2,562	0.22%	"	"
1969	5,002	0.73%	"	"
1970	10,366	3.0 %	DDT total coverage	MDA selective coverage
1971	11,347	4.2 %	"	
1972	25,961	8.3 %	"	"
1973	22,853	7.4 %	DDT selective spraying	"
1974	25,441	7.1 %	"	"
1975	24,772	7.1 %	"	"
1976	15,087	4.0 %	"	"
1977	27,679	6.9 %	"	"

In addition to the intervention measures carried out from 1970 to 1977, larviciding, ULV applications, source reduction, biological control and fogging were applied in foci of high level transmission.

From the review of activities carried out from 1962 until 1977 and the analysis of the results it appears clear that up to 1968 the objective of the programme was short-term eradication. After this date, due to technical, financial and other administrative constraints, the progam was only able to reduce malaria incidence with varying degrees of success while dealing with emergency situations and reducing mortality. In this respect, a great and commendable effort has been made to make antimalarial drugs available to the population by maintaining Voluntary Collaborators (about 6,000 people in 1977) which by and large are covering all the malarious areas of the country. Founded in 1962, this system of Voluntary Collaborators progressively grew and has provided the main epidemiological evaluation system used for the monitoring of the fluctuations of malaria incidence.

DDT resistance was first detected in 1968 and found widespread by the early 1970's. Thereafter, small scale trials were carried out with alternative insecticides such as CMS33 and malathion (used in ULV application). With regard to the former, a field trial was carried out in Trou Caiman, using the partial spraying technique developed in El Salvador. A total of ten houses were sprayed and assessment of fumigant action were carried out. The mortality of the test mosquitoes was 100% after three hours exposure.

In late 1972, aerial ULV applications of malathion were made in the Miragoane Valley to assess the operational practicability of this method under Haitian conditions. Although a reduction in A. albimanus density seems to have been achieved by some applications, the epidemiological results remained inconclusive.

In the meantime, DDT has continued to be used to a varying extent in several parts of the country despite an apparent reduction of susceptibility of the confirmed vector A. albimanus. Other limited anti-mosquito measures comprise larviciding, fogging, source reduction and biological control (use of the Guppy, Poecilia reticulata). In addition, mass drug administration is being carried out sporadically. The relative impact of each of the measures has never been assessed.

With regard to malaria transmission, between 1968 and 1972 the overall reported malaria incidence rose from 2,562 to 25,961 cases, or more than tenfold, thereafter remaining relatively constant. Considering the reduction of slides taken and examined, the actual increase was even greater.

In conclusion, it can be stated that despite DDT indoor residual spraying from 1962 to 1964, transmission has continued (Mason, 1968 loc. cit.). Apparently good results were obtained in areas of low endemicity using DDT alone but not in other areas. In areas of high endemicity, good results (but without interruption of transmission) were obtained when mass drug administration was carried out with a coverage averaging 90%.

Section 2. Present Status of the Anti-Malaria Program

The general impression gained during the mission is that not enough attention has been devoted from the beginning of the program: (1) To the definition and measurement of the variables of malaria transmission such as season of transmission, entomological parameters and geographical distribution of malaria in the country. (2) On the stratification of the malarious area, and on the assessment of the impact on malaria of intervention measures and (3) On evaluation of malaria mortality and morbidity rates in some indicator areas. It has also been observed that there is a tendency to overlook the need to supervise the work in the field and to collect the needed information. The data available are also not presented in a way permitting an easy analysis and interpretation for continuous planning feedback.

One of the main difficulties encountered by the members of the Team in charge of the technical evaluation of the program and the accuracy of technical guidance, was the lack of information well prepared in advance and the non-existence of annual progress reports as well as detailed annual plans of action with well defined yearly targets, thus making impossible, not only for the Team, but also for SNEM itself, the evaluation of achievements against expectation.

2.1. Field Operations, Field Observations and Evaluation

The antimalaria program in Haiti is one of the few programs in the world making operational use of a combination of attack measures against the disease and its vector(s). Apart from the residual spraying and large scale administration of drugs which form the principal approach

in malaria eradication, the SNEM in Haiti has succeeded to organize a use of larviciding, fogging, larvivorous fish, and above all, environmental management.

Examples of these operations were visited in different parts of the country by members of the Evaluation Team. Below are the results.

2.1.1. Residual Spraying

DDT indoor residual spraying was last applied on a limited scale in 1978. During the same year 30 metric tons of fenitrothion (sumithion) 40% wdp were purchased from Japan for application in an area in Zone III near Les Cayes. In another area, Anse à Veau, malathion 50% wdp was applied in early 1979.

a. The area

a.1. Fenitrothion. The sprayed area consists of 453 localities with 28,414 houses and 102,000 population in one sector, lying along the southern coastal plain to the east and west of Les Cayes (see Map 2, Tables 3&4). Of the total number of villages (453), 295 were positive for malaria and of these only 179 and 182 were sprayed respectively during the first (4-7-78/9-11-78) and second round (4-11-78/21-2-79). A plan for the third round, presently in operation, calls for total coverage of the whole area.

a.2. Malathion. The sprayed area includes some 6,833 population and 2,040 houses in 23 localities sprayed during the first round. The plan for the second round calls for the spraying of 2,246 houses. However, unlike the fenitrothion area where sprayed localities (1st and 2nd rounds) are scattered among unsprayed villages, in the malathion area, total coverage was

MAP 2

LEGENDE

Area sprayed with Fenitrothion

Area sprayed with Malathion

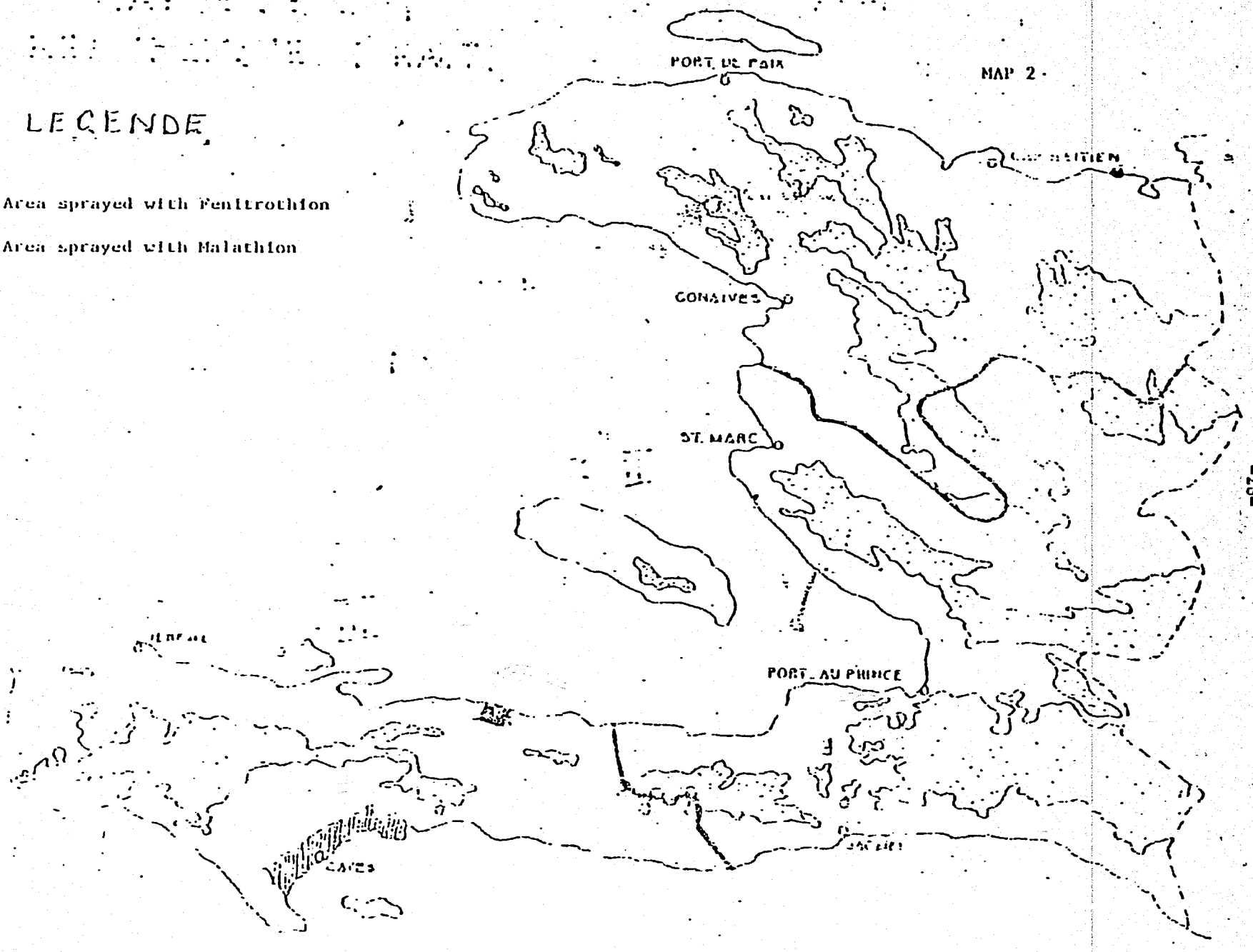


Table 3

PERIODICITY OF SPRAYING CYCLES 1/ (FENITROTHION)

COMMUNE	SECTION RURALE	CYCLE I START	CYCLE I END	CYCLE II START	CYCLE II END	CYCLE III START	CYCLE III END
CAYES	1st BOURDET	4-7-78	16-10-78	14-11-78	7-2-79	1-3-79	
	7th LAURENT	18-8-78	21-10-78	4-11-78	1-12-78	1-3-79	
	12th BODEMIER	4-7-78	16- 8-78	14-12-78	12-2-79	6-3-79	
ST. LOUIS DU SUD	2nd BAIE DUMESTE	29-8-78	12-10-78	8-1-79	16-2-79	1-3-79	
	3rd GRENODIERE	4-7-78	28-8-78	14-1-79	5-1-79	1-3-79	
	4th LES ANGLAIS						
	6th SOLON	16-10-78	9-11-78	21- 1-79	23-2-79		
CAVAILLON	1st BOILEAU	4-7-78	29-9-78	14-11-78	10-1-79	1-3-79	
	2nd MARTINEAU	2-10-78	9-11-78	11-1-79	21-2-79		
TORBECK	1st BOURY					1-3-79	

Table 4

Fenitrothion Test

Sections Rurales, Localities, Number of Houses

SECTIONS RURALES	LOCALITIES	HOUSES	1st and 2nd REMARKS
1st Bourdet	21	3786	1st and 2nd cycles
	23	2148	Added to 3rd cycle planning
	Total 44	5934	3rd cycle
7th Laurent	44	2707	1st and 2nd cycles
	44	1282	Added to 3rd cycle planning
	Total 88	3989	3rd cycle
12th Boulmier	10	854	1st and 2nd cycles
	28	902	Added to 3rd cycle planning
	Total 38	1756	3rd cycle
1st Boileau	13	2034	1st and 2nd cycles
	23	860	Added to 3rd cycle planning
	Total 36	2894	3rd cycle
2nd Martineau	11	1641	1st and 2nd cycles
	20	1057	Added to 3rd cycle planning
	Total 31	2698	3rd cycle
2nd Baie Dumesle	21	1476	1st and 2nd cycles
	35	827	Added to 3rd cycle planning
	Total 56	2303	3rd cycle
3rd Grendodiere	37	1774	1st and 2nd cycles
	3	46	Added to 3rd cycle planning
	Total 40	1820	3rd cycle
6th Solon	23	1011	1st and 2nd cycles
	14	245	Added to 3rd cycle planning
	Total 37	1256	3rd cycle
1st Boury	45	4161	3rd cycle
4th Les Anglais	38	1604	3rd cycle
T. Planif. 3rd cycle	453	28414	
	453	28414	

SUMMARY

	Locality	Houses
1st and 2nd cycles:	180	15276
3rd cycle :	273	13138
TOTAL	453	28414

maintained. Also while the fenitrothion area is located in a coastal plain with high humidity, abundant water and dense vegetation, the malathion area is a drier, better drained and hilly area where water during dry seasons is limited to a few distant sources. Also, houses in the malathion area are made of bare strips of coconut palm leaves, on which residual insecticide is known to last longer than on mud walls, prevalent in the fenitrothion area. Thus, a comparison of the efficacy of the two insecticides applied in the two areas will be problematic. Besides the size of the malathion area is too small for meaningful epidemiological evaluation.

b. The Spraying Operation and Organization

Before starting the spraying the existing geographical reconnaissance data were updated, houses renumbered, house cards placed, sketch maps prepared and average surface sprayed per house determined. The spraying operation is carried out by brigades of five spraymen and one brigade chief. Each four brigades are supervised by one field supervisor. The Sector Chiefs and Chief Zone field operations provide overall supervision of operations. One brigade of four spraymen operates in the malathion area and 3 of five spraymen each in the fenitrothion area.

The spraying equipment used is the Hudson Compression Sprayer, 3 gallon capacity. It is provided with nozzle tip 8001E and pressure gauge. The tank is filled up with 3 liters, given 30 pump strokes before beginning spraying. In practice, it was observed that some spraymen gave a higher number of

strokes, over 100, which inevitably leads to overdosing and wastage of the insecticide.

The nozzle tip was said to be replaced every 15 days. Some spraymen were observed spraying with tips of three weeks old. A number of field tests were carried out and the results showed nozzle tip outputs over 20% greater than the standard discharge rate. This leads to considerable overdosing and wastage of the expensive insecticides. Weekly water tests of all tips is recommended; those showing excessive wear must be replaced. The extent of erosion to be allowed can be estimated on the basis of the cost of insecticide and the cost of nozzle tips (WHO/MAL, Kuo, Rafatjah and Kolta). Replaced tips can be recalibrated and reused.

The insecticide powders are preweighed and bagged at Zone offices; 1 kg for fenitrothion and 0.8 kg for malathion. The powder is then mixed with water in the field by the sprayman into paste and later into a suspension. Preparation of paste is time consuming and exposes spraymen to additional avoidable exposure to insecticides.

The need for paste should be substantiated by testing the quality of suspension made from a slurry or outright from the powders. Otherwise paste making may be dispensed with.

The spraying is done with care and diligence; spraymen seemed well trained and were following correct spraying speed and technique. Walls, eaves, parts of ceiling below 3 m height,

underneath furniture and beds were sprayed thoroughly. Coverage seemed complete. Some spraymen in the malathion area seemed to use a slightly faster speed of spraying.

The validity of leaving roofs above 3 m height unsprayed needs to be verified, as well as spraying of roofs made of galvanized iron sheet, most prevalent in the fenitrothion area. In Kisumu (Kenya) it was observed that due to sunlight and high temperature, no mosquitoes were resting on these roofs during the day. The excessive heat causes rapid breakdown of both compounds.

The brigades have an itinerary including localities and houses to be sprayed each day (about 12 houses per sprayman per day). Often they do not carry a sketch map of the locality to locate houses. A sketch map will facilitate locating houses, ensure total coverage and at the same time provide for updating of headquarters maps.

Total coverage seemed to be aimed at in the third round. In the first and second rounds coverage of localities was 36% only. Mopping up brigades were said to operate and spray unsprayed houses. On one occasion in the fenitrothion area it was observed that some 450 houses still remained unsprayed 5-6 weeks after the spraying round III had started.

c. Dosage, Cycle and Timing of Spraying

Both fenitrothion and malathion are applied at the target dosage of 2 g active ingredient per square meter in cycles of 3 months. In practice, however, the average applied dosage must be higher. Cycles were also extended well beyond 3 months.

The timing of spraying rounds should be whenever necessary in relation to peaks of transmission or seasons of white washing of houses. These two factors are important elements and should be given consideration as well as the length of cycles. It is very likely that different spraying regimens need to be followed in different areas. While total, complete and sufficient coverage may be necessary in highly receptive areas, application of such coverage in the present malathion area or similar arid areas may not be necessary in a control program. It should be remembered that apart from the high cost, both fenitrothion and malathion are among the few insecticides remaining for residual spraying, and thus, all should be done to lessen insecticidal pressure on the vector and thus increase the service and useful life of these compounds.

Proper timing of spraying rounds, their number and duration and the dosage of insecticides should be tailored to the epidemiological conditions and in line with objectives set out for the programme. As these may vary in different areas, field trials need to be organized in different ecological areas to determine the spraying regimen to be followed. It is very likely that the number of rounds and possibly the dosage in certain rounds can be reduced.

An important point to be investigated is the degree of disturbance of sprayed surfaces, especially by human contact, and the consequent rubbing off of the sprayed insecticide,

as the houses are quite small (30 m^2 of sprayed surface per capita). The extent of rubbing off is expected to be quite considerable, particularly in the lower 1 m to 1.5 m height from the ground. Entomological observation can indicate whether such surfaces can be deleted from spraying.

It would be also interesting to field test emulsion concentrate formulation of both compounds to compare their adherence to sprayed surfaces and their residual life with powders presently applied at heavy dosages.

d. Safety Precautions and Equipment

Soon after the first round of fenitrothion spraying started in July 1978, the operations had to be halted due to excessive toxicity manifestations among spraying personnel. The personnel had been trained in proper handling and application of the insecticide and were subsequently provided with protective equipment: hat with wide brim, goggles, surgical masks, rubber gloves, in addition to their uniforms and shoes. Above all, they were instructed to wash their hands and faces with soap and water frequently during the day and especially after each mixing and preparation of pump charge and to take a shower or bath at the end of the days' work. Uniforms are washed every afternoon.

The day's work consists of one hour for transportation to and from the field and six hours of operation and one hour for clean-up. Spraymen were observed to follow closely the safety instruction despite the hardship they caused them in

the heat of the day. Most tedious are the goggles and surgical masks, which perhaps could be omitted at least in case of malathion, which normally has a very low dermal toxicity of the order of 4,400 mg/kg of body weight (white rat). A toxicologist can be consulted and the proposal tried on a small scale before use in general field operations.

Since the introduction of new protective equipment and safety measures, blood cholinesterase levels of all spraymen are checked weekly, using the tintometric method. Checks have also been made in the case of some local inhabitants. The latter, representing age groups 4-50, showed practically no change. Of the total of 65 spraymen, brigade chiefs and field supervisors working with fenitrothion there have been, to date, 15 cases of inhibition to 50% and two of 37.5%. The latter spraymen were laid off and the others were given rest of one week. Thereafter they returned to work.

With malathion there have been practically no problems. One drop to 75% and a few to 87.5% has been recorded since operations started on 24 January 1979. As a safety measure injectable atropine and PAM have been provided to Zone Chiefs.

