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**THAILAND NATIONAL MALARIA CONTROL PROGRAM
EVALUATION REPORT**

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1. INTRODUCTION

1.1 Purpose

The Malaria Project Evaluation Team was asked to evaluate the degree to which the National Malaria Control Program has attained its objectives as delineated in Health Development Plan No. 5 (1982-1986); to assess the contributions of the USAID-funded Anti-Malaria Project to the achievements of the RTG Anti-Malaria Program; to determine the unmet needs of the Anti-Malaria Program; to make recommendations for improving the effectiveness of the program; and to review available resources and potential external assistance for meeting the needs of the program. (For detailed terms of reference see Annex 1, Scope of Work.)

1.2 "Modus Operandi"

At the initial briefing session for the Team, the Malaria Division presented a tentative schedule for the Team activities which was agreed to without change. The itinerary for field visits included problem areas in each of the 5 regions as well as regional, zone (unit), sector and village activities.

1.2.1 Field Visits

During the 22 days of field visits, the Team inspected all 5 regional offices, 9 zone offices, 13 sector offices; met and talked with 54 regional officials, 33 zone and assistant zone officers, 64 sector officers, 15 field workers, 6 malaria volunteers, 4 health volunteers; visited 26 malaria clinics, 1 health center, 6 hospitals and traveled 4,500 kilometers by plane and 3,080 kilometers by microbus. (For detailed itinerary of field visits see Annex 2.)

1.2.2 Reporting

At the initial briefing sessions at USAID and at the Malaria Division it was emphasized that much information on the project was already available through the USAID Anti-Malaria Project Mid-Term Evaluation of 1981 and the Final Evaluation of 1983 as well as the Assignment Reports of the Project Monitor, Richard B. Kalina. It was therefore indicated that the Team should concentrate its efforts on updating of the information for the one year extension of the project and devote most of its efforts to a careful analysis of the available information in terms of its significance for future planning.



1.3 Executive Summary

The Evaluation Team has visited problem areas of all five regions, discussed problems with all levels of office, laboratory and field personnel and to the extent possible attempted to address all of the issues contained in the Scope of Work (Annex 1).

The Team wishes to make it clear that it considers the Thailand Anti-Malaria Program to be a well-organized and operated program with many unique features worthy of duplication in other country programs. In keeping with the terms of reference in the Scope of Work and the instructions given in the initial briefing, the Team has concentrated on an analysis of problems and suggestions for improvement. In so doing it has been necessary to identify weaknesses. Criticism is given in the spirit of finding ways of making a good program better.

The Team has concluded that the USAID-funded Anti-Malaria Project has been carried out efficiently for the most part and has contributed to the achievement of the objectives of the RTG Anti-Malaria Program. Although the stated objectives of the Malaria and Vector Borne Disease Control Program/Health Development Plan No. 5 (1982-86) have not been completely met, substantial progress has been made and further progress can be expected.

However, there are a number of serious problems impeding further progress in reducing the incidence of malaria in Thailand. The Team is of the opinion that the overriding need at the present time is to develop a long range plan which will lead to a solution of these problems and thus increase the effectiveness of the program. The Team report contains numerous suggestions for development of such a plan.

The report also reviews resources for meeting future requirements, identifies certain requirements as being suitable for external assistance, identifies some potential donor agencies and suggests exploration of the possibility of multi-donor funding to meet the future needs of the program.



2. CURRENT STATUS OF THE MALARIA CONTROL PROGRAM IN THAILAND

2.1 Epidemiology

2.1.1 Malaria Control Strategy

As a result of the WHO revised global strategy of malaria eradication, the plan of anti-malaria operations in Thailand was revised. During the period from 1971-1976, the plan of operations was designed to meet the costs of the project in the face of budget reductions by adjusting program phasing and developing appropriate criteria for implementation activities. By 1979, the areas of the country were divided into two operational areas which consisted of:

2.1.1.1 Control Area: This area covered forested, mountainous and border areas where malaria transmission persistently occurred with varying degree of endemicity. The strategy applied in this area is that of long-term malaria control.

2.1.1.2 Eradication Area: This area covered most of plains areas where malaria transmission receptivity is low and there was evidence that malaria transmission in these areas had been interrupted. The strategy applied in these areas is to prevent the re-establishment of malaria transmission thus malaria eradication methodology is utilized.

2.1.2 Phasing of the Program

Since the inception of long-term malaria control strategy, the progress of phasing the operational areas of the country was as follows:

	Year/Population in Millions						
	1979	1980	1981	1982	1983	1984	1985
<u>Control Areas</u>							
Under Spraying	3.99	3.34	3.73	4.30	3.69	3.52	3.04
Without Spraying	5.32	6.39	6.43	6.15	7.12	7.59	8.32
Sub-Total	9.31	9.73	10.16	10.45	10.81	11.11	11.36
<u>Eradication Area</u>							
Late Attack	0.03	0.01	0.01	0.01	-	-	-
Consolidation	2.18	1.97	1.70	1.33	1.20	1.10	0.50
Partial Integration	31.18	35.52	32.94	25.72	26.40	27.30	28.30
Full Integration	-	-	-	8.51	8.50	9.07	8.74
Sub-Total	33.39	34.50	34.65	35.57	36.10	37.47	37.54
Country Total	42.70	44.23	44.81	46.02	46.91	48.58	48.90

From the above program phasing, it appears that the division of operational areas was constantly maintained throughout the program. It is not possible for the Team to determine whether there had been any shifting of areas from one to another.