2.1.2. Larviciding

a. This operation includes application of:

- Gasoil mixed with 10% volume gasoline and,
- Abate E-500, temephos 50% emulsion concentrate.

a.1. Gasoil mixture is designed to be applied to breeding places with dense vegetation or with some degree of pollution and where water

is not used for human use and cattle drinking or for other domestic purposes. The mixture is transported in 180 liter metal drums and applied at a rate very close to 40 ml/m^2 as in residual spraying. The nozzle is maintained down close to the water surface and spraying is done at the speed used for residual spraying. The dosage applied is, therefore, about 6 times greater than the recommended 5-9 ml/m^2, which, apart from considerable wastage, may cause water pollution and phytotoxicity. In spraying oil larvicide the lance and nozzle should usually be maintained at an angle of 45 degrees to the surface of water and spraymen should walk against the wind, holding the lance at a height to assure that the material is spread over the water area. The sprayman should be trained to attain the desired dosage by adjusting the height of the tip and the speed of his walking. The edges of streams and marshes having dense vegetation may be sprayed with the nozzle directed to the water and land area, but at a speed to apply the recommended dosage.

The mixture as observed in the field does not spread well and the oil film on water is not persistent. Further, the addition of gasoline causes dermal irritation of larviciders' hands. The use of spreading agent, e.g., Triton X-40 at 0.5-1%, will considerably improve the spreading power of oil and its film's persistence on water surface.

The oil is applied with the Hudson Compression sprayer and the 8002E nozzle tip. This nozzle's output is twice as great as needed for larviciding and the spray pattern not very suitable.

Instead, adjustable cone jet nozzle SS5500 should be used. This nozzle produces 3 spray patterns: (a) a solid stream for spraying distant areas up to 10 m; (b) a hollow cone for spraying nearby waters and (c) atomization for spreading minute drops over wide areas using air and wind motions.

a.2. Temephos EC 50% is applied to breeding places without dense vegetation and with clear water. To prepare the finished spray material, 9 cc of the 50% concentrate is mixed with one tankfull of water (11.6 liter) and applied over 200m^2. This represents a dosage of about 225 ml of the active ingredient per hectare which is over twice as much as recommended.* This should be corrected by reducing to 4 cc per tankfull the amount of concentrate used; or, preferably, to 3 cc, while reducing the tank charge to 9 liters, leaving an air space for pressurization of the tank. The coverage thereafter should be 150 m^2/tank charge.

It should be noted that the above application rate is for shallow water areas. Where water is deeper than 10 cms, the dosage should be proportionately increased.

b. Cycle and timing of larviciding

Both larvicides are applied at 10-12 day cycles. Recently, however, it was decided to reduce this to one week, a decision that needs to be implemented. Larviciding teams observed in the field are still applying according to the old cycle. Vehicle breakdowns cause prolongation of even this frequency of application and shortage of larvicides or abate has prompted the use of gasoil where its use was inappropriate.

*WHO Manual on Antilarval Operations

Larviciding is normally to be done during the dry season, but records show that it continues practically through the year. Exceptions are areas during the rainy seasons where breeding places expand excessively.

If larviciding is to be effective, application cycles should be adjusted closely with cycles of mosquito development in different seasons. In Haiti, the normal cycle is reported to be 5-7 days. Similarly, the timing of larviciding should be adjusted to the productivity of breeding places in rainy and dry seasons. If rain causes flushing or water level fluctuation in breeding places to the extent that larval development is disrupted, no larviciding will be needed.

Cycle, timing and dosage requirement of different types of breeding places in different seasons of the year should be investigated and form the basis for planning of the operation.

c. Larviciding operation and organization

Larvicides are applied to marshes, rain pools, streams, sewerages, ditches and areas of rivers positive for vector breeding. Some larviciders were observed applying material to rice fields. Larviciding may be applied: (a) as a supplement to other antimalaria measures in areas of persistent transmission or, (b) as a main intervention measure in arid areas or in urban situations.

Some 13 mobile brigades, 20 auxiliary entomology technicians and 21 contractual labourers operate throughout the country. A brigade consists of two larviciders, one brigade chief and one auxiliary entomology technician. The latter check breeding places

for vector positivity by dipping. This needs to be standardized as to the number of dips per m^2 area of the parts of breeding places known to be most productive.

Larviciding is done when vector breeding is confirmed. The entomology technician of the sector then visits treated areas and checks the efficacy of operations, sometimes within 24 hours of application. Adequate reporting forms exist and were found fully filled in. However, there was little indication of their data being analyzed and returned to field for follow-up action.

At the zone office, the chief of field operations is responsible for larviciding operations, while at the central offices, this responsibility is vested with the Chief of the Entomology Section. Larviciding operations must be an integral part of field operations, planned and supervised by that Division's staff. Evaluation of the activities, however, needs to be done by the Entomology Section, independent of the operations section. In principle, larviciding should be considered as an interim measure and until the breeding areas receive basic treatment through an environmental management operation; yet another reason for the integration of larviciding with source reduction and other attack activities.

The need for assignment of one auxiliary entomology technician to each brigade is questionable as with a little training the brigade chiefs should be able to perform the pre-treatment dipping, having only two operators to supervise.

Breeding places to be treated are numbered and listed and sketch maps prepared of each one. The sketch shows the estimated

surface area, but not the depth, and even the area is snown only for the date the sketch was made. Considerable variations in area and depths may occur during the year and their extent is important for planning operations and estimating requirement. Sketches are not made to scale; they remain at sector and central office in files. Copies should be made and taken out by brigade chiefs for updating and to show area variations on them.

In addition, each village included in the larviciding program, and its surrounding areas, needs to be surveyed and mapped to record all breeding places, assign a number to each and shown them on the sketch map. Larviciding cannot be reasonably effective if coverage of all breeding sites is not achieved. The present operational coverage seemed quite spotty.

Pre-treatment dipping may be misleading and may miss positive breeding areas. Where larviciding is a major attack measure, all breeding areas proved positive should receive regular treatment unless thorough investigation by qualified entomological staff proves repeated negative results, or until environmental management operations applied have modified the previous ecology.

Supervision both of operations and of evaluation needs to be strengthened. In a Sector visited on 25 April 1979 adult capture in 1979 was done only once each in January and February in three of 53 localities of the Sector under larviciding. Data available does not allow an evaluation of the degree of efficacy of larviciding and the role that it plays in the antimalaria program.. Larvicides applied irregularly and to widely scattered breeding areas (and often in combination with other antivectorial or antiparasitic measures) cannot properly be evaluated. Entomological checks on both adult mosquitoes and larvae need to be systematized and strengthened for this purpose.

2.1.3. Thermal Fogging

This operation is performed with portable machines (Dynafog and Swing fog) using a malathion solution in gasoil. The operation is not regular, nor does there appear to be a standard number of cycles. Application is done by the personnel of larviciding operations at and after sunset and is planned to continue for about 3 hours. Both the interior of the houses and the surrounding areas are treated. The cycle of application is 10-12 days matching that of larviciding. This cycle setting seems to be correct as it generally matches the average expected sporogonic cycle, but has to be rechecked for different seasons

and altitudes. Provided infected mosquitoes, including the exophilic portion of the population, are eliminated by fog, the operation should be effective against malaria. Whenever fogging is applied outdoors it is necessary to determine the resting places of the vector. However, no entomological/parasitological evaluation of the effectiveness of fogging under Haitian conditions has yet been carried out, and this question is not one which can be settled by arguments for or against The present operation and its impact on the malaria situation cannot be evaluated as pre-and post-treatment entomological and parasitological data are not available, and certain villages treated are affected also by other antimalarial measures.

So far, in malaria programs, fogging has had limited use, being usually reserved for special, emergency or epidemic situations, particularly in urban areas where residual spraying is not feasible.

In view of the great commitment of effort and resources entailed in large-scale fogging operations, the well-known dependence on appropriate weather conditions necessary to obtain maximum impact and also the observed difficulties in insuring proper coverage by this method in darkness, especially in hilly terrain with scattered houses, it is strongly indicated that before proceeding with thermal fogging on an operational scale a series of field trials should be conducted as soon as possible with carefully prepared protocols so as to provide proper entomological and parasitological evaluation of this operation under Haitian conditions.

As noted elsewhere, to reduce the risk of resistance development to organophosphates which may be used for general residual applications,

malathion should not be used for fogging purposes. Instead Naled, Neopybuthrin (or other synthetic or natural pyrethroids) or other unrelated insecticide groups may be used providing susceptibility testing is satisfactory.

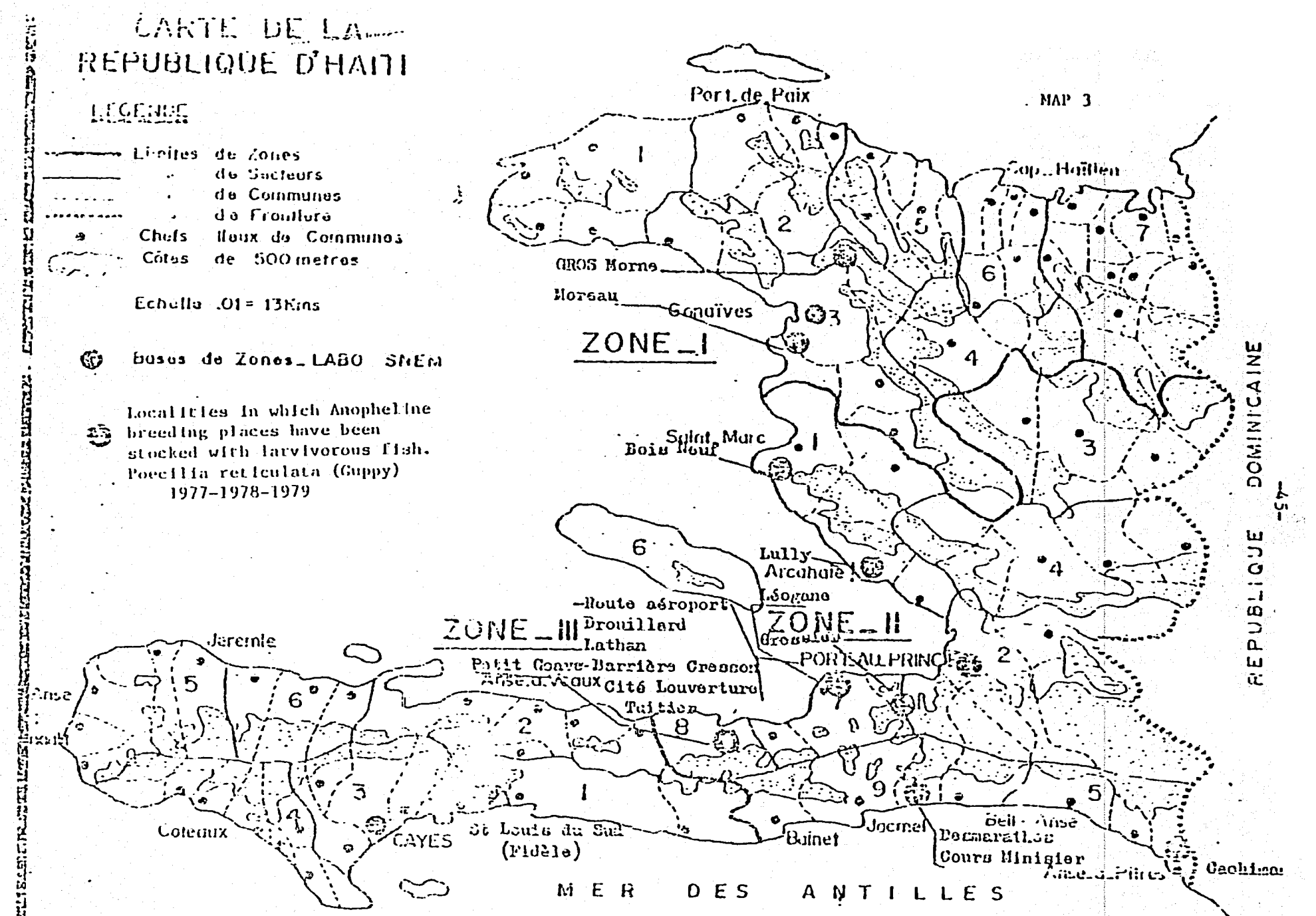
2.1.4. Biological Agents

Larvivorous fish Poecilia reticulata, (Lebistes reticulatus, or Guppy) were imported a few years ago from the Dominican Republic; some 6,000 have since been distributed to 27 breeding places. The fish has thrived well in most breeding areas (locations shown on Map 3), but it was said where other bigger fish existed the Guppy had disappeared.

In zone offices, in addition to the use of natural breeding places, special basins were constructed to breed the fish. Insecticide contamination of the basin in Zone III killed all the fish.

During the field visit, it was noted that there are many permanent water sources that can be used as natural rearing basins. Due to the mild temperature in winter, fish can thrive in all permanent breeding places and several of these, well distributed in malarious areas, can be selected and stocked with fish. From these, other permanent and temporary breeding areas can be stocked. If necessary in the initial stage a portion of water can be separated with nylon netting to protect the young from predators.

The fish can be transported from these points to other breeding areas. Plastic bags can be used for transportation and if the distance is more than one or two hours, water in the bag can be renewed. All supervising staff should stop at these points on the way to the field and carry a number of fish to release in breeding places.


CARTE DE LA REPUBLIQUE D'HAITI
MAP 3
LEGENDE
Limites de Zones
de Secteurs
de Communes
de Frontière
Chefs lieux de Communes
Côtes de 500 metres
Echelle .01 = 13Kms
Bases de Zones_LABO SNEM
Localities in which Anopheline breeding places have been stocked with larvivorous fish. Poecilia reticulata (Guppy) 1977-1978-1979
Port de Paix
Cap Haïtien
GROS Morne
Moreau
Gonaïves
ZONE_I
Saint Marc
Bois Neuf
Lully
Arcahaie
Léogane
Route aéroport
Drouillard
Lathan
ZONE_III
ZONE_II
Grosses
PORTAUPRINCE
Petit Goave-Barrière Cresson
Aux Cayes
Cité Louverture
Tuitien
Jérémie
Anse d'Hainault
Coteaux
CAYES
St Louis du Sud (Fidèle)
Bainet
Jacmel
Belle Anse
Cours Minigier
Cachimbo
MER DES ANTILLES
REPUBLIQUE DOMINICAINE

The locality sketch maps prepared of breeding places should be used to indicate which ones require additional fish. The fish density should be maintained at not less than five fish per square meter. Below this, fish will not be fully effective.

Temporary breeding areas should be stocked with fish even if they last only a few weeks or months. Such treatment is both safer and less costly than larviciding and will frequently constitute a one-time operation.

As vegetation may hamper fish activity, use of Herbivorous fish, e.g., Tilapia zolli or Chinese Carp (white Smore) etc. can be tried jointly with the Guppy. Other fish, e.g., Notobranchus Guentheri, an annual fish may be tried in land-locked temporary breeding places. Once introduced and thriving, the fish lay eggs in the mud; the eggs survive the dry season, hatch with the first rain and control mosquito larvae. Specimens for trial can be obtained from Dr. Markovsky of the Orentriech Foundation, New York City.

So far the efficacy of larvivorous fish (Guppy) under Haitian conditions has not been evaluated. This needs to be given immediate attention; field trials should be carried out at recommended densities of fish population in different conditions to identify its characteristics, larval control capacity and the impact on malaria transmission. Such a trial should be organized where other measures of malaria control are not applied and the vector density and endemicity sufficiently high to allow meaningful conclusions.

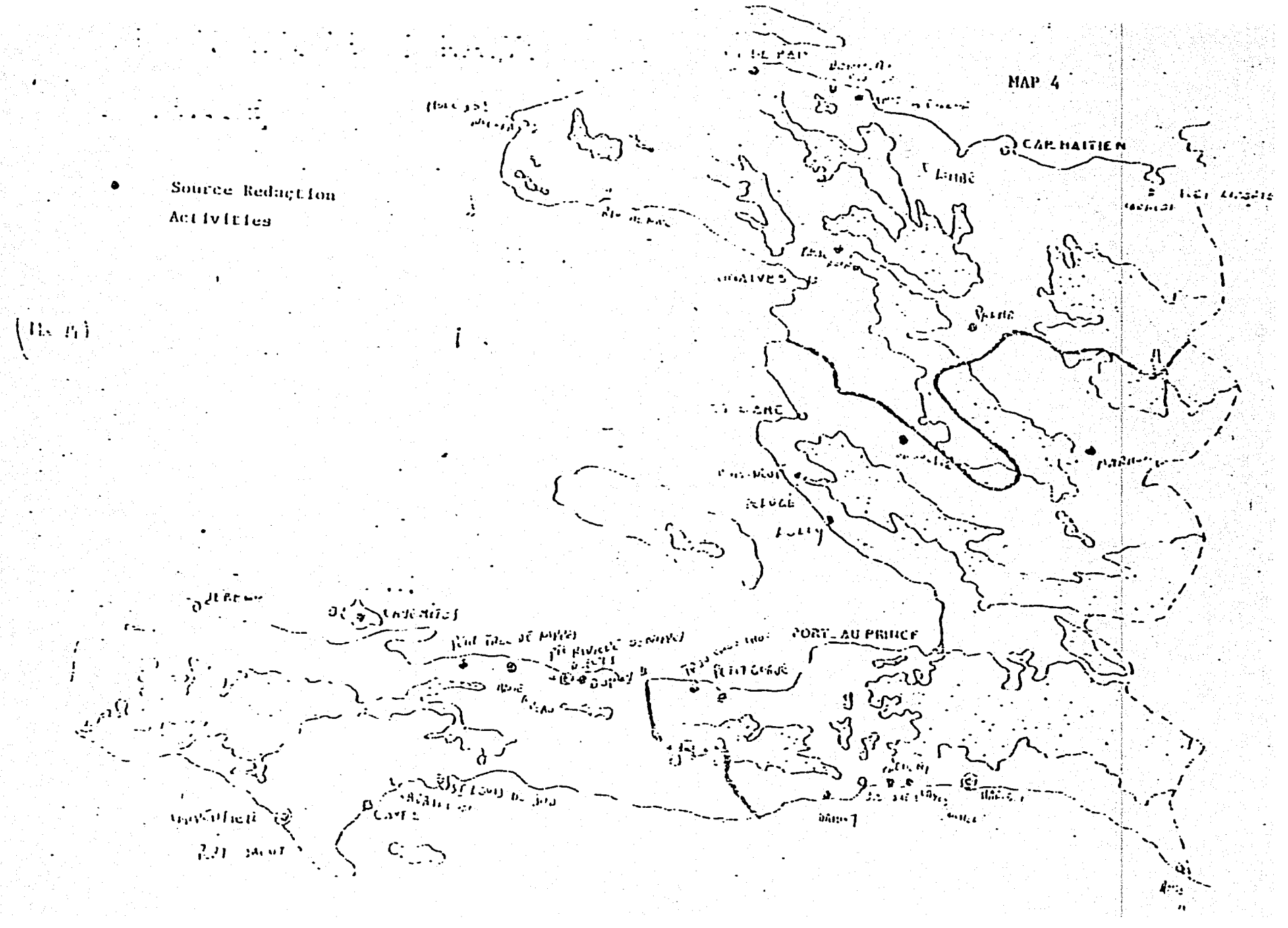
Before introducing non-indigenous larvivorous fish on an operational scale, it is necessary to insure that they do not constitute a threat to the environment. Whenever possible, local fish considered potentially useful should be given for trial and operational use thereafter.