2.1.3 Anti-Malaria Activities

In 1978, the Malaria Division had issued guidelines for implementation of malaria control measures and the anti-malaria activities in the country were carried out under the guidelines. The control measures currently applied consist of the following:

2.1.3.1 Residual Insecticide House Spraying: This measure is still being considered as the major malaria control measure to be used in the control area. However, the guidelines advise that some control areas may be exempted from residual spraying if the following criteria are met:

a. A village (or part of a big village) not under the influence of An. dirus. (An. balabacencis), An. minus, and/or An. maculatus and where there is no evidence of persistent transmission of malaria.

b. A village (or part of a big village) under the influence of An. dirus, An. minimus, and/or An. maculatus where the incidence of malaria contracted in the village is 0.1/1000 population or less.

c. In urban and semi-urban areas.

d. Armed forces or police camps, forestry or wood workers camps, refugee camps, mining operations, road construction camps and other similar situations where other methods of control are being applied and are found to be adequate.

Based on the above criteria, the areas not to be sprayed have to be assessed and recommended by the Regional assessment team from other regions. However, the suggested assessment could not be followed and the assessment and decision were entirely left to either the Zone or Sector staff who are responsible for those areas.

The Team observed that in some sectors, there was a tendency to reduce the area to be covered by residual spraying because of the problems of resistance of villagers to spraying rather than based on the above criteria.

2.1.3.2 Malaria Case Detection and Treatment: This measure is applied in both control and eradication areas. The method of case detection depends on malaria clinics, malaria voluntary collaborators, hospitals, health centers and active/selective case detection. Sulfadoxine-pyrimethamine plus primaquine are used for presumptive treatment and the recommended adult dose is 2 tablets of sulfadoxine-pyrimethamine and 30 mg. of primaquine for areas where P. falciparum shows good or partial response to sulfadoxine-pyrimethamine and number of tablets of sulfadoxine-pyrimethamine should be increased to 3 in areas where P. falciparum shows poor response to sulfadoxine-pyrimethamine.

M.S.P. (Mefloquine 250 mg. and sulfadoxine 500 mg. and pyrimethamine 25 mg.) is being used for radical treatment of P. falciparum positive cases. The recommended adult dose is 3 tablets MSP and 30 mg. Primaquine given as a single dose. This regimen was started country-wide in early 1985. For P. vivax and P. malariae infections, standard dose of 1500 mg. chloroquine for 3 days and 14 days of 15 mg. primaquine are used for treatment. Quinine and tetracycline are recommended for alternative treatment of P. falciparum cases who are allergic to sulfa drugs or demonstrating failure to MSP. The adult dose consists of 3x600 mg. of quinine per day for 3 days, 2x500 mg. of tetracycline per day for 7 days and 30 mg. of primaquine on the last day of treatment.

2.1.3.3 Primary Case Investigation. The attempt is made to investigate all malaria positive cases in order to determine the source of infection which will lead to specific foci of transmission. However, due to extensive movement of population and large number of malaria cases, all positive cases could not be totally investigated.

2.1.3.4 Supplementary Measures. These measures are recommended in areas where the application is feasible. The following measures are now being practiced.

- Space spraying using thermal fogging.
- Larviciding using abate.
- Larvivorous fish.
- Self-protection by encouraging the community to use the available methods for personal protection. At present, mosquito nets and repellents are being emphasized.
- Source reduction.



2.1.4 Malaria Situation

The malaria situation in Thailand can be determined from the results of malaria case detection. Over the past 10 years, the maximum number of malaria cases was reported in FY 1982 with total cases of 464,353 (Annex 3).

The increase of cases was more pronounced in Regions I, II and V while in Regions III and IV, the peak was observed in FY 1981. By FY 1983, malaria incidence in the country had drastically dropped with a total case load of 266,633. The reason for the reduction of malaria cases during 1982 to 1983 was not clear. It was believed that climatological and entomological factors might not be the cause for this reduction and that the most plausible explanation was attributed to the striking increase in the number of malaria clinics and productive malaria voluntary collaborators which resulted in early diagnosis and appropriate therapy. However, in FY 1984, malaria was slightly increasing in comparison to FY 1983. The increase was noted only in Regions I and V while in other regions the status was either maintained or decreasing. The trend of countrywide malaria incidence in FY 1985 will probably be maintained at the level of FY 1984. In Region IV, a striking reduction of cases was observed during the first 7 months of FY 1985, while in Region I, malaria is on the increasing trend and by the end of FY 1985, the number of cases may exceed that of FY 1984.

The parasite species formula has not significantly changed during the period from 1980 to 1984 (Annex 4). P. falciparum is still the predominant species with a range of 65% to 70% of all infections. P. vivax was found at a range of 30% to 35% of total infections while P. malariae was rare. It is interesting to note that the parasite species formula of Region IV is different from the above pattern by demonstrating even distribution of P. falciparum and P. vivax.