2.1.5. Environmental Management Operations

These operations began for the first time in 1976 with creation of the Section of Assainissement in the SNEM and appointment of an engineer as its head. Since that time the section, despite limited means and budget ($270,000 in C.Y. 1978) has initiated some 29 projects, (locations shown on Map 4), of which eight have been completed. These projects range from simple drainage and filling to rather important water management.

The work is performed manually, a factor which accounts in part for relatively slow progress and usually meager impact on local malaria situations. Of the two old loader trucks available to the section in Zone III, one was found completely out of service in the Zonal headquarters and the other on the roadside awaiting repairs.

This already engages an important portion of the section's resources and will be on the increase as more works are initiated and completed. The participation of communities and such ministries as Agriculture, Public Works and Irrigation Service and municipalities services should be secured in such projects. Many of these projects have produced additional land and water for the extension of agriculture and urbanization and are, therefore, of direct relevance to agriculture services and the communities involved. Such major projects should normally be carried out by other entities of government charged with such responsibilities; the role of SNEM should be primarily promotional, but should include provision of technical assistance and even supervision in the planning, construction and maintenance of environmental management operations which affect mosquito breeding.


MAP 4
Source Redaction
Activities
CAP HAITIEN
PORT AU PRINCE

The work presently carried out includes drainage, filling, clearing, cleaning, management of coastal marshes and rivers and a project on water level fluctuation and flushing. In planning these activities there has been little entomological and epidemiological input and thus the projects deal with source reduction alone rather than with the problem of malaria as a whole in the areas or locality involved. The precise evaluation of impact remains problematic because of a shortage of entomological and parasitological baseline data.

There is no doubt of the efficacy of environmental modification works. Once a water area is drained or filled in, mosquito production is henceforth eliminated or greatly reduced. The key question, however, is what would be the impact of work done on local malaria problem as a whole and hence what additional measures should be included to achieve the degree of impact required. In addition to engineering design, major source reduction works should be preceded by thorough entomological and epidemiological surveys to identify the malaria problem, the extent of source reduction activities and the supplementary measures required, with established guideline for evaluation.

Once the plan is prepared it should be reviewed and discussed with the related national or local services outside SNEM to secure their participation for execution. Concurrently, a program of public information and participation should be designed and implemented to enlist the support of the public and their participation in the construction and (at a minimum) maintenance of the work. For this the assistance of organizations working in community development, e.g., HACHO (Haitian American Community Health Organization) may be sought.

To facilitate coordination among various departments concerned in environmental management operation, a commission at the central level, needs to be formed of the representatives of these departments, under SNEM chairmanship and with the Chief Engineer of Assainissement as secretary. The Commission should meet every 3 months and, as necessary, on an ad-hoc basis, to review plans for water and land management works and to discuss each party's share of responsibilities and resources.

a. The Organization of the Section d'Assainissement

Environmental management operations are planned and carried out at the central level by the Section d'Assainissement. The Section, headed by a civil engineer, has two other engineers, one geographer, one cartographer and over 400 field supervisors, masons and laborers.

The great number of personnel, dispersion of the works throughout the country and shortage of qualified field supervisors makes it difficult to supervise properly the work from the central level. It seems, therefore, essential to decentralize the service and to train a substantial number of technicians which needs time and additional financing. On the other hand, the slow progress in manual operations is increasingly consuming the time of engineering staff at the central office in works that can be planned and carried out by Zonal Staff with some assistance from the center.

It is, therefore, proposed to:

1. decentralize the responsibility for the present simple source reduction activities to Zonal staff and organize additional training for zonal personnel to enable them to plan and carry out their activities;

2. assign responsibility for the planning, design and construction of major projects and for coordination of the works with other concerned services in and outside SNEM, to the Section d'Assainissement.

The Section will, as necessary, assist zones with their planning of source reduction activities and with overall technical supervision of the works.

To enable the Section to proceed rapidly with completion of projects, it is strongly recommended that as soon as possible, SNEM should procure at least 3 backhoes with front-end loader of 1/2 to 1/4 m^3 bucket capacity and with telescopic stick, and 3 diesel trucks of 5 m^3 capacity. This equipment will not only help expedite source reduction activities, but will also improve the quality of the work to a level which cannot be achieved with manual operation. This would represent only a one time investment.

b. Planning Environmental Management Operation

The environmental management works are basic operations which can provide lasting solutions to vector problems. As such, they avoid problems of vector resistance, environmental contamination and human toxicity risks and continuing costs inherent in the use of pesticides. In addition, they produce important side benefits to communities involved, and can therefore be considered as an investment. The funds allocated to these works will produce high returns and as areas are permanently freed from the vector and the disease, funds and other resources saved can be diverted to extend operation in other areas.

In planning these works, SNEM should define its objectives and aims and establish priorities. These can be:

(i) Technical; that is, intervention in areas of persistent transmission where high vector production potential prevails, or,

(ii) Operational and economic, consisting of works that produce operational gains or economic advantages to the communities, e.g., source reduction in arid areas or in urban situations. The work done by SNEM in Petite Riviere de Nippes, Baie de Henne and Port-au-Prince are examples.

Considering the malaria situation in the country and the past experience with antimalaria activities, it seems essential that the priority for major environmental management efforts should be given to areas with high vector production potential where persistent malaria transmission was observed in the past. In these areas a comprehensive plan of combined antimalaria activities with special emphasis on basic environmental management, combined with the use of biological means, chemotherapy and judicious use of pesticides, indoor residual spraying, larviciding or fogging should be organized.

For the work to be effective, it is essential that only a few areas comprising a few localities be selected at a time to concentrate efforts for an adequate coverage and rapid completion.

At the same time, simple filling and drainage work will continue, mostly in arid areas where permanent solutions to malaria problems can be achieved at low costs. Here again, the bulk of effort should be concentrated in a few areas in order to establish adequate control quickly and transfer resources to other areas.

c. Evaluation

While there are at present a few projects for which epidemiological data are available for evaluation of the impact of work done, such data

are missing in respect of many others. To substantiate the impact of source reduction on the malaria situation, feasibility surveys must include, besides engineering surveys, also entomological and especially parasitological baseline data. Follow-up surveys carried out at regular intervals will indicate the efficacy of the combined strategy and can produce data on effectiveness/cost and benefit/cost.

2.1.6. Radical Treatment

Radical treatment for P. falciparum malaria as used by SNEM consists of 450 mg of chloroquine and 45 mg of primaquine given on one day and 300 mg of chloroquine given on the following day.* An optional 450 mg of chloroquine may be given on the third day. These drugs are administered by medication dispensers, although the passive and active search evaluator, drug distributor, and even supervisors may give them. Radical treatment is given as a program to all slide-positive individuals who have perforce taken a suppressive dose of chloroquine and to others present in that household. Excluded from radical treatment are confirmed cases which occur during periods and in areas of mass medication.

In 1978, 167,093 radical treatments were given to 42,606 malaria cases and 118,487 household contacts (Table 5). SNEM has not evaluated its radical treatment program for its efficacy in reducing malaria transmission, morbidity or mortality. Furthermore, the rationale for its administration is not discussed in any SNEM documents.

*This appears to be the official scheme of treatment; at field level a variety of tables with different dosage, combination and brand names are being distributed, creating a great deal of confusion. In view of the toxicity of primaquine which is given combined with a 4-aminoquinoline, it is strongly recommended that clear instructions on drug administration be issued immediately.

Table 5 : Radical Treatments

Given by SMEM Personnel

1975-1978

Year	Slide Positive Cases	Radical Treatments To Slide Positive Cases	Radical Treatments To Household Contacts *	Total
1975	24,733	27,107	35,961	63,068
1976	15,087	11,544	33,278	44,822
1977	27,679	26,755	67,892	94,647
1978	60-472	42,606	118,487	161,093

* The same schedule of treatment given to confirmed cases of malaria is also applied to household contacts

2.1.7. Mass Drug Administration

SNEM's mass medication program administers presumptive treatment to localized populations when affected by high malaria rates. A single dose (adult) of 450 mg of a 4-aminoquinoline and 45 mg of primaquine is used. Within programmed Sections Rurales, the population is covered every three weeks for six cycles. The six-cycle regimen may be repeated or extended in the same year if thought necessary. Household registry cards and daily productivity cards are maintained similar to those used in other mass medication programs. Thick-film blood slides are taken from all fever victims encountered by the drug distributors and an active search for and sampling of fever cases is performed during the fourth cycle.

Criteria for choosing the location and time for mass treatment are vague. Sections Rurales are chosen by reviewing malaria case reports for the preceding year. However, threshold attack rates, changes in attack rates or other adaptations of the collected data are not specifically utilized. Within the chosen Sections Rurales, any locality reporting cases and contiguous localities are selected for treatment. The timing of mass drug administration is supposedly based on the local transmission season. However, malaria positive slides have until 1979 been tabulated or recorded by date of examination rather than by the date when the slide was actually taken (date de prise); and even now, tabulation by date de prise is being maintained only informally. Therefore, data on seasonality of malaria in these sections rurales are not available. The timing is simply planned by the intuition of the group choosing the method. Old rainfall and altitude data are sometimes referred to.

2.2. Epidemiological Section

a. Malaria in 1978

The Slide Positivity Rate (SPR) stabilized between 6.9% to 8.3% during the period 1973 to 1977 (with the exception of 1976 when the SPR fell to 4.0% due to exceptional drought conditions). The SPR showed a sharp increase in 1978 when it reached a maximum of 16.5%--the highest since inception of the anti-malaria effort.

The 1978 distribution of malaria, by Zone, can be summarized as follows:

Table 6. Malaria Cases 1978

	Zone I	Zone II	Zone III	Total
Number of Cases	14,846	24,156	21,470	60,472
API*	10.6	14.6	17.7	14.2
Slide positivity rate	12.9%	13.5%	30.4%	16.5%
Estimated population at risk	1,400,000	1,650,000	1,210,000	4,260,000
Number of blood specimens examined	115,256	179,354	70,592	365,202

*Annual Parasite Incidence: Positive malaria slides per thousand population per year

For operational purposes, the country has been divided into three zones, each of which is subdivided into sectors (22 in total); further subdivisions are communes (116) and sections rurales (560) Sections rurales are composed of a varying number of localities.

Passive case detection accounts for 75.7% of the blood specimens collected. Almost since the beginning of the program, and particularly since 1964, the collection of blood specimens from fever cases has been carried out by a network of voluntary collaborators (V.C.) which has increased from 809 in July 1964 to 3,200 in late 1964, 5,000 posts in 1968 up to 6,271 in 1978. SNEM reports that in 1978, 58% of the V.C. posts were productive. From observations carried out in the field during the present mission, particularly in Zone III (Sectors II and III) it appears that the number of cases as detected by the system of V.C.'s very much understates the actual total, at least in some areas; a prevalence parasite survey (which measures infection at a particular time) carried out in Sector III in July 1978 showed a prevalence rate of 12.69% (423 cases out of 3,345 blood specimens taken in the general population) as against a cumulative annual incidence of 4.45%, as calculated from the positive cases detected in the same area by the V.C. posts. In the same way, a parasite prevalence rate of 6.49% was recorded in the Section Rurale of Baconois (Zone III, Sector II) in Jan. 1979 among the general population, whereas the cumulative annual incidence rate for 1978 in the same area was reported to be 3.65%.

Table 7 gives the distribution of sections rurales according to the number of blood specimens found positive for malaria parasites per one thousand population.

Table 7 : Distribution of Sections Rurales (SR)
by Annual Parasite Incidence* (API) 1978
(all figures by date of Slide Examination)

API	Zone 1 Number of SR	Zone 1 % of Total	Zone 2 Number of SR	Zone 2 % of Total	Zone 3 Number of SR	Zone 3 % of Total	Country Total Number of SR	Country Total % of Total
0 - 4	122	59.5	73	41.2	54	36.0	249	46.8
5 - 9	25	12.2	33	18.7	23	15.3	81	15.3
10 - 14	11	5.4	16	9.0	19	12.7	46	8.6
15 - 19	9	4.4	19	10.7	18	12.0	46	8.6
20 - 24	13	6.3	11	6.2	3	2.0	27	5.1
25 - 29	8	3.9	4	2.3	4	2.7	16	3.0
30 - 34	4	2.0	10	5.7	2	1.3	16	3.0
35+	13	6.3	11	6.2	27	18.0	51	9.6
Total	205	100	177	100	150	100	532	100

*Positive malaria slides per 1,000 population per year

In reviewing malaria data by Sections Rurales from 1975 to 1978 it is apparent that even in an epidemic year, 1978, almost half the Sections Rurales had very low API's. A much smaller group of Sections Rurales produced the bulk of cases. The Sections Rurales of low malaria incidence in 1978 also had uniformly low incidence in 1975, 1976 and 1977. The remainder were distributed among those which had consistently high incidence through the four year period and those which had actual epidemics following years of low incidence. Even Sections Rurales with high incidence, when analyzed by individual localities, are a composite of some localities of very high incidence and a large group with very low incidence (Table 8).

Table 8

Distribution of API* by Locality for 15 Sections Rurales Selected at Random (5 from each Zone) with API from 5 to 80--1978

API		Number of Localities	Percent of Total
equal to or greater than	100	49	6.6
	50-99	58	7.9
	10-49	143	19.4
less than	1- 9	70	9.5
	1	418	56.6
Total		738	100.0

*API: Annual Parasite Incidence--Reported malaria cases per 1,000 population

The above table is illustrative of the type of analysis of parasitological data, which, if carried out for the whole country, would greatly clarify the extent of the malaria problem and facilitate accurate identification and stratification of the malarious area. Such information ought to be generally available and maintained up to date.

These data are not at all surprising as malaria can be a very focal phenomenon. Essentially, the Section Rurale is not the most appropriate epidemiologic division for describing malaria in Haiti.

Surveillance System

The malaria parasite surveillance system, as it presently stands, has evolved from a system designed for a malaria eradication program. A large corps of personnel are involved (Table 9) and these also have a variety of other incorporated functions.

Table 9: Number of Personnel Involved in Case Detection and Follow-up, 1978 and 1979, Haiti

Job Designation	Number	
Passive Search Evaluators	50	75
Active Search Evaluators	50	0
Squad Chiefs; Passive Search	5	10
Squad Chiefs; Active Search	5	0
Medication Dispensers (Radical Treatment)	29	35
Investigation Aides (Radical Treatment)	0	71
Drug Distributors (Mass Drug Administration)	215-398 (seasonal)	178
Group Chiefs	10	8
Squad Chiefs	48	36
"Marcheurs"	113	145
Voluntary Collaborators	6450	6450

The responsibilities and job designations are similar to those found in other programs and published guidelines. For brevity the observation made herein will only cover important differences in function.

A network of Voluntary Collaborators (VC) in both malarious and non-malarious areas serves for passive malaria case detection, and simultaneously makes a contribution to the medical facilities available in the country. SNEM pays the VC $1.00 for each positive slide. Slides taken by VC's are collected and carried to SNEM facilities by a special corps of "marcheurs". However, to increase the frequency of slide collection any SNEM employees visiting a VC post may bring in slides. "Marcheurs" also supply the VC post with materials. The Passive Case Detection Evaluator has the responsibility of supervising the work of the VC and promotes the VC in the community.

Active case detection has been done only sporadically by Active Case Detection Evaluators, Drug Distributors, Medication Distributors and occasionally Passive Case Detection Evaluators. Regular active case detection by Drug Distributors during the four cycles of mass medication are called investigation slides, as are those taken for follow-up of radical treatment.

All slides are read by microscopists (30 in all) at the Zone level. Results and accompanying data are registered by a statistical unit, also at the Zone level. The locality is the basic population unit by which data are registered; the basic time unit is the month of slide examination. Age and sex are not recorded or analyzed, although they are initially noted when the slide is taken. Only positive results are reported back to the field.

SNEM, its advisory staff and previous external evaluation reports mention difficulties at all levels of this surveillance system. Particularly disturbing, a large number of VC's cannot maintain required

productivity. For many posts the VC must be changed frequently. In general, in the highly malarious localities visited by this Evaluation Team, the VC's were quite productive and the same person or household had been involved for a long time--sometimes since the founding of the program. Some decrease in productivity was noted in association with mass drug administration. However, in some localities, particularly as noted in Zone III, the posts appeared to need better promotion and to be supplemented by active search. Nonetheless, on a gross scale the problem is not poor promotion but an excess of VC's in inherently non-malarious areas. A comparison of Section Rurales in Zone I with API greater than 5 per thousand to those with API less than 5 per thousand (i.e., with a low probability of transmission) reveals a nearly identical coverage of both areas and a large number of VC in areas with consistently low malaria (Table 10).

Table 10

Voluntary Collaborator's Coverage of Sections Rurales of Varying API Zone I (1978)

	Number of S.R.	Average Population per V.C.	Number of V.C.
Section Rurales with API < 5/1000 [1]	120	884	809
Section Rurales with API ≥ 5/1000 [2]	82	759	989

[1] Greater than 5 per thousand

[2] Equal to or less than 5 per thousand

A second major problem is the great delay in collecting slides from the VC, despite the fact that all SNEM personnel are required to pick up slides when visiting a VC post or associated locality. This is compounded when the laboratory is not able to keep up with the volume of slides. Other concerns were relatively minor and would be resolved under good supervision.

Once collected, registry and utilization of data suffer several significant faults. As already stated, monthly registration of cases is by date of slide examination; consequently, the present registration offers no accurate means of associating malaria cases in time with natural events of control measures, either for programming or evaluation of measures. In 1978 records maintained by the date of taking the slide were maintained informally at the Zone level. The laboratory reports only the positive findings; and therefore, negative results are not registered. The data suffer from gross inaccuracies and the work is an unnecessary duplication.

Infinitely superior to the handling of the aforementioned data is the registry of malaria cases by place. SNEM statistical clerks sort and register all results by "localité". In this manner, malaria foci can be identified within each Section Rurale . However, many inconsequential "localités" with very small populations exist which for epidemiologic purposes could be consolidated.

The registry cards themselves are not kept in good order. Numerous erasures and a cluttering of boxes with data from four different searches make them difficult to read. Totals both monthly and yearly, population and houses are often not entered although space exists.

The final utilization of these registered data is meager in proportion to the effort expended in collecting and registering them. Only yearly totals and rates by Section Rurale are compiled. Routine analysis of applied measures is not done.

In general, there is no meaningful pictorial presentation of operations in the forms of tables and graphs. For example, there is no follow-up table showing at a glance the performance of Volunteer Collaborator posts, wall charts showing the malaria history of each Section Rurale since the start of the program, or maps kept up-to-date and showing for fixed periods of time, the place and extent of the areas where operations are carried out as well as the distribution of malaria cases year after year by locality. These simple tabulations, by correlating operations and end results, could have permitted:

1. Improvement of operations
2. Judgment of their relevance and,
3. Delineation of hard-core areas where special investigations have to be carried out.

Regarding Central Headquarters, the same observations as regards Zone Offices can be made; it is regretted that no annual critical evaluation reports have apparently been issued since 1971.

Observations Regarding Use of Organophosphorus Compounds

In 1978 SNEM decided to use organophosphorus compounds as alternatives to DDT.

Application of fenitrothion at a dosage of 2 gm technical product per square meter has been carried out in parts of the three communes of St. Louis du Sud, Cavaillon and Les Cayes with a combined population

estimated at around 100,000 people. The whole area was never considered for a total spraying coverage; only the localités found malaria-positive in the first six months of 1978 were to be sprayed. However, even this plan was not fully applied, and only 179 out of the 295 localités found positive (out of 495 total) were treated during the first cycle. In other terms this means that only 36.1% of the localités in the area have been sprayed.

During an extended field visit in Zone III, the Team attempted to make a preliminary evaluation of the results of the first cycle of fenitrothion application. The data that were extracted from the files of Zone III are presented in Tables 11 and 12.

From the data presented in Tables 11 and 12 it is not possible to formulate any judgment on the epidemiological impact of fenitrothion on malaria incidence.

As stated above, the test area has not undergone a total spraying coverage; furthermore, the case detection mechanism was not up to the standard required for a well controlled field trial.

Finally, so many ancillary antimalaria measures were and are being employed simultaneously in the same areas, both treated and control (drug treatment, thermal fogging, larviciding, source reduction) that it becomes impossible to disentangle their relative effects epidemiologically. All that can be said is that should transmission continue, the insecticide did not work; but if transmission is, in fact, interrupted or decreased, this cannot be assigned with certainty to the impact of the insecticide. Further light could be thrown on the efficacy of the insecticide if an adequate entomological evaluation

Table 11

Parasitological data collected in the localities treated with fenitrothion--malaria cases detected by PCD

Months	Names of the Sections Rurales (number of localities treated)							
	Bale Dumesle (20)	Grenodiere (33)	Solon (21)	Bolleau (13)	Martineau (11)	Bourdet (21)	Laurent (42)	Boulmier (10)
1/78	58	57	14	60	4	169	271	20
2/78	25	7	1	112	2	162	196	28
3/78	24	5	3	58	2	104	137	31
4/78	3	11	5	26	8	86	128	19
5/78	18	13	16	2	1	113	90	4
6/78	57	72	83	41	23	313	202	20
7/78	11	4	41	27	10	164	60	5
8/78	21	0	12	10	10	86	61	5
9/78	14	0	23	7	8	4	23	4
10/78	13	0	52	4	7	19	77	5
11/78	8	22	42	11	11	16	32	4
12/78	33	41	18	26	4	35	40	24
1/79	22	8	18	53	16	87	52	27

<——> spraying period

[ ] Mass Drug Administration

Parasite prevalence surveys carried out in July 1978 in some localities of same Sections Rurales gave the following results (general population)

	Bale Dumesle	Grenodiere	Solon	Bolleau	Martineau	Bourdet	Laurent	Boulmier
Number slides	325	320	192	478	297	854	668	211
Number Positive	40	59	68	40	22	61	118	15
%	12.3	18.4	35.4	8.4	7.4	7.15	17.7	7.11

Table 12.

Parasitological Data Collected in the Control Localities - Malaria Cases Detected by PCD only

Months	Name of the sections rurales (number of localities)	
	Les anglais (32)	Bourg (41)
1/78	19	64
2/78	9	78
3/78	10	42
4/78	42	32
5/78	21	30
6/78	58	25
7/78	8	32
8/78	16	42
9/78	7	9
10/78	27	25
11/78	41	34
12/78	26	24
1/79	32	37

[ ] Mass Drug Administration

were carried out. Observations on induced vector mortality are quite inadequate, there being no window trap or room-kill data obtained. No bio-assay is carried out to indicate fall-off of residual activity of the insecticide. Insectary and laboratory facilities should be made available in the Zone for entomological work.

Malathion has been used in 19 localités in the Commune of Anse à Veau with a total population of 5,100 people. The first cycle of malathion was applied starting on 24 January 1979, and no post-operational parasitological data are yet available.

Regarding these two organophosphorus compounds, no study design and protocol for their assessment under Haitian conditions have been prepared; fenitrothion and malathion were in fact used directly as operational tools, taking their efficacy for granted. It is only fair to say that SNEM now intends to correct the shortcomings regarding coverage in 1979. However, before embarking on the large-scale use of expensive and highly toxic insecticides, their efficacy in interrupting transmission should be thoroughly demonstrated.

Some guidelines for assessing the impact of residual insecticides on malaria transmission are proposed under Discussion.

2.3. Entomological Section

In an antimalaria program in which measures aimed at the vector are relied upon as the main means of attack, it is essential to monitor closely the impact of these measures on the target mosquito so as to insure that operations are producing the desired effect and to produce a continuous feedback of information for purposes of forward planning. Besides this the entomological services have an important contribution to make to the overall epidemiological intelligence system, in which there is also a large planning element, and in epidemiological investigations of areas where malaria does not respond to intervention measures. Further, before launching a new anti-mosquito measure operationally in an eco-epidemiological system in which it has not been applied hitherto, entomological services have a critical role to play in the assessment of impact on the process of malaria transmission and in the guidelines of forward operational planning.

2.3.1. Present Activities

1. Operational

At the present time, the vast majority of staff of the Entomological Section are exclusively engaged in operational activities at the field level, namely, larviciding and thermal fogging, carried out either in conjunction with a mobile brigade or by the entomological staff themselves assisted by two laborers. Provision is made for checking of larval and adult densities before and after treatment, but the fact that the entomological staff are dependent for transport, either on their particular mobile brigade or on the Chief of the Sector in which

they are posted, appears to make adequate post-operational evaluation extremely difficult on many occasions. It should be mentioned here that the larviciding cycle in most instances is synchronized with the thermal fogging activities and is longer than the optimum. The possible efficacy of these activities is commented upon elsewhere in this report.

2.3.2 Insecticide Trials

In Zone III, staff of the Entomological Section participate in the evaluation of the malathion and fenitrothion treatments. Their activities are confined to conducting human bait catches outdoors and indoors in local houses designated as observation posts. Sampling of the biting anophelines normally extends over the first three hours of the night. No mortality observations and dissections for parity ratio or bio-assays to monitor the length of life of the residual deposit are carried out. The only data being produced consists of rough estimates of larval and adult densities.

Since, during the first two rounds of spray in the fenitrothion area, coverage was not total, the significance even of crude density estimates is extremely doubtful. Entomological evaluation of any further insecticide trials should include basic observations described under Section 2.4 (b); below.

In the malathion area, observation posts are operated both in the sprayed area and unsprayed control area; however, in the fenitrothion trial there appears to be no regular entomological observations in an unsprayed control area. No protocol appears to exist for either trial.

2.3.3 Epidemiological Activities

There appears to be no participation by the Entomological Section in epidemiological activities at the present time. This is surprising in view of the need for epidemiological stratification of malarious areas in Haiti and the accepted role in antimalaria programs world-wide of the entomological surveillance network as an early warning system for the epidemiological and operational components.

As a basic minimum, there should be available in every Sector up-to-date maps of anopheline distribution together with sufficient meteorological data derived from different localities and altitudes to give some indication of the variation in receptivity throughout the year. This should be supplemented by information on anopheline densities in selected eco-epidemiological entities and regular monitoring of susceptibility levels.

2.3.4 Monitoring of Susceptibility Levels

Summaries of recorded tests from the year 1960 to data are presented in Tables 13, 14, 15

Table 13

Number of Suceptibility Tests per Five Year Period and Number of Localities in Which the Tests were Performed

Period	Tests	Localities
1960-1964	22	16
1965-1969	56	48
1970-1974	135	116
1975-1979	27	23

Table 14

SUSCEPTIBILITY MONITORING OF VARIOUS INSECTICIDES
Number of Tests and Number of Localities, by Zone

DDT

Year	Zone I		Zone II		Zone III		Total	
	Tests	Locs.	Tests	Locs.	Tests	Locs.	Tests	Locs
1960	1	1	0	0	0	0	1	1
1961	1	1	1	1	0	0	2	2
1962	6	3	1	1	0	0	7	4
1963	3	2	0	0	1	1	4	3
1964	2	2	1	1	3	1	6	4
1965	3	2	2	2	3	3	8	7
1966	4	4	2	2	0	0	6	6
1967	0	0	0	0	1	1	1	1
1968	3	3	5	3	1	1	9	7
1969	7	5	12	11	2	2	21	18
1970	4	4	3	3	1	1	8	8
1971	5	4	8	8	3	2	16	14
1972	3	2	4	4	5	5	12	11
1973	7	7	17	16	22	18	46	41
1974	8	8	13	10	6	6	27	24
1975	1	1	6	4	1	1	8	6
1976	1	1	2	2	0	0	3	3
1977	0	0	0	0	0	0	0	0
1978	1	1	0	0	1	1	2	2

DIELDRIN

Year	Zone I		Zone II		Zone III		Total	
	Tests	Locs.	Tests	Locs.	Tests	Locs.	Tests	Locs.
1961	1	1	1	1	0	0	2	2
1962	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0
1966	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0
1969	4	3	4	3	0	0	8	6
1970	0	0	1	1	0	0	1	1

No Dieldrin Tests After 1970

Table 14 (continued)

MALATHION

Year	Zone I		Zone II		Zone III		Total	
	Tests	Locs.	Tests	Locs.	Tests	Locs.	Tests	Locs.
1969	1	1	2	2	0	0	3	3
1970	0	0	0	0	0	0	0	0
1971	1	1	1	1	0	0	2	2
1972	3	2	5	3	5	3	14	8
1973	0	0	0	0	2	2	2	2
1974	0	0	1	1	0	0	1	1
1975	0	0	1	1	0	0	1	1
No Malathion tests until 1978								
1978	0	0	1	1	0	0	1	

PROPOXUR

Year	Zone I		Zone II		Zone III		Total	
	Tests	Locs.	Tests	Locs.	Tests	Locs.	Tests	Locs.
1974	0	0	6	4	0	0	6	4
1975	0	0	5	3	0	0	5	3

FENITROTHION

Year	Zone I		Zone II		Zone III		Total	
	Tests	Locs.	Tests	Locs.	Tests	Locs.	Tests	Locs.
1978	0	0	0	0	7	6	7	6
1979	0	0	0	0	1	1	1	1

CHLORPHOXIM

Year	Zone I		Zone II		Zone III		Total	
	Tests	Locs.	Tests	Locs.	Tests	Locs.	Tests	Locs.
1978	0	0	0	0	1	1	1	1

ABATE (TEMEPHOS)

No information

Table 15

TESTS SHOWING ONSET AND DEVELOPMENT OF DDT RESISTANCE

Commune	Sector Rurale	Locality	Last Test Showing Complete Susceptibility	First Resistance		Highest Level		Latest Test	
				MZ	Date	MZ	Date	MZ	Date
Zone I									
Fort Liberte	Bayama	Garde Saline	VII.66	94	IX.68	25	IV.74	25	IV.74
Artibonite	Bac Coussin	Segur	VI.69	11	X.73	11	X.73	39	II.74
Caracol	Champy	Caracol	IV.62	(Only Test)					
Plaine du Nord	Morne Rouge	Morne Anglais	VII.66	69	V.69	28	II.75	28	II.75
Rabel	Vieille Batte	Guillette	VI.63	13	III.73	13	III.73	13	III.73
Rabel	La Coma	Cabaret	VI.63	9	XI.74	9	XI.74	9	XI.74
Gros Morne	Ravine Gros Morne	Gros Morne		30	IV.69	6	VII.76	6	VII.76
Dessalines	Fosse Nabothe	L'Ester	VII.66	43	IV.73	22	XII.74	22	XII.74
Fort Liberte	Dumas	Malfety	VII.65	(Only Test)					
Gonaives	Pont Tamarin	Pont Gaudin		31	XI.73	31	XI.73	32	XI.74
Gros Morne	Moulin	Dosny		30	VII.70				
Grande Saline	Desdunes	Desdunes	XII.64	22	XII.74	22	XII.74	25	XII.74
Dessalines	Fosse Nabothe	Hauteur Cadeau	V.69	29	IV.73	29	IV.73	29	IV.73
Zone II									
Thomazeau	Grande Plaine	Trou Caiman	VII.73	87	XII.73	84	VI.74	99	V.75
Jacmel	Ravine Normand	Etang Bossier		55	XII.71	52	IV.73	60	II.74
Jacmel	Ravine Normand	Bambou						99	XI.66
Hinche	Agua Blonde	Samana		13	XI.73	(Only Test)			
Grossier	Morne Bateau	Godet	XII.70	72	XI.71	28	VII.73	28	VII.73
Grossier	Morne Bateau	Borne De Fer						99	XII.69
Anse a Pitre	Boucan	Anse A Pitre		27	IV.73	17	II.74	36	III.75
Arcahaie	Les Vases	Corail	IX.64	17	X.73	17	X.73	17	X.73
Verrettes	Bellanger	Deschapelles	XI.69	(Only Test)					
Verrettes	Llancourt	Drouette		22	IX.76	22	IX.76	35	X.76
Verrettes	Llancourt	Poterie		18	X.76	18	X.76	18	X.76
Jacmel	Bas Cap Rouge	Jacmel		74	XII.69	6	XI.71	24	I.75
Jacmel	Bas Cap Rouge	Breman		27	VI.74	27	VI.74	27	VI.74
Jacmel	Montagne La Voute	Pasquette		36	XII.71	2	VII.73	2	VII.73

Table 15 (continued)

Commune	Sector Rurale	Locality	Last Test Showing Complete Susceptibility	First Resistance M%	Date	Highest Level M%	Date	Latest Test M%	Date
Zone II									
Leogane	Dessources	Bellevue		80	X.69	21	VIII.73	21	VIII.73
Miragoane	Chalon	Robüse	II.71	53	I.72	22	VII.73	26	VI.74
Miragoane	Chalon	Dupare Diable		31	XII.73	20	III.75	20	III.75
Mirebalais	Sarazin	Corporan		88	I.70	88	I.70	88	I.70
Petit Goave	Plaine	Source Pinaud	X.69	25	X.73	20	VI.74	20	VI.74
Petit Goave	Plaine	Coperlier Donou		68	I.72	32	V.74	41	IX.74
Petionville	Charbonnier	Greffin		62	XII.73	54	I.74	54	I.74
St Marc	Bois Neuf	Bois Neuf	VI.69	74	XI.71	31	XI.72	45	VII.74
Port-au-Prince	St Martin	Delmas		50	X.69	16	IV.71	56	V.73
St Marc	Bocozelle	Cocozelle	IX.66	26	X.73	26	X.73	26	X.73
Port-au-Prince	Varreux	Trois Bebes	XII.65	17	XII.68	17	XII.68	17	XII.68
Zone III									
Cayes	Laurent	Merrier	VIII.69	66	XII.71	16	V.74	42	IV.78
Miragoane	Pemel	Dimizainte		64	XII.72	19	V.73	19	V.73
Les Anglais	Cosse	Les Anglais		14	XI.73	14	XI.73	14	XI.73
Jeremie	Basse Voldrogue	La Saline		53	IX.74	53	IX.74	57	IV.75
Dame Marie	Bartadelle	Non Griffe		30	IX.74	30	IX.74	30	IX.74
Corail	Duguillon	Roche Crasee		18	V.73	18	V.73	18	V.73
Cayes	Mercy	Flandiere		49	X.72	49	X.72	49	X.72
Cavaillon	Martineau	Desravines		64	I.73	64	I.73	64	I.73
Pte Aron De Nippes	Tiby	L'Usine		24	II.73	24	II.73	45	IX.73
St Louis du Sud	Grenodiere	St Louis du Sud	XI.69	52	IX.72	11	VIII.73	17	VIII.73
St Louis du Sud	Bale Dumesle	Feandiny		52	IX.72	52	IX.72	52	IX.72
St Louis du Sud	Les Anglais	St Georges		47	III.73	47	III.73	47	III.73
Morbeck	Boury	Formon		51	X.73	30	V.74	30	V.74
Anse a Veau	Bacommois	Morne Pio		24	II.73	24	II.73	24	II.73
Anse a Veau	Grande Rivere	Massan		35	II.73	33	IX.73	33	IX.73
Cayes	Bourdet	Cayes	XII.65	33	VII.73	33	VII.73	33	VII.73
Cayes	Laborde	Cocoyer		66	I.73	66	I.73	66	I.73
Cavaillon	Bolleau	Berard		47	XI.73	44	XII.74	44	XII.74
Baraderes	Gerin	Baraderes	I.63	23	IX.73	23	IX.73	23	IX.73
Aquin	Colline a Mongon	Etang You		61	X.73	17	IV.74	17	IV.74
Aquin	La Colline	Fodoise Medecin		95	VIII.70	18	I.73	18	I.73
Aquin	Maccare	Aquin	XII.65	67	II.73	37	VIII. 73	37	VIII.73

M% - Mortality on one hour exposure to 4% DDT

2.3.4.1 DDT

According to available records, DDT resistance in Anopheles albimanus was first detected in Zone I in September 1968 (in the Commune of Fort Liberté, Section Rurale of Bayama and locality of Garde Saline). Thereafter the number of localities in which DDT resistance was demonstrated varied from year to year, reaching a maximum of 27 in 1973, the year in which the maximum number of tests were recorded in the largest number of localities. In passing, it is interesting to note that DDT was used as a larvicide from October 1965 up to August 1968, i.e., for almost three years. There is no accurate record of the incidence and spread of DDT resistance in the country and up-to-date information is not available, there being only two tests on record since 1976.

2.3.4.2 Dieldrin/HCH

Very few tests against Dieldrin/HCH have ever been carried out. According to available records there were two tests in 1961, eight in 1969 and one test in 1970. Resistance was demonstrated only in three localities (Gros Morne in Zone I and two localities in Port-au-Prince in Zone II, the latter being of a relatively low level). In the other four localities where tests were carried out (two in Zone I and two in Zone II) the anopheline populations sampled were susceptible to Dieldrin. No tests against Dieldrin are on record for Zone III.

2.3.4.3 Other Insecticides (Malathion, Propoxur, Fenitrothion, Chlorphoxim, Abate)

The few tests carried out against these insecticides all indicated the susceptibility of A. albimanus. There have been no tests against Propoxur since 1975, but some tests against Fenitrothion, Chlorphoxim and Malathion were carried out in 1973.

Despite the fact that Abate (Temephos) is being used operationa there appears to be no information on susceptibility baseline data.

With regard to the possible eventual development of resistance to fenitrothion and malathion in Haiti, this would, of course, depend on the scale of use, both in public health and agriculture, of these and related compounds, not only in Haiti, but also in the Dominican Republic. The information available to the group at the present time is insufficient for even the roughest estimation.

So far as public health use in Haiti is concerned, it would appear logical to conclude that while either of the above insecticides is confined to focal or localized application in a control programme, selection on the anopheline population as a whole would be minimal, enabling prospective use of the insecticide for an extended period.

Enquiries at the Agricultural Extension Service of the Ministry of Agriculture and also at the offices of a commercial insecticide importing firm in Port-au-Prince indicated that the following range of insecticides is in use in the agricultural sector:

DDT	Pyrethrum
Dieldrin	Toxaphene
Malathion	Sevin
Chlordane	Azodrin
Lindane	Dimethoate
Baygon	Decis
Dipterex	

Unfortunately, the actual amounts imported were not available, however, the impression gained from the above and other sources is that use of pesticides for agricultural purposes does not as yet take place on a large scale in Haiti.

2.3.5 Personnel

Entomological staff met in the field and in the Central Office were of good quality but require further training and opportunity for career development. They are practically without exception overwhelmed by involvement in operational activities and are thus unable to provide the entomological intelligence services which are desperately needed.

2.3.6 Transport

This appears to be a serious problem for the Entomological Section as a whole. The vehicle at present assigned to the Chief Entomologist is not appropriate for entomological activities. The PAHO Entomologist has no transport assigned to him although he arrived in the country on 13 September 1978.

2.3.7 Laboratory/Insectary Accommodation

Basic insectary and laboratory accommodation assigned to SNEM exists in the National Research Laboratory in Port-au-Prince, but it has apparently been disused since 1968. One functional compound microscope is available. The laboratory be re-activated; it could be put back into service for a comparatively modest outlay.

Considering the position of SNEM as the service responsible not only for malaria, but for the other vector-borne diseases which are also of outstanding importance in Haiti, a fully functional entomological laboratory would greatly enhance its status and capabilities.

2.4. Discussion

a. Epidemiology

Blood specimens are mainly taken through passive case detection posts and are sent to Zonal laboratories. The time-lag between the taking of a blood slide and the availability of the results is often three months or longer, but is of varying duration. This delay is mainly due to logistic problems involved in the collection and transport of the material from the field. Additionally, since the beginning of the program the parasitological data have been recorded not according to the date when the blood specimen was taken, but to the date on which it was examined in the laboratory. In consequence, it is rather impossible on the one hand to derive any good correlation between the actual occurrence of the cases and the natural epidemiological patterns of the disease, and on the other to make a proper planning of application of intervention measures such as residual spraying, mass drug administration, larviciding, source reduction, etc. In addition, intervention methods are applied in combination on a very irregular basis, thereby making it impossible to evaluate correctly either the impact of any of the methods used alone, or their combined effect.

The antimalaria activities in Haiti can be considered as a malaria control program and, therefore, the purpose of the existing surveillance system is not to discover all malaria cases. Data collected through the case detection mechanism, which covers rather well the malarious areas of the country, permits the monitoring of malaria incidence trends.

In Table 2 the number of malaria cases reported in the country for the period 1962-1977, given in parallel with the type of operation carried out, shows very clearly that a general increase in transmission

occurred in the country after the termination of the large scale mass drug administration. However, the gross figures for the whole country can be misleading, as shown in Table 7. A very great proportion of positives are originating from a relatively limited number (13%) of Sections Rurales, and among these, in a proportion of localities only.

The positivity rate of the slides varies greatly for this reason. High incidence of malaria exists mainly in coastal areas. The population in high incidence areas represents about 15 to 20% of the total population under malaria risk. The exact population has to be ascertained.

Past records have shown that DDT spraying has been beneficial in many areas of low endemicity, whereas in other areas its efficacy remains doubtful.

From experience acquired elsewhere, it is reasonable to assume that the cause of non-efficacy of DDT in those highly receptive areas may have been the inability of this insecticide to reduce the man/vector contact below the critical threshold necessary to interrupt transmission. Due to the lack of any entomological monitoring in indicator areas that should have been selected in various eco-epidemiological strata, this critical threshold has never been estimated in Haiti. It has to be stated here that no precise delineation of the malarious area of the country or stratification into homogeneous zones seems to have been done.

It is of prime importance (whatever may be the immediate objective of the program--short-term eradication or malaria control) to stratify the localities in the Sections Rurales with high transmission, using as indicators such measurements as levels of malaria incidence and vector production potential.

It would be of great practical value if attempts were made, based on previous documentation, to list areas where residual insecticide alone was able to interrupt transmission. Assuming that no marked adverse changes in the environment have since taken place, it would be inferred that any insecticide which is as effective as DDT was prior to the development of resistance could be of equal use in those areas.

b. Justification for and outline of research projects (fenitrothion, malathion and DDT)

From the data made available to the Evaluation Team in high incidence areas of Les Cayes, it is not possible as yet for the Team to assess whether or not fenitrothion as applied at the present rate of 2 gr/m^2 and a 3-month periodicity could be the main weapon to be used if short-term eradication were the aim of the program. It would be strongly justified to carry out, for instance, in Miragoane and Petit-Goave, a research project under well-controlled conditions, using malathion, fenitrothion and DDT in three "zones" of very comparable eco-epidemiological features, and in new areas where fenitrothion and malathion have not been sprayed. The population to be placed under total coverage in each of those "zones" should be at least 50,000. One area of 15,000 population (where no antimalaria measures will be carried out, other than administration of presumptive drug treatment) will serve as comparison for both of those zones. Since a well substantiated answer to the question of efficacy of both malathion and fenitrothion is urgently needed, it is proposed that prior to spraying, baseline data be collected through passive and active case detection in central areas (later referred to as evaluation areas) of 15,000 population in each

of the areas to be treated, as well as in the whole comparison area. Passive case detection would have to be enhanced in the remaining parts of the sprayed areas serving as a protective barrier through a strong activation of the various case detection posts (as described elsewhere in the body of the report). The duration of this preliminary parasitological investigation could be reduced to 3 months (during this period a thorough updating of the geographical reconnaissance, including mapping of houses and breeding sites, should be carried out). In each of the evaluation and comparison areas, three fixed entomological stations should be selected, in each of which the following information would be required on a fortnightly basis.

1. Gross anopheline adult and larval densities.
2. Density of vector in contact with man, taking into account the behavior of local residents.
3. Parity rate of vectors sampled.
4. In two properly constructed experimental huts in each of the fixed stations, to operate window traps, and floor collections, the huts being inhabited during the night of observation.
5. In 10 houses in each of the fixed stations, pyrethrum spray collections should be made on a monthly basis. The mosquitoes should be classified according to abdominal stage, and among the newly fed specimens a sample should be precipitin tested to determine the origin of the bloodmeal.
6. Baseline susceptibility levels should be determined in two localities in each evaluation and control area.

After spraying: Malathion or fenitrothion should be sprayed at 2 gms (active ingredient) $/m^2$ on a total coverage basis once every three months for three cycles in the two previously delimited areas. After the first spraying coverage in the treated areas, and at the same date in the comparison area, parasitological and entomological data should be collected at the same frequency (with the exception of susceptibility testing) for a total duration of nine months. In addition, once every two weeks, a three-house bio-assay test using A. albimanus bred from larvae should be carried out in local housing in each evaluation area as well as in two of the experimental huts.

The results of these investigations will permit:

1. the evaluation of the impact on the anopheline population of the insecticide applied at three-month intervals, and determination whether there is a cumulative effect of successive applications, and
2. the monitoring of the epidemiological situation during the period of nine months.

The routine activities of case detection posts consisting of the administration of presumptive drug treatment should be continued in both treated and untreated areas; however, any other complementary measure(s) such as larviciding, fogging, mass drug administration and source reduction should be discontinued in these areas for the duration of the experiment. In addition, population movements inside study areas should be monitored and their epidemiological importance assessed.

In the comparison area, the same activities and observations as suggested during the baseline period should be continued during the

succeeding nine months. Bio-assay control check may be carried out in two of the experimental huts. If these activities were started in July 1979 it would be possible to have an answer by mid-1980.

It would be of interest, and of potentially great practical value, if DDT were also to be subjected to a similar trial in parallel with the organophosphates. This would greatly assist in clarifying both the past and present role played by DDT in the program. A study design for these research projects could be prepared, if requested, by the Malaria Action Programme, WHO Geneva.

c. Entomology

For several years the malaria program has not had the benefit of appropriate entomological services. This is a very serious handicap for any program using a large number of vector control activities. Besides a lack of standard entomological surveillance there has been no thorough evaluation of effectiveness of the several different control methods employed. The candidate replacement insecticides, malathion and fenitrothion, are being assessed in such a way that no clear-cut results will emerge for or against. The elements lacking in this assessment are noted elsewhere.

In general, entomological information of epidemiological significance is lacking. Even simple maps of anopheline distribution are not available at Sector level.

Besides this, insecticide susceptibility monitoring of the program has been rather sporadic with insufficient coverage in space and time.

It would appear essential, therefore, in order to conduct the program along recognized, practical, scientific lines, that the Entomology Section be completely re-organized, the present activities

of the entomological staff being returned to the Field Operations Section to which they rightly belong. After appropriate training the Entomology Section should proceed with its legitimate roles of evaluation, epidemiological intelligence and operational research for which purpose it will require appropriate laboratory facilities, transport and equipment. The above is essential if SNEM is to fulfill the role implied in its title.

d. Mass Drug Administration

The effect of mass drug administration on malaria, either reported cases or on transmission, has not been evaluated. It is felt by SNEM that by achieving high coverage rates (higher than 80%) malaria can be successfully reduced.

Data do in fact exist at SNEM which can be used to demonstrate the effectiveness of this measure. In selecting nine Sections Rurales from those treated with mass medication in Zone II one can observe a consistent pattern of a rapid fall in reported malaria after mass medication is initiated (Table 16). However, examination of individual monthly totals (not detailed in Table 16) reveals that the rapid decrease in malaria took place during the first month of medication, with little change in subsequent months. The change in case numbers is not as impressive as one would expect from the coverage. When lower case numbers were involved results were poor.

However, for numerous reasons, not everyone takes the medication every cycle. As more consecutive cycles are completed, the proportion of unmedicated persons grows. Although the combined effect of mass prophylaxis, mass suppression and mass suppressive cure greatly reduces

Table 16: Malaria Cases from 9 Sections Rurales of Zone II where Mass Drug Administration was given from Aug. through Dec. 1978, by Date of Taking the Slide

Section Rurale	Mean Coverage per Cycle	Period A Jan-Apr	B May-Aug	C Sep-Dec	Percent Change B to C
Lianccurt	76%	218	215	47	-78%
Deluge	76%	73	95	27	-72%
Aguadionde	82%	236	296	226	-24%
Plaine	79%	166	469	67	-86%
Ravine Normande	85%	113	563	190	-66%
Savane Du Bois	85%	29	178	30	-83%
Belanger	79%	80	131	108	-18%
Cabral	85%	33	12	33	175%
Coupe Mardi Gras	89%	40	161	25	-84%
TOTAL		988	2120	753	-64%

cases, some remain. Whenever coverage drops sufficiently or is terminated and anopheline densities are high, malaria rates can rapidly return to their original level. This failure of mass medication was observed by Mason and others when it was used as an eradication measure.

Mass medication can be an effective temporary control measure, particularly when case numbers are high. It cannot uniformly interrupt transmission because high rates of coverage cannot be maintained, consistently leaving a small reservoir of infected individuals. Based on careful evaluation of malaria surveillance data, limited use of mass medication for seasonal or sporadic increases in transmission can greatly reduce morbidity and mortality. However, the measure should not detract excessive funds and manpower from permanent vector control activities.

e. Radical Treatment

For malaria eradication, radical treatment has been recommended only for the very few cases detected during the consolidation and maintenance phases. In these circumstances radical treatment constitutes a justified attempt to eliminate the residual parasite reservoir. Haiti is not in the consolidation or maintenance phases, nor does it have very few cases. Opinions differ as to the utility of radical treatment in such circumstances.

Two important factors of malaria epidemiology interact to contraindicate the administration of radical treatment in areas of transmission even if all cases detected through surveillance were treated within 15 days (the average duration of the action of a suppressive dose of chloroquine given when the slide was taken). First, malaria multiplies under favorable conditions in an exponential fashion. Thus, reductions in absolute case numbers, even if substantial, will have little quantitative effect on malaria cases produced by subsequent or simultaneous occurrence of conditions favorable to transmission. Unless all cases are eliminated, the effect of radical treatment is rapidly dissipated. In this respect, the second factor is important; disease surveillance in general cannot detect all cases. The greater the actual attack rate the greater the amount of residual undetected cases. Even the test for confirming malaria, the thick blood film, produces an important percentage of false negatives. Since radical treatment is linked to the detection of slide-positive cases, these false negatives are not treated.

Data from SNEM support these contentions. A point prevalence survey of the population of selected localities in Zone III in July 1978 (Table 8) revealed the deficiency of surveillance. As shown elsewhere, during the point prevalence survey more slide positive cases than detected by the surveillance system during the preceding three months were discovered. The epidemic potential is dramatically evidenced by data from 1977 and 1978 in 10 Sections Rurales. Of 46 localities with annual parasite incidence (API) of more than 50 per thousand in 1978, 21 had had no detected cases in 1977, and six others had shown five per thousand or fewer.

The system of passive case detection as well as mass medication better serve to reduce morbidity and mortality. The suppressive dose of chloroquine given probably prevents recrudescences in a large proportion of the semi-immune Haitians so treated. Those individuals whose malaria would recrudesce are not reached for 40 or more days after the presumptive treatment was administered, giving malaria every opportunity to weaken or kill the patient and to serve as a source of infection for anophelines. Fortunately, the patients who do suffer recrudescence can always visit their convenient voluntary collaboratory for more presumptive treatment. Also, to eliminate the gametocytes, the dose of primaquine is not sufficient and again comes too late.

In summary, the selective administration of radical treatment is a superfluous measure which occupies time and manpower out of proportion to its value for the current malaria situation in Haiti.

It involves a great deal of effort which could be better used in other, more productive areas such as active case detection or entomologic surveillance. It is given to a large number of people probably already rendered parasite-free by presumptive treatment. Radical treatment could be given in the future where a large malaria-free area with some receptivity needed to be maintained. In fact, radical treatment is currently a major part of the program of the Dominican Republic. Field research would first have to demonstrate that it would be a practical and necessary method of maintenance.

f. Field applied research

In any antimalaria program, whether control or eradication, there should be a field-applied research-cum-training component; this component has not been established in the program.

The purpose of field-applied research is to find a solution to existing and potential problems and to give technical guidance to the program. Some concrete examples of field-applied research which should be carried out in the framework of the present anti-malaria program are listed below.

(1) Formal investigation regarding causes of persistent transmission following application of intervention measures in some areas, and reasons for success elsewhere.

(2) Due to the fact that no thorough assessment has even been made of the impact on malaria of intervention measures, either applied alone or in combination, it is not possible to formulate an antimalaria strategy on the basis of technical evidence. For this reason, a number of pilot projects and field trials have been proposed in the body of the report. For example,

it remains to be demonstrated:

(1) What is the proportion of P. falciparum cases which can be radically cured by a single does treatment, excluding obviously the risk of re-infection.

(2) The administration of systematic radical treatment to positive cases is not justified in malaria control programs in those areas where malaria transmission is going on unabated; mass drug administration is more effective and should be preferred; in malaria eradication programs, according to the proportion of cases cured by a single-dose treatment, it should be possible to reconsider either the rationale for a full radical treatment or the drug posology and duration of the radical treatment. In all instances it is essential to evaluate experimentally the adequate scheme of radical treatment for P. falciparum and the type and dosage of sporontocides required to render a gametocyte carrier non-infective to mosquitoes.

(3) A thorough study regarding (a) the significance of epidemiological findings and (b) the entomological procedures and techniques to be used for the operational evaluation of intervention measures against the vector, should receive special attention in order to contribute to a better technical guidance of the program.

(4) The feasibility of assessing the real impact of antimalaria measures on the reduction of general and specific age mortality and morbidity rates should be explored.

(5) Monitoring of P. falciparum sensitivity to 4-aminoquinolines.

CHAPTER III - ADVISORY SERVICES AND TRAINING

3.1. Advisory Services

Without question, the recommendations made elsewhere in this report call for an augmented advisory effort. The Evaluation Team foresees the need for both long, medium and short-term advisors.

3.1.1 Long-term Advisors

PAHO's present advisory staff consists of a senior advisor (malariologist), a sanitary engineer, an entomologist and two sanitarians. The two first listed above are shortly to complete their work in Haiti, and well-qualified replacements are urgently required.

The new chief of party should be an epidemiologist; supported by the entomologist, he possesses the key to proper assessment of need for attention, selection of appropriate intervention measures, measurement of progress and evaluation of results.

The sanitary engineer, whose work in environmental management and source reduction is vital to permanent protection of key areas by reduction or elimination of potential for vector production, is also a key factor in the unique multiple-measure Haitian program. A continuation of this work is important; if none of the insecticides to be subjected to field research proves capable of total or substantial interruption of transmission, environmental management offers the best hope for the long-term future while chemotherapy holds malaria-caused morbidity and mortality in check.

AID has in earlier years provided a management advisor; he was replaced in 1978 by an experienced malaria specialist who was also to fill the role of management advisor. SNEM has chosen to assign to him the management advisory functions while refusing to consider any advice in the area of his technical qualification, on the grounds that PAHO was to be the source of all such advice. The experiment in combining the two functions is not working well.

The extent of AID involvement in the anti-malaria effort in Haiti makes it imperative that AID continue to provide the services of a well-qualified, experienced malaria specialist. In addition, the team recommends restoration of the management advisory post, with a particular view to improving record maintenance, establishing direct relationships between activity and cost, and assisting in such areas as the development of properly targeted annual action plans. Additionally, the substantially modified program and quite probably augmented financial burden, which could arise from a demonstration of the technical feasibility of interrupting transmission would unquestionably require a modification and possibly a complete reversal of the present arrangement under which AID funds are used for current expenses (salaries, petroleum products, etc.) while GOH funds are used to procure supplies of items which must be available in quantity. The management advisor's role in this respect makes reinstitution of the position imperative.

The relationship between AID and PAHO also require immediate modification, quite probably in the context of a renegotiation of the Memorandum of Understanding among the three participants in Haiti's anti-malaria effort--GOH, PAHO and AID.

3.1.2 Medium-term Advisors

The definitive field-research projects which represent a major element of the Evaluation Team's recommendations will require the highest quality of advisory leadership, careful planning and meticulous execution. The results of these projects may define the course of the future anti-malaria effort in Haiti; at a minimum, they can establish the firm base on which future plans may be built with the assurance of technical feasibility.

The field-research projects of the three insecticides--fenitrothion, malathion and DDT--should be conducted under the direction and full operational control of a project leader whose qualifications to conduct these projects has been demonstrated elsewhere.

The project leader should be an epidemiologist. He will require top-flight support from the entomologist assigned to the long-term staff, and the full-time services of a particularly well qualified sanitarian to provide on-the-spot project supervision.

While PAHO is expected to continue to provide long-term advisory services, direction of the field research projects could equally appropriately be provided by AID. The question is less the source of the advice than ability to provide it.

3.1.3 Short-term advisors

This report has observed the relaxation of standards of application of existing regulations in such areas as personnel management and vehicle maintenance. Short-term advisory services in these fields appear to be needed if the gains from earlier advisory effort are not to be dissipated.

Additionally, PAHO should be requested to provide the short-term assistance of a training advisor thoroughly familiar with the French language training materials, prepared for use at the school at Lomé or elsewhere, to assist the chief of the Training Section in establishing the body of training material needed.

3.2. Training

3.2.1 In-country Training

SNEM's organization chart does not indicate the locus of responsibility for training, nor does there appear to be any single individual who is charged with responsibility to assure that new employees are fully instructed as to the functions they are to perform or the conditions to be met if their performance is to be considered satisfactory.

This is not to say that no training is carried out. In practice, the new employee is given what amounts to a period of apprenticeship--on-the-job training (OJT). Such a system can, in fact, be reasonably effective; a senior offical can assure that in addition to appropriate technical training and instruction, the new employee is given guidance as to the role he is to play in an integrated team effort. Its weakness is that it tends to inhibit changes in patterns of operation which have not proved to be effective. To the extent that the senior official is himself required to direct his attention to functions other than those for which his position exists, his "apprentice" is similarly misdirected.

At lower levels of the organization, OJT appears to be a regular part of the pattern of operation. For example, spraymen (who are employed for specific spraying cycles rather than on a permanent basis) are regularly trained by their supervisors. Since there is a previous history of such employment going back over many years, most "new" spraymen are in fact already experienced. Training manuals were said to have existed in the past; they could not be located.

With the introduction of the insecticide, fenitrothion, it became necessary to break with past practice. At the insistence of a visiting group representing AID and PAHO's headquarters office, the application of the highly toxic insecticide was deferred to enable a training team provided by CDC/Atlanta to provide a thorough grounding to supervisors and spraymen alike in the safe handling of toxic insecticides used as residual spray, and to give instruction in measuring decreases in cholinesterase levels on the part of individuals exposed. To avoid the loss of these trained spraymen, they have been employed on a permanent basis.

PAHO advisory staff have unquestionably provided a measure of OJT to the SNEM employees with whom they have been associated, but no member of the PAHO staff is specifically responsible for providing assistance in the creation of a training unit, for urging the selection of a particularly well qualified individual to head such a unit, or for advising and assisting such an individual in understanding and discharging his functions or identifying and securing

existing French-language training materials. This responsibility becomes even more important in the light of organizational changes which the Team recommends (e.g., the compression of functions in the surveillance and drug distribution system), the stratification of the country into homogeneous eco-epidemiological zones, and the greatly increased use of epidemiological and entomological data in selecting tools of intervention and evaluating results.

The Evaluation Team strongly urges the immediate creation of an In-Country Training Section, responsible for assuring that all employees are fully instructed and properly trained in their functions. It is appropriate to prepare manuals of instruction (or, if possible, to adopt or adapt instructional material already in existence) on repetitive functions; such manuals can define the work of microscopists, cartographers and even junior entomologists as well as spraymen, larviciders and drug distributors. They cannot serve fully to replace personal training, provided not only at the time of employment but as refresher courses as it becomes necessary to update skills or adopt new methods of attack, surveillance or maintenance. The Chief of the Training Section has a vital role to play, contributing to but also drawing on the skills of all parts of the SNEM organization.

3.2.2 External Training

PAHO finances a number of out-of-country training courses annually. Zone III Chief has recently returned to post after extended study in Mexico, and the Chief of Zone I is currently

receiving external training. The Evaluation Team has noted elsewhere in this report the vital need for advanced training in epidemiology and entomology. The remarkable linguistic capacity of Haitians, many of whom speak Spanish and English in addition to French and Creole, makes it possible to take advantage of training courses available in Spanish-speaking Latin American countries and in the United States as well as French-language training.

3. 2.3 Advisory Support

PAHO is soon to replace its chief of party (the incumbent is soon to leave Haiti); presumably his replacement will be a well-qualified epidemiologist. The new man to be nominated should, if possible, be experienced in the important area of training, and give immediate attention to the creation of an effective in-country training section, the hands-on instruction and guidance of the SNEM training officer and the careful selection of candidates for external training. He should be supported by the short-term assistance of a training advisor familiar with the wide range of malaria training materials prepared for the instruction of senior malaria officials (and, indeed, the "training of trainers", which have been developed for use in WHO-supported training institutions in French-speaking Africa.

3. 2.4 Research-cum-Training

The field research activities which the Team recommends are not only crucial to the determination of program direction and success; they are also invaluable as a source of high-level training.

The incorporation of the research function into the training section should be considered; even if the two functions are not physically combined into a single unit, the need for full coordination of the two functions is apparent.

3.2.5 Public Cooperation

Although not itself a part of the pattern of training of SNEM's staff, the need to secure cooperative effort by the beneficiaries of anti-malaria activities is apparent; such cooperation can not only make SNEM's efforts more productive but can extend those efforts at little or no cost. It is appropriate that the campaign to elicit community cooperation through publicity, and through education within and outside the school system, should be directly associated with the training effort; in essence, these functions complement and extend the training of SNEM's staff.

3.2.6 Summary

The persistence of malaria in Haiti, at a time when the disease has virtually disappeared from the rest of the Caribbean area, points up the need for perfect execution as well as appropriate selection of intervention measures. The field research to determine the technical feasibility of interrupting transmission of malaria through the use of residual spraying of one or more of the three insecticides to be tested will require about three months for planning, nine months for the trials themselves, and three months of evaluation. This time must be used to bring to a fine edge the

skills needed for execution and evaluation of the program which is indicated by the results of the field research. Training, in country and outside, is one key to successful implementation. Another is the highest quality of advisory service.

Chapter IV Administration

4.1. Planning and Budgeting

Since January 18, 1977, under a revision of the long-standing Memorandum of Agreement among supporters of Haiti's anti-malaria program, (GOH, AID and PAHO), Haiti has been embarked on a program of malaria control. The agreed mission of the program was reiterated by SNEM in the Five Year Plan--a document which, prepared in 1977, provided in broad outline the courses of action to be followed in implementing the chosen strategy over the period 1978-82. Specific annual plans and their supporting budgets were to be submitted to an Executive Commiteee representing the three supporters of the program and chaired by the Minister of Public Health and Population (DSPP).

The annual plan is, in fact, a simple list of line items, prepared at SNEM headquarters. Totals of the cost-items are mathematically correct, but provide no indication as to the location of planned action. Once the annual "budget" is approved by the Executive Committee, only the grand total is used for financial guidance.

In fact, the 1978 action plan would have provided little guidance to Zone Chiefs, or even to Headquarters offices, since the document is not specific as to what each zone or office is supposed to do. Zone chiefs had no opportunity to participate in plan formulation, although semi-annual meetings to modify the action plan may provide some opportunity for field input. Actual instructions to the field do not become part of a total plan of operations; they are issued in the form of individual

letters, telegrams and even telephone calls. SNEM officials were unable to provide the revised 1978 plan of operations.

It should be noted, that, however fragmentary, the revised action plan represents reality far more than did the original action plan. This real plan is not reviewed by, approved by, or even communicated to the Executive Committee.

In 1978 SNEM undertook, without prior discussion with the Executive Committee, to alter its initially announced control tactics to incorporate the use of a relatively toxic, expensive insecticide, fenitrothion. Initial purchases were followed by increasingly larger and more costly second and third purchases. The efficacy of the insecticide under Haitian conditions is still to be revealed.

SNEM does not use the annual budget as a management tool. Monthly (and even annual) expenditures relate only casually to budgeted amounts that were established for the SNEM offices and field operations.

Periodically the Administrator deducts the accumulated obligated amount from the budget total to determine the amount available for other purposes. He has on occasion been obliged to commit funds which were not available, borrowing from the banking system to meet bills, and repaying when the gradual-release system of GOH finally makes funds available. This problem of liquidity of funds traces to an earlier decision and agreement with AID to use AID funds primarily for salaries and local-purchase

items, with GOH funds used primarily for commodity imports. Since GOH funds are released on a fractional basis, month by month, and AID funds on a reimbursement basis, bulk procurement of supplies for a projected year presents a serious continuing problem, causing at least some of the delays and curtailments of such field activities as mass drug distribution.

AID has, reportedly, made funding advances now totalling $250,000; further advances might help but not cure the problem As SNEM attempts to convert the program to one which is not only larger, but which involves an increasing proportion of offshore procurement requiring foreign exchange, the reasoning which led to the present unusual division of expenditures becomes less applicable. For numerous reasons, AID funds should be applied to offshore costs; GOH funds to ongoing expenditures such as salaries.

Figures presented to AID in claims vouchers for reimbursement appear to be entirely valid as to their totals, but may bear only a casual detectable relationship to the functional areas supported by these funds, or to the funds specified for these areas in the budget and plan of action. For example, AID was asked to reimburse 1978 expenditures for Evaluation and Statistics in the amount of nearly $522,000 against a total budget for the item of $222,000 and an AID share of $213,000—and did so! Much of this glaring discrepancy is accounted for by Drug Distribution, for which AID's maximum input had been established at $287,000, but for which SNEM made no claim. Thus, the problem of uncosted implementation of individual activities is compounded by SNEM's inability even to assign costs to the simple line-item budget categories.

Previous adjurations to SNEM to formulate a program budget to enable determination of the costs of each unit of activity have proceeded on the assumption that the SNEM Administrator was familiar with program budgeting, and that the SNEM Director was interested in management information. As he is the first to admit, the Administrator lacks the experience to institute the system; none of the elements in SNEM (with the notable exception of Assainissement) provides the kind of detailed reporting which would enable preparation of and use of a performance budget.

4.2. Organization

SNEM's organization (chart 1) traces back to the period of service of a former administrative advisor. Although it has not been revised on paper, the chart does not portray the effective organization of today's SNEM.

In fact, the earlier organization chart failed to provide for three vital needs of an operation as large and complex as SNEM: a planning unit, an audit capacity independent of general administration, and a training function. Public information (health education) is identified as a function of field operations. The Evaluation Team, on the basis of its observation of SNEM's organization, observes that the chain of command within SNEM is tenuous. So many decisions must be made by the Director that it is virtually impossible for him to devote adequate attention to the genuinely critical decisions. A more efficient delegation of authority and responsibility is imperative.

The Evaluation Team suggests an organization pattern (see chart 2) which endeavors to take into account the present structural weaknesses and omissions, and recommends it for SNEM consideration.

CHART 1

Existing SNEM Organization Chart

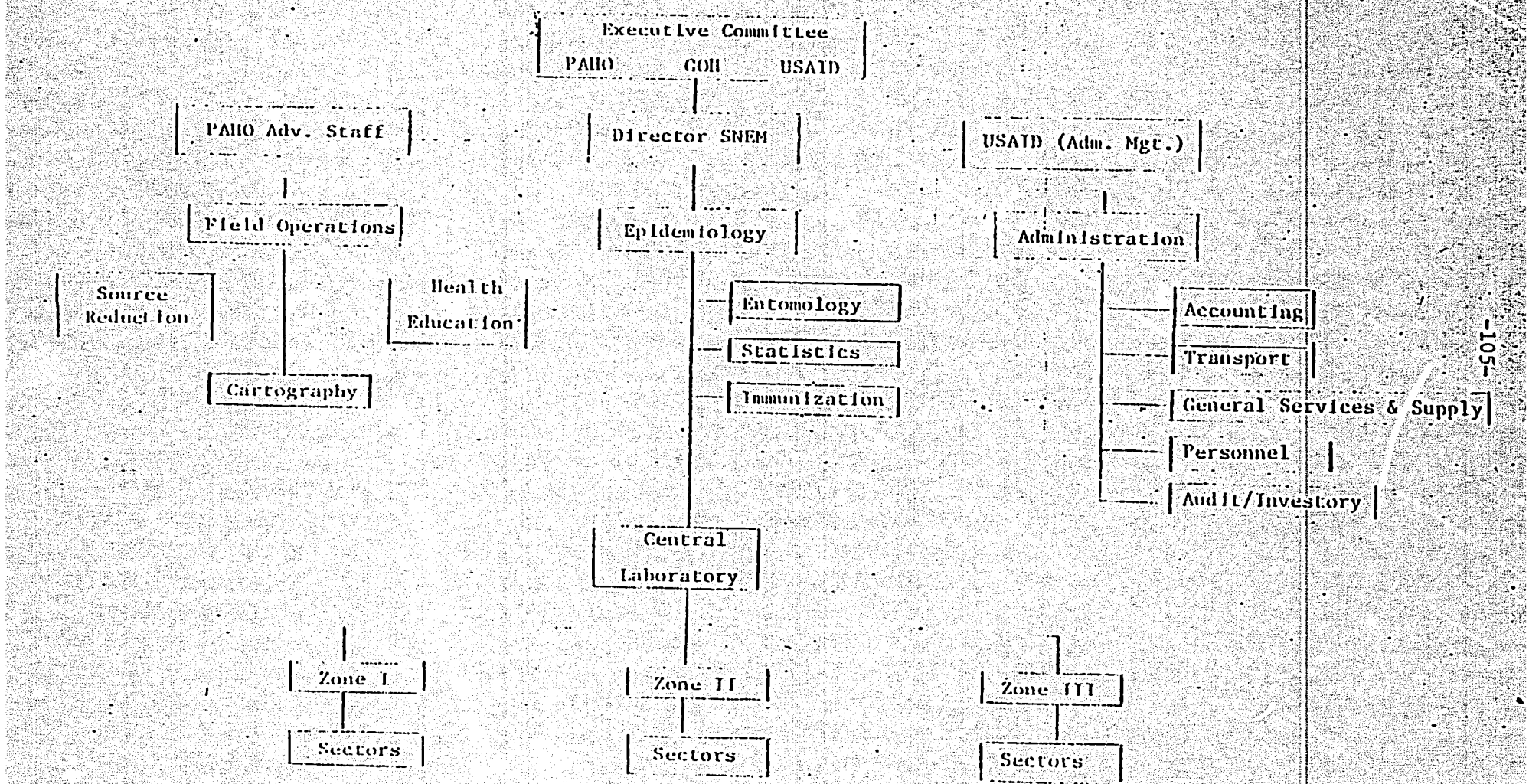
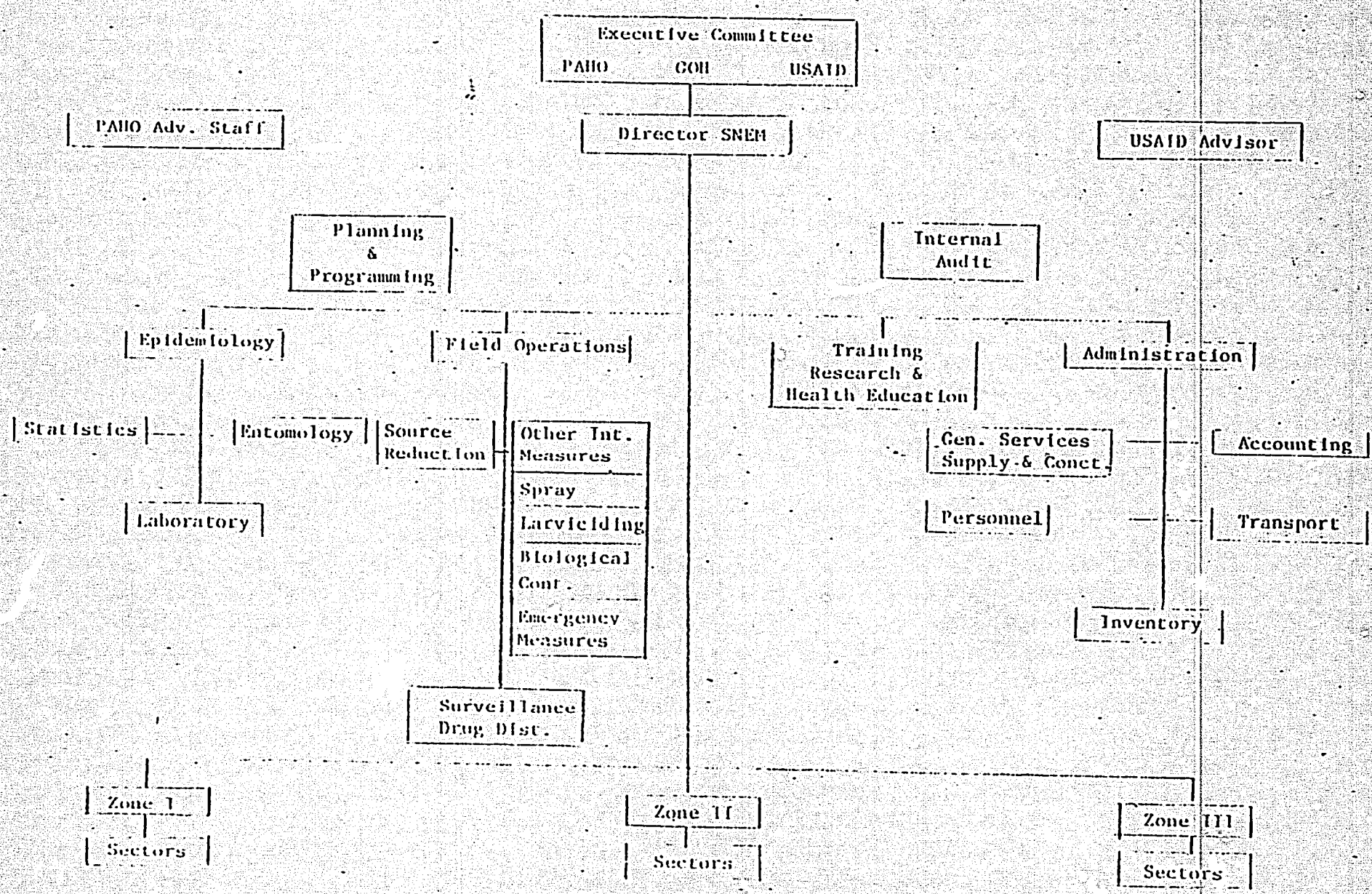


CHART 2

Proposed SNEM Organization Chart



4.3. Direction

An AID consultant observed some 2 ½ years ago that the personnel system of SNEM was well above average and compared with the best government personnel systems in many countries. He noted as plus-values the effective classification system, salary scales, promotion and pay policies, transfer policies, payroll procedures, etc.--all contained in regulations and being implemented.

They continue to be embodied in regulations, but implementation is less praiseworthy. Among other implementation breakdowns, the Team observed the following:

- Over the past 30 months a minimum of 31 transfers involving 16 Sector chiefs. Transfers were announced by curt telegrams of instruction from headquarters.
- Promotions not countenanced by regulation (listed as "Administratively determined".
- Creation of new positions not provided for in the classification system.
- Pay at rates not attaching to the level of the job in question.

As a pattern of operation, they evidence a situation of internal problems.

Promotions, assignment of equipment, transfers, salary policies--for all of these issues, each an area of potential problem unless standardized, there are personnel procedures and documents which give guidance on how to manage, how to reach decisions. Procedures are not being followed. A transfer, assigned as a punishment, may ultimately result in two, three or more other transfers--against which Division Chiefs have protested without success.

One particular set of transfers is totally inexplicable: at one location both the sector chief and the supervisor especially trained to provide proper guidance in the use of toxic insecticides have been transfered and replaced by untrained men.

4.4. Transport

The transport situation confirms the observations of the recent Audit Report. In effect, an excellent working system has been allowed to go downhill. Vehicles are indeed being maintained and repaired, but records are unavailable, stock inventories are low, vehicles are perforce cannibalized to make routine repairs, and service takes an inordinate amount of time. Zonal garages have requested but not received needed high-usage spares. When not available locally, spares must be air-freighted from the U.S.--an added and easily avoidable use of funds. Many vehicles are overage, expensive to operate and should be surveyed out.

A particularly glaring example: two grossly inefficient trucks, acquired at considerable cost from military excess. One has been cannibalized to the point of no return, the other is in constant need of repair. Even when in service, it has a payload of a vehicle half its size.

If SNEM is to be made responsible for repairing all DSPP vehicles, as is projected, SNEM's own performance must first be brought back to the standards which apparently existed in the fairly recent past.

CHAPTER V. ALTERNATIVE STRATEGIES

5.1. Introduction

Considering Haiti's small size and its location, a possible approach to the malaria problem might be eradication. The appeal for such an approach is reinforced by the successful results obtained in other parts of the Caribbean area.

It is possible, if not assured, that the malaria problem could be resolved if an eradication program covering the entire country were feasible. According to crude estimation, such a program would require annual expenditures of about $10 million for 6 years, followed by recurrent expenditure for the maintenance of the malaria eradication status, the location of the responsibility for which could depend on the state of Rural Health Delivery Service at the time of the achieved eradication. At this time, however, a classical malaria eradication program, relying heavily on residual spraying, cannot be held to be feasible, either technically or financially. There is as yet no residual insecticide demonstrated to have the capacity to interrupt transmission in Haiti; no plan of action has been prepared; the necessary financial input cannot be assured; and required expertise is not adequate for the taste.

There remains a second approach: a program of control to begin with, concentrating on areas of high endemicity and aiming at preventing sickness and death due to malaria and at reducing the incidence of the disease to levels meeting health and socio-economic requirements of the country.

A short description of the two above mentioned alternatives is outlined below.

5. 2. Short term eradication

Past experience has shown that eradication of malaria in highly malarious areas has been feasible only when a very effective residual insecticide was on hand and where a total coverage of the malarious areas was effectively carried out. If the trials proposed regarding a thorough evaluation of the effectiveness of malathion, fenitrothion and DDT prove that one (or possibly more than one) insecticide has the capacity to interrupt malaria transmission or at least to reduce it to a level sufficiently low that residual foci of transmission can be eliminated by additional measures, then it would be technically justified to embark on a malaria eradication program. In this approach the entire malarious area should be placed under a total coverage with a suitable insecticide and an efficient surveillance system. The highly receptive areas where persistent foci of malaria transmission were discovered in the past should immediately receive in addition environmental management and other additional measures such as the use of larvivorous fish to facilitate achievement and consolidate gains.

The implementation of the program should commence with an intensive preparatory phase of at least one year, during which the following activities should be carried out:

a. Staff training,

b. Completion of geographical reconnaissance including the mapping of all permanent vector production sources in persistent foci

of malaria transmission, and completion of detailed epidemiological (including entomological) survey,

c. Estimation of requirements for the whole duration of the program,

d. Setting up managerial services required and logistic arrangements and purchase and distribution of the required stocks of supplies and equipment for the next phase of the activities.

After the completion of the preparatory phase all malarious areas should be placed under spray coverage while a system of entomological and parasitological monitoring already established during the preparatory phase should be maintained at a high level of capacity. Spraying could be withdrawn from areas where endemicity has disappeared and transmission has been undoubtedly interrupted (no cases reported for at least two years) provided that the surveillance system is up to the required standard of efficiency. Source reduction and biological control measures, initiated since the start of the eradication program, would be boosted in the highly receptive areas in order to decrease their malariogenic potential and would gradually be extended to other less receptive areas.

With perfect execution, it is possible that if this strategy proves to be feasible and is correctly applied, interruption of malaria transmission could be achieved in the whole malarious area of the country, conceivably in six years or even less. Regular spraying operations could then be withdrawn from the entire country. The status of interrupted transmission could be maintained by continued surveillance operations and permanent mosquito control measures, particularly environmental management and biological methods.

These mosquito control measures will continue to reduce still further the receptivity to malaria in areas where the malaria potential was previously high, and therefore reduce the risk of re-establishment of malaria endemicity in vulnerable areas. In order to accelerate the above process, it would be appropriate that whenever residual spraying has been suspended in areas quickly responding to attack measures, the resources should be re-allocated to expand environmental management activities. As implementation of the eradication program progresses, the merging of the National Malaria Eradication Program with the Rural Health Delivery Services should be initiated and implemented in accordance with a plan prepared in advance and which coordinates plans for eradication with those for development of health services.

5.3. Malaria Control

The extent of malaria control activities and the degree of control to be achieved depends on the objectives of the program and the scale of resources made available.

In a country such as Haiti, where malaria is subject to exacerbation following unforeseen natural happenings, it is scientifically impossible to fix a level of control that could be maintained year after year. Therefore, for planning purposes it is more appropriate to set up achievement targets on the basis of the maximum number of cases permissible in a given population unit.

On the basis of 1978 surveillance data available there are 67 Section Rurales where the number of cases is higher than 30 cases

per thousand people. The combined population of these sections rurales is approximately 600,000 people. If one of the candidate insecticides (malathion, fenitrothion and DDT) is proved effective, those Sections Rurales should receive total spraying coverage combined with surveillance as well as biological control and environmental management.

In the remaining Sections Rurales, surveillance should be strengthened in all localities and be complemented by such anti-malaria measures as focal use of insecticide, other feasible mosquito control measures and mass drug administration in localities where transmission is considered high, e.g., more than 2-3 indigenous cases per locality per month for two consecutive months.

At the end of every year an assessment should be made of the malaria situation in every Section Rurale, and a new plan of action should be prepared for the following year.

As a first step, the program will aim at reducing malaria incidence in the country to a maximum of 10 cases per thousand inhabitants in any Section Rurale presently classified as highly receptive. Thereafter this threshold may be progressively lowered in accordance with additional resources becoming available to the program. This strategy will not be complete until linked to the development of the Rural Health Delivery Service (RHDS) in accordance with the plans for the gradual integration of the SNEM with RHDS prepared prior to program initiation.

The methods and techniques to be used have been discussed in the part of the report devoted to field operations, field observations

and evaluation. However, it is relevant to underline here the need for a better surveillance system.

The dual purposes of surveillance are (1) to collect epidemiological data for a continuous monitoring of the malaria situation, and (2) to serve as an attack measure on the malaria parasite through presumptive treatment of fever cases, and whenever indicated, for the radical treatment of confirmed cases. Monitoring of the malaria situation includes both parasitological and entomological data collection. Parasitological data should be collected through a system of motivated passive case detection, and it is imperative that the results of examination of blood specimens taken from fever cases in highly receptive areas be available at the most within two weeks so as to permit an updated evaluation of the situation, so that, whenever indicated, follow-up action may be initiated in time. The V.C. network may be strengthened by assigning an animating and collecting agent to every cluster of 10 to 15 V.C. posts. This represents on an average 30-45 localities per agent, with a population of about 9,000-10,000 people. This agent, who should, where necessary, be provided with a means of transport (bicycle or motorcycle) will call weekly on the V.C.s working in his area of operation, will supervise their work and collect the slides they have taken, and will deliver these slides to the nearest laboratory for prompt examination and return of the results. At the time when a blood specimen is being taken from a present or recent fever case, a presumptive treatment should be administered as a single dose according to posology recommended by the World Health Organization.

Each Zone of operation should be stratified into homogeneous eco-epidemiological areas. In each of these well defined epidemiological areas there should be at least one fixed entomological monitoring station (4 stations in each Zone would be an acceptable number) so that in each zone an entomological group comprising a Senior Entomological Technician, a Junior Entomological Technician, two Field Supervisors, and 8 Insect Collectors would be able to carry out the appropriate observations on a fortnightly basis.

It should be emphasized that, to be effective, entomological teams should have sufficient and reliable means of transportation, laboratory facilities should be made available in each Zone, and one skilled laboratory technician should be assigned to processing the collected material and keeping records.

CHAPTER VI RECOMMENDATIONS

The following recommendations are listed in the sequence of the several chapters and sections of the report which provide the data supporting Team judgments.

6.1. Epidemiology and Field Research

6.1.1. It is universally recognized that in relation to malaria and to any other disease, epidemiological factors should govern the selection, mode of application and periodicity of appropriate intervention measures.

Recommendations

a. Using past information, complemented by further studies and utilizing technical criteria, the malarious area of the country should be subdivided (stratified) into homogeneous eco-epidemiological strata.

b. Following such stratification and limited field trials, intervention measures most likely to have an impact on the malaria transmission process should be preselected on the basis of probability of success and thereafter given more extensive field testing in order to evaluate for each measure its effectiveness, cost and applicability under operational conditions.

c. The materials, periodicity and place of application of such intervention measures as larviciding and fogging should be fully re-evaluated so that their use may be justified on technical, operational and financial grounds. Both have their place, and may appropriately be used under appropriate conditions, but their use under conditions for which these measures are not suited is to be avoided on economic and technical grounds.

6.1.2 An effective epidemiological monitoring of the malaria situation is essential for the planning, conduct and evaluation of any anti-malaria program. An effective surveillance system is an integral and vital element of epidemiological monitoring.

In Haiti, the surveillance system is also inseparable from the continuing effort to reduce the morbidity and mortality which are produced by untreated malaria. The Evaluation Team has found the existing system to be less than fully efficient, unnecessarily large in some respects, and susceptible to substantial improvement at no increase in cost.

Recommendations

a. The present corps of employees and voluntary collaborators (VC) involved in taking slides and administering drugs should be made more efficient by relating its size and composition to the eco-epidemiological stratification proposed under Recommendation 8.1.1.a, above, concentrating manpower and attention on localities with high malaria incidence. VC's in low or zero incidence areas where transmission is unlikely to occur should be drastically reduced in number, while limited increases should be made in areas of high incidence where a need and potential benefit can be demonstrated.

b. A scale of attention to these VC by SNEM personnel should be devised whereby posts in less important areas receive supervision at bimonthly or greater intervals by the marcheur.

c. For areas of higher incidence, SNEM personnel presently used for evaluation and drug administration should be consolidated into one job designation which involves VC supervision, slide collection, active case detection, case investigation, mass drug administration, presumptive treatment, or other special case treatment. Each of these employees should be given a route of localities; responsibilities should be in accordance with the specific program for each locality. Frequency of attention to localities should be based on reported malaria incidence and should be weekly except where incidence is low or sporadic and no special drug administration is programmed.

d. The registration system must be improved.
   1. A worksheet should be maintained to tabulate dam of taking the slide by locality before transfer to the section rurale cards.
   2. Data collection forms are unnecessarily detailed; these should be reviewed and unnecessary or repeated items eliminated.
   3. Separate columns for different types of malaria searches on the registry are needed. The different varieties of active search must be consolidated.

e. Above all, the data produced by this system must be used to program and evaluate control measures. A formal system needs to be established whereby malaria data from areas under specific measures are routinely registered, tabulated and reviewed.

6.1.3. The Entomological Section is understaffed; much of its present effort is dissipated in operational activities such as larviciding and fogging.

Recommendations

a. After appropriate recruitment, training of new personnel and retraining of present personnel, the Entomological Section should be reconstituted to enable it to assume its expected (and vital) duties in the field of epidemiological monitoring, operational evaluation and applied research. In addition, the necessary transport, laboratory and insectary facilities must be made available.

b. The type, time, periodicity and quality of applied intervention measures must always be correlated with epidemiological data.

6.1.4. Successful anti-malaria programs have almost universally incorporated a training-cum-research element. Such an element is essential for the proper selection of intervention measures and for their appropriate application.

Recommendations

a. SNEM should institute a training-cum-research program which would have (among others) the following purposes:

(1) Training auxiliary staff and further development of professional personnel in epidemiological methodology and evaluation and assessment procedures.

(2) Studying factors hampering program progress to determine their cause and identify practical solutions to any impending problems.

(3) Testing new weapons and techniques and adjusting them whenever required to prevailing local conditions through well-controlled field trials. In particular, properly sited and planned pilot projects should be

carried out for the epidemiological evaluation of all candidate residual insecticides considered for operational use, including fenitrothion, malathion and DDT. None of these (nor any other residual insecticide) should be put into operational use until its capacity to interrupt transmission under Haitian conditions has been demonstrated.

6.1.5. In any country, the epidemiological situation must be reviewed in the light of the malaria conditions within the country, but also in the light of possible mutual impact with neighboring countries having common borders and/or similar eco-epidemiological patterns.

Recommendations

a. Exchange of technical information should be encouraged through regular reports and periodic and ad hoc inter-country meetings.

b. In line with established WHO policy, related to technical cooperation among developing countries, cooperation between Haiti and its Caribbean neighbors should be promoted in the fields of exchange of scientific workers as well as information on malaria conditions.

6.2. Intervention Measures

6.2.1. Residual spray: Proper application of a residual spray of demonstrated capacity to interrupt transmission is the most effective attack measure to bring about a rapid reduction in malaria incidence and malaria transmission. Two organophosphorus compounds, fenitrothion and malathion, are under present consideration; DDT may also retain comparable effectiveness. In the body of this report are set forth the details of a comparative test of these insecticides, under controlled conditions and in areas falling into the same eco-epidemiological stratum. Conduct of such tests will provide a determination of the relative efficacy of each insecticide under Haitian conditions. To the extent that

test results show that one of the insecticides has a marked superiority to competing compounds, it would become the insecticide of choice. Should two (or even all three) demonstrate positive but comparable results, the least expensive should be the insecticide of choice.

Recommendations

a. Three field research projects are urgently needed to test definitively the effect of DDT, fenitrothion and malathion on the interruption of transmission. These pilot projects should be sited in contiguous areas of high endemicity with about 50,000 population each. The one selected for the DDT trial should present or have presented evidence of resistance to this insecticide.

b. These field research projects should not start until a very complete plan of operations is drafted with thorough specifications with all pertinent details on how to conduct the epidemiological, including entomological, and spraying activities.

c. The director in charge of the three projects should be a competent malariologist capable of strict adherence to the plan of operations. He should report directly to the Director of SNEM.

d. To analyze the results of these field research projects, an advisory committee is necessary. This committee, to be appointed by the Executive Committee in consultation with the Director of SNEM, should be kept regularly informed of progress under the three pilot projects. At the end of one year, the Advisory Committee should meet to select the insecticide to be used operationally.

e. Pending the outcome of these field research projects, operational use of residual insecticide should not be initiated in any new area.

6.2.2. Larviciding: In the limited areas where larviciding is appropriate, supervision of both operational use and evaluation should be strengthened. Larvicides applied irregularly and to widely scattered breeding areas cannot properly be evaluated.

Recommendations

a. Larviciding should be restricted to those areas, primarily urban and periurban, where its use is demonstrably cost-effective and its application and evaluation can be well-supervised.

b. Larviciding should under no circumstances employ an insecticide which is to be employed as a residual insecticide.

6.2.3. Fogging: No entomological/parasitological evaluation of the effectiveness of fogging under Haitian conditions has yet been carried out. This measure of attack requires, under all circumstances, particularly careful timing in application. It is normally considered an emergency measure, to be used to deal with epidemic conditions.

Recommendations

a. In view of the great commitment of effort and resources entailed in large-scale fogging operations and the well-known dependence on appropriate weather conditions to secure maximum impact, it is strongly recommended that before proceeding with thermal fogging on an operational scale a series of field trials should be conducted as soon as possible to provide proper entomological and parasitological evaluation of this operation under Haitian conditions.

b. To reduce the danger of resistance development to organophosphorus insecticides which may be used for general residual application, malathion should not be used for fogging purposes.

6.2.4. Biological Controls: In Haiti, the only form of biological control in present use in the antimalaria program is the distribution of larvivorous fish and their introduction into potential mosquito breeding places. The use of this measure has the advantages of being inexpensive, easy to apply and free of any tendency to contribute to mosquito resistance to insecticides. Experience elsewhere has shown that this form

of biological control is generally effective as a supplementary measure.

Recommendation

a. A controlled experiment should be conducted to determine effectiveness (under conditions in Haiti) of larvivorous fish (including those locally found) in reducing anopheline population.

6.2.5. ULV: The application of insecticide through ultra-low volume aerial spraying has been shown to be an effective technique for bringing about a quick reduction in anopheline population, but widespread and necessarily repeated application of the measure would be expensive and would, above all other measures, place selection pressure against the vector, offering the probability of the most rapid obsolescence of any insecticide used. The only use of ULV to date is reported to have reduced the mosquito population in the test area, but to have produced no evidence of interruption of transmission of malaria. It should be observed, however, that the test was of too short a duration to provide conclusive results.

Recommendation

a. ULV spraying should be reserved for possible use to combat epidemics, and then only in major populated areas.

6.2.6. Source Reduction and Environmental Modification

6.2.6.1. Concentration of effort

Important but expensive, it is readily apparent that environmental modification is not something which can be conducted everywhere in the short run. A concomitant of socio-economic development, it can be expected, in major

part, and in the long run, to be carried out by public and private entities other than SNEM. SNEM's budget can and should encompass work which is directly related to vector control in critically important sites--especially in those sites where high vector density increases the danger of widespread malaria transmission to large bodies of population, or endangers work of major economic significance. However, source reduction is particularly appropriate in those localities where perennial transmission has been demonstrated.

Recommendations

a. The Section d'Assainissement should continue and, as funds become available, augment its environmental modification effort, concentrating that effort in those areas where high vector density increases the danger of widespread malaria transmission to large bodies of population, or endangers work of major economic significance.

b. Drainage and similar source reduction efforts may appropriately be undertaken to reduce vector density and malariogenic potential in localities where perennial transmission has been demonstrated.

6.2.6.2. Significance of Baseline Data

Although the work of the Section d'Assainissement was generally well-executed, the location of some minor source reduction activities appears to bear little relationship to either malaria prevalence or vector density.

The relationship between conditions conducive to high vector density and environmental modification is at least in some instances tenuous. Even in those cases where environmental modification efforts appear appropriately sited, work does not appear always to have been initiated on the basis of pre-project baseline data which would enable measurement of

effectiveness through post-project checks of vector density and detected malaria incidence. The activity itself is too important to allow its effectiveness to be discounted because it cannot be measured.

Recommendation

a. Prior to the initiation of any work of environmental modification, the locality in question should be subject (in addition to an engineering survey) to entomological and epidemiological study to assess the magnitude of the problem to be overcome. Such baseline data, in comparison with similar post-project measurements, enable an evaluation of the effectiveness of the completed projects in reducing the potential of the project locality for vector breeding and for malaria transmission.

6.2.6.3 Mechanization

Many of SNEM's drainage activities could be executed more rapidly, more efficiently and quite probably at a lower cost through the application of relatively simple mechanization. At present, these activities are being executed by casual labor. As a device for creating rural employment, this use of hand labor has a measure of appeal. However, since SNEM's function is malaria control, rather than work relief, the speed and effectiveness of execution becomes a major consideration. Simple and relatively inexpensive mechanization (e.g., the backhoe) would cut execution time (in appropriate areas) with equivalent savings in manpower costs which could be applied to the acquisition of equipment.

In any event, the availability of adequate trucking to convey construction materials to project sites is imperative, and the present truck fleet is in urgent need of augmentation. The importance of SNEM's vehicle fleet and its systematic

renewal is discussed elsewhere in this report; of all the vehicles currently available to SNEM, the heavy truck component is in greatest need of attention.

Recommendation

a. The proposed budget for vehicle fleet renewal should be protected against competing claims for financing, to assure (among other things) the availability of funds to replace the grossly inadequate truck supply.

b. SNEM should undertake a demonstration of the utility of the backhoe in the rapid and efficient completion of source reduction efforts (units are readily available in Haiti for such a test). Should the test demonstrate a favorable ratio of output to cost and shorter completion time and improve the work quality, SNEM should consider a substantial movement from the present virtually total reliance on hand-labor to a rational mix of mechanized and hand operations.

6.2.6.4. Coordination of work of entities which have impact on malaria

Environmental management and source reduction represent lasting and, if maintained, permanent measures to reduce vector density, and as such have a continuing role in anti-malaria efforts.

Major environmental management projects are frequently multi-purpose, producing important benefits to neighboring communities and contributing to the work of such elements of the central government as the Department of Agriculture, Irrigation Service and the Department of Public Works. Conversely, the activities of these Departments may and frequently do have an impact, favorable or unfavorable, on vector density.

The magnitude and cost of such efforts will frequently place them outside SNEM's capacity to execute or finance,

especially where the principal purpose of the project is other than malaria control. Nevertheless, SNEM should have a role to play in the planning of such efforts.

To assure full recognition of the need to execute such projects in a manner which will, if possible, reduce or eliminate vector breeding sites, and will in any event not produce new breeding sites ("man-made malaria") it is necessary to create a mechanism for coordinating the design engineering of such projects. Such a body, might appropriately be called the Environmental Management Engineering Committee; most certainly, SNEM should be a full member and the SNEM Chief of Section d'Assainissement should serve as secretary. This body, meeting regularly to discuss engineering plans of projected activity, would provide SNEM an opportunity to be aware of such activities prior to execution, and to offer SNEM's services, at no cost, to make such design changes as would eliminate those features of projects which would foster vector breeding.

Recommendation

a. Through its parent organization, the Ministry of Public Health and Population (DSPP), SNEM should take the lead in establishing an interdepartmental group which would be responsible for assessing, in terms of the potential impact of the project on increasing or reducing vector densities, the design of projects which would result in environmental management (e.g., highways, irrigation projects). Through this body, which SNEM might well chair, SNEM would offer its services, without charge, in modifying engineering design in such a manner as reduce or eliminate vector breeding sites or, at a minimum, avoid the creation of new sites.

6.2.7. Drug Distribution

Drug distribution--presumptive treatment, radical treatment and mass drug administration--has played an important role in reducing morbidity and mortality from malaria in Haiti, and in fact has constituted an intervention measure as well. During the period of field testing of residual insecticides under consideration, drug treatment should be considered the mainstay of the anti-malaria effort in Haiti. Recommendations for consolidation of personnel in the surveillance system must be considered in relation to the following three recommendations.

Recommendations

a. Radical treatment should be suspended until a time when malaria incidence is so low that eradication appears imminent and the effectiveness of radical treatment in reaching that goal can be demonstrated.

b. Presumptive treatment by voluntary collaborators (VC) should continue as modified by suggested changes in the VC network.

c. In areas of high incidence an active search for and presumptive treatment of fever cases should supplement the VC system.

d. Mass drug administration should be used in areas of high incidence with the purpose of reducing morbidity and mortality. Timing, length of cycles, and duration of application need to be determined on the basis of analysis of current data and field applied research.

6.3 Advisory Services

6.3.1. Without question, the recommendations advanced in this report will require maintenance of the long-term, full-time advisory effort, augmented by medium-and short-term support in critical areas. Most significant is the need for a particularly well

qualified and experienced advisor who will assume responsibility for and full control over the planning, execution and evaluation of three field-research projects. The purpose of these projects is to determine the technical feasibility of interrupting transmission of malaria in Haiti through the use of one or more of three candicate insecticides used as a residual spray. Other field research projects and courses of action recommended will require additional advisory support, largely short-term.

The existing Memorandum of Understanding among GOH, AID and PAHO does not appear to provide either the flexibility or the assurance of continuity implicit in acceptance of the recommendations of this report concerning the number, the qualifications and the responsibilities to be assumed by advisors, and appears to be quite rigid in prescribing the kinds and sources of advisory services to be provided. For these and other reasons, it may be necessary, and it would certainly be desirable, to reconsider and renegotiate the terms and conditions of the present Memorandum of Understanding.

Recommendations

a. In view of the imminent departure of the two senior members of the PAHO-provided staff advising SNEM, PAHO should proceed without delay to recruit replacements for the chief of party and the sanitary engineer. The new chief of party should be a well-qualified, malaria-experienced epidemiologist. Preferably, he should be experienced in the important area of training, to enable him to provide continuing support to the Haitian chief of training (a post to be created under another recommendation), although this function could be discharged by another advisor.

b. Recruitment of a particularly qualified and experienced advisor for the Team-recommended field research projects (to test the feasibility of interrupting malaria transmission through use of three candidate residual insecticides) should be initiated at the earliest possible time. His role should include operational control as well as planning and evaluation. Direction of these field research projects could be provided by AID or by PAHO; the question is not the source of this advisor, but the ability to locate and recruit him. His period of service would in all probability be limited to the time required to plan, execute and evaluate these field trials.

c. Shortcomings in SNEM's utilization of a number of management tools already available, coupled with the probable realignment of the uses to which AID-provided and GOH-provided funds will be put, strongly support the conclusion that AID should restore the full-time services of a well-qualified management advisor. The extent of AID's participation in Haiti's anti-malaria effort makes it not merely prudent but imperative to continue to provide the services of a well-qualified, experienced malaria specialist.

d. Short-term advisory services should be provided, by AID or PAHO, to assist the new Haitian training chief in preparing course material for the important task of training new staff, and retraining existing staff, in the proper application of methods of intervention. The advisor could well be selected from candidates already familiar with French-language training materials created for use in WHO-sponsored African training courses, to be adopted or adapted as necessary.

e. The management advisor (recommendation 6.3.1.c. above) may wish AID to supply short-term consultants in personnel management and vehicle maintenance to assure against further dissipation of gains achieved from previous advisory effort.

f. GOH, PAHO and AID should re-examine the existing Memorandum of Understanding in the light of recommendations of this report to determine the desirability and/or the need to reconsider and possibly renegotiate its provisions.

6.4. Training

6.4.1. The importance of effective pre-service, on-the-job (OJT) and refresher training to the successful implementation of anti-malaria programs has been widely recognized. SNEM has opted to use a combination of OJT and PAHO-provided high-level external

training; there is at present no provision in the SNEM organizational structure for in-country training.

Recommendations

a. SNEM should, at the earliest possible time, establish an In-Country Training Section, headed by an officer possessing both taste and talent for the important task of providing to others the knowledge and skills--and the motivation--to carry out their parts in the anti-malaria effort. (See also Recommendations 4.3.1.a and c. above concerning essential continuing and short-term advisory support).

b. The chief of the new Training Section should also be responsible for, or at least be able to take full advantage of and have a functional relationship with the research-cum-training effort described in the body of the report.

c. The campaign to elicit community cooperation and support of SNEM's efforts--not only in the acceptance of anti-malaria drugs but in participating in construction of and maintenance of source reduction activities should be directly associated with the training effort, since they complement and extend the training of SNEM's staff.

6.5 Administration

6.5.1. Personnel Administration; Vehicle Maintenance and Replacement.

SNEM's personnel system, as set forth in its printed regulations, appears to be excellent; while it is apparent that many job descriptions would be modified (and, indeed, some would be totally altered through compression of functions now assigned to several classes of employees), the need for a new system is not pressing. There is indeed a need to put into practice the personnel system already on the books.

Similarly, the recommendations of the Puett report are considered to represent excellent guidance in the important area of vehicle replacement and maintenance. In practice, vehicle replacement has been deferred in favor of large-scale purchases

of fenitrothion, and an excellent maintenance system is gradually disappearing through poor record maintenance and failure to make timely purchases of essential spare parts.

Recommendations

a. The Team makes no proposals in these areas beyond the strong recommendation to put into practice the personenl system, vehicle replacement schedule and maintenance system already embodied in SNEM's regulations or contained in earlier recommendations of well-qualified consultants in these fields. See also Recommendation 5.3.1.b and e. above, concerning advisory services.

6.5.2. Procurement. SNEM faces serious difficulties in making the advance procurement of commodities, the manufacture of which requires a long lead time, yet which must be available on time if activities are to be conducted on schedule. A major contributing factor is the problem of liquidity of funds, tracing to a previous decision to use AID funds primarily to meet current obligations (salaries, petroleum products, etc.) while undertaking major procurement through use of funds provided by GOH. While AID funds are provided on a reimbursement basis, the Team understands that AID advances of funds now total $250,000. GOH funds are released fractionally, month by month; the problem of advance procurement is serious and sometimes crippling.

Without commenting on the highly unusual situation in which funds supplied by an external donor are used for in-country expenditures while funds supplied by the host government are used to meet commodity requirements calling for foreign exchange, it appears probable that if other recommendations of the

Evaluation Team are accepted, the balance between foreign exchange needs and gourde expenditures may be altered.

Recommendations

a. The Team has observed in Recommendation 6.3.1.f. above, the desirability and, indeed, the need for re-examination and renegotiation of the existing tripartite Memorandum of Understanding. In the process of this renegotiation, the question of appropriate utilization of funds should be fully explored. A simple advance of funds does not appear to provide the answer.

6.5.3. Planning. SNEM's annual plan of action and supporting budget fail to reveal any detail of proposed field activity, nor are these documents based on field inputs. Neither does SNEM consider them to represent either a commitment to a course of action or a constraint on subsequent program modification; only the total of the annual budget (as approved by the Executive Committee) is used for financial guidance.

In Sec. 6.5.4 the Evaluation Team proposes a restructuring of SNEM to provide a firm locus of responsibility for a number of functions now not covered in SNEM's organization chart, or so sited as to assign implementation and verification to a single unit. One of the functions contained in the recommended restructuring is an Office of Planning and Programming, responsible to the Director but designed to draw on the inputs of all of SNEM's major divisions, including the three zones, as well as its advisory staff.

Recommendation

a. The annual plan of action and supporting budget should represent firm proposals; when approved by the Executive Committee, these documents should limit SNEM to the implementation of such proposals.

6.5.4. Organization. SNEM's present organizational structure makes no provision for a planning and programming unit, a training function, any kind of operational research, or an independent audit capacity. In general, the organization appears to be overcentralized, providing for inadequate delegation of authority and responsibility.

Recommendation

a. SNEM should adopt the alternate organizational structure outlined in Section Administration. There may be valid reasons to modify some allocations of functions; for example, Haitian custom to combine inventory and internal audit may be a compelling factor. However, the organizational pattern adopted should under any circumstances provide for:

1. A planning and programming unit
2. A distinct training function at the division level
3. An independent audit capacity.

6.6. Coordination and Guidance. In other parts of this report, the Evaluation Team has urged the coordination of certain of SNEM's efforts with those of other entities whose interest in malaria may be tangential but whose impact may be direct and, in some instances, negative (see Recommendation 6.2.6.4.a, above). The thrust of this recommendation is to maximize SNEM's influence over engineering plans for activities which, properly directed, could help reduce anopheline breeding sites.

The coordination effort above recommended should in fact be an element in a broader coordination of antimalaria activities with those of other agencies and scientific institutions having a direct interest in, an influence on or being adversely affected by malaria.

Recommendation

a. The Evaluation Team recommends the organization of a Malaria Board, under the chairmanship of the Minister of Public Health and Population, with membership at the highest level from all other agencies and scientific agencies concerned with malaria from the standpoint of interest in, influence on and capacity to assist, or vulnerability to the adverse impact of malaria. The Malaria Board would be charged to review plans for antimalaria activities and take necessary decisions for coordination of their own planned related activities with those of SNEM.

6.7 Control. The foregoing recommendations detail the views of the Evaluation Team as to courses of action to determine the feasibility and the time-frame implicit in various approaches to the anti-malaria effort in Haiti. Decisions should be reached on the basis of scientifically conducted field research and careful evaluation of results. Thereafter, program decisions on intervention measures should be made on the basis of epidemiological and entomological findings, within the framework of eco-epidemiological stratification of the country's malarious areas.

It should be noted, however, that the Executive Committee is empowered to determine the measures appropriate to the realization of the objectives of the program, in conformity with the terms of the Memorandum of Agreement itself; to require of the SNEM Director regular and special reports as deemed necessary; to meet every three months (or more frequently) to provide program rules and guidance, with an agenda to be distributed two weeks before the meeting to enable study and collection of necessary information. In other words, the Executive Committee has and should use every opportunity to inform itself on the state of the SNEM and to decide on the strategy to be followed.

Annex 1

List of Individuals and Organizations Consulted

A. Departement de la Sante Publique et de la Population. (DSPP) Port-au-Prince

Dr. Willy Verrier, Secretary of State for Public Health
Dr. Evariste Midy, Director, Bureau of Planning and Evaluation
Dr. Francis Milord, Chief, Executive Unit for Regionalization

B. USAID/Haiti

Mr. Lawrence Harrison, Mission Director
Mr. Allan Furman, Deputy Director
Dr. Willard H. Boynton, Chief, Public Health
Mr. Edwin T. McKeithen, Acting Chief, Public Health
Mr. Roger Grenier, Malaria Advisor (contract)
Ms. Linda B. Morse, Nutrition Advisor
Mr. William Rhoads, Economist
Mr. Joel Cotton, Mission Evaluation Officer
Ms. Sylvie Kulkin, Health Projects Manager

C. American Embassy, Haiti

Ms. Anne Carey, Economics Section

D. PAHO/Haiti

Dr. Carlos Pettigiani, PAHO Representative a.i.
Dr. Jorge R. Linares, Malariologist/Team Leader
Ing. Gustavo Tapia Murillo, Sanitary Engineer
Mr. Bernard Feinstein, Entomologist
Mr. Antonio Benitez, Sanitarian
Mr. Ramon Figueroa, Sanitarian

E. Pacific Consultants

Dr. J.S. Prince

F. SNEM (Partial list of individuals consulted)

Dr. Charles Dambreville, Director
Mr. Jacques Debrosse, Administrator
Dr. Eberte Prophete, Chief, Epidemiology Section
Ing. Morylle Gattereau, Chief, Field Operations Division
Mr. Marc Solis, Chief, Entomology Section
Ing. Raymond Lahens, Chief, Source Reduction Section
Mr. Alexandre Gutierrez, Chief, Personnel Section
Dr. Jean Claude Ambroise, Chief of Transport
Dr. Roland Oscar, Acting Chief, Zone I)
Zone II)----and their staffs
Dr. Vely Jean Francois, Chief, Zone III)

Annex 2

Team Scheduling

After preliminary arrangements and appointments had been made by the Team Leader, the Evaluation Team arrived on Sunday, April 1. After briefing meetings with the USAID Contract Malaria Advisor, Mr. Roger Grenier, and the USAID liaison Officer, Dr. Willard H. Boynton, the Team met briefly with the USAID Director Harrison and his senior staff, with the Secretary of State for Public Health, Dr. Verrier and staff and with Acting PAHO Representative Pettigiani.

A week of intensive meetings with senior staff mebers of SNEM and SNEM's PAHO advisory staff ensued--some as group meetings and discussions, some as conversations, discussions and data review and compilation. No comprehensive background material had been prepared by SNEM, and it proved necessary to explore innumerable records and files, at Headquarters and in the field, to secure data needed for the evaluation. It must be noted, however, that SNEM personnel at all levels were infailingly cooperative.

Dr. Dambreville was not in Haiti during the first portion of the Team's evaluation, due to his participation in a regional malaria meeting in Mexico; accordingly, the Team had no opportunity to meet with Dr. Dambreville until the evaluation was well advanced.

Field trips included a two-day visit to activities in Zone II: a six-day exploration of activities in Zone III (where, in particular, ongoing field trials of fenitrothion and malathion were evaluated); and a five-day examination of activities in Zone I.

The Team was accompanied on all field trips by SNEM senior staff and members of the PAHO advisory staff, as well as by the USAID contract advisor. Their support was uniformly excellent.

Following the field survey, the Team requested additional data; some tabulations were developed by Team members in conjunction with SNEM staff. Dr. Dambreville met with Team members--in particular, with the Team leader--and responded willingly and in detail to inquiries as to his program strategy, his reasons for wishing to abandon malaria control in favor of a fenitrothion-based program of eradication, and his views on optimum methods of application of this insecticide.

The report itself represents the findings, conclusions and recommendations of the entire Team.

Conclusions and recommendations have been discussed with the Secretary of State for Public Health, with the PAHO representative a.i., with the PAHO advisory staff, with the USAID Director and his staff, and with the Director of SNEM and his staff--including Zone Chiefs who were called to Port-au-Prince for the discussion.

The Team wishes to express its gratitude to Ms. Donna Schroyer, attached to Dr. Boynton's staff during the Team's stay in Haiti, whose unflagging efforts in providing administrative support substantially assisted the Team in carrying out its assignment. Similarly, the ability of Mrs. Pamela Thornton to decipher the diverse and individualistic handwriting of the Team members, and Mrs. Thornton's willingness to work on holidays and Sundays, at home or in the primitive office space provided, made it possible for the Team to complete its work on schedule.

Annex 3

Locations Visited

Zone I

Baie de Henne
Bois Neuf
Bombardopolis
Cap Haitien
Fort Liberte
Gonaive
Jean Rabel
Limbe
Mont St. Nicolas
Valle de Artibonite

Zone II

Cite Simone O. Duvalier
Jacmel
Leogoane
Marigot
Port-au-Prince area

Zone III

Anse a Veau
Aquin
Les Cayes
Macaya
Petit Riviere de Nippes
Port Salut
Roche a Bateau
St. Louis du Sud