Malaria mortality is on the decreasing trend. The malaria mortality rate had dropped from 8.2 per 100,000 population in 1979 to 5.9 per 100,000 population in 1983 (Annex 5). A marked drop of malaria mortality was noted in 1983 which corresponded with the pronounced reduction of malaria cases in the country. The Team had learned from the hospitals which were visited during the trip that cerebral malaria was still the main cause for malaria deaths. In Trad Hospital, during FY 1984, among 3,856 malaria cases, 50 had cerebral malaria.

2.1.5 Problems

The major problem in controlling malaria in Thailand is caused by occupational migration of population. The migration which involved both internal and external movement has had a reverse impact on the effectiveness of control measures. Region II had analyzed data of malaria cases in FY 1984 and found that only 3.3% of the cases had contracted malaria inside the villages while 89.0% and 7.7% were infected in the forested area and neighboring countries respectively.

In zone 6 Trad of Region V where the problem of people migrating across the Kampuchean Border for gem mining prevailed, 6,740 malaria cases were reported from this group during FY 1984, and so far there is no effective measure available to protect these people from malaria.

Another major problem of the anti-malaria program is P. falciparum resistance to drugs. This problem has impeded the success of the program for many years and continues to persist. Although, Mefloquine the new drug introduced for treating P. falciparum malaria, is a promising one which gives a cure rate of up to 97%, the problem still remains with presumptive treatment since there is no efficient drug to be used. Sulfadoxine-pyrimethamine which is currently being used for presumptive treatment was found to be less sensitive to P. falciparum. In recent studies carried out by the Malaria Division, sulfadoxine-pyrimethamine gave a cure rate ranging from 0-36% only.

2.2 Operational Entomology

2.2.1 Malaria Vectors

Among the anopheline mosquitoes recorded in Thailand three are recognized as primary vectors; An.minimus, An.balabacensis (An.dirus) and An.maculatus and two as secondary vectors; An.sundaicus and An.aconitus. An.philippinensis, An.campestris and An.culicifacies are considered as suspected vectors in certain situations.

At present, An.minimus is the most important malaria vector in the country. It breeds in slow running streams in forested and cleared foothills. According to available records An.minimus is prevalent throughout the country except probably the most southern part. In the early years of the



malaria campaign An.minimus responded favorably to DDT residual spraying. However, under the long term impact of DDT residual spraying it has become more exophilic and exophagic, and consequently its response to the DDT spraying has decreased.

An.balabacensis (An.dirus), the forest mosquito, is the most efficient malaria vector in Thailand. Due to its exophilic and exophagic habits in association with the human ecology and housing structure in forested areas, DDT residual spraying has not produced the desired effect. Nevertheless, it has maintained a certain level of control.

An.maculatus which breeds in running water streams was incriminated only once in the most southern part of the country. A research project to study the bionomics of this vector and its role in malaria transmission in two areas, one in Songkla in the South and the other in Pakchong in Central Thailand has just been completed and results are awaited.

An.sundaicus, a malaria vector in the coastal areas is responsible for sporadic malaria outbreaks as in the island of "Samet" in Rayong Province.

An.aconitus, a rice field breeder is probably responsible for the low malaria transmission in plain areas.

Although some tolerance to DDT has been reported in some mosquito populations in limited areas with An.minimus, An.balabacensis, An.maculatus, An.philippinensis, An.aconitus, generally speaking all vectors are still susceptible to the insecticide.

2.2.2 Manpower

The entomological manpower at the Malaria Headquarters, Regional Offices and Zones are as follows:

	<u>Senior/Regional Entomologists</u>	<u>Entomologists</u>	<u>Regional Team</u>	<u>Zonal Investi- gation Teams*</u>
HQ	1	2	-	-
Reg. 1	1	1	1	7
Reg. 2	1	2	2	6
Reg. 3	1	1	2	6
Reg. 4	1	1	1	7
Reg. 5	<u>1</u>	<u>-</u>	<u>1</u>	<u>7</u>
Totals	6	7	7	33



*Each zone has one "Zonal Investigation Team," consisting of a leader and four insect collectors except in Region 2 where each team includes one additional staff, an assistant team leader.

The increase in the number of qualified entomologists is expected to reflect favorably on the entomological activities in the program.

The majority of the professional staff are university graduates; six with M.Sc. degree or equivalent, two are still studying for their M.Sc. and two with B.Sc.

2.2.3 Training

The last refresher training for team leaders was conducted in 1982. In order to up-date the knowledge of these staff it is imperative that they should attend one refresher course per year. The course should be designed to cover their field needs.

2.2.4 Entomological Activities

The current entomological plan of field activities was developed in 1978. Considering that this plan was discussed in reports of previous assessment teams, in 1979, 1981 and 1983, it is therefore unnecessary to repeat what has been mentioned earlier. In this report only the most important aspects in connection with each activity and the achievements made in 1984 will be discussed.

2.2.4.1 Evaluation of anti-adult measures in indicator areas

Originally, this activity was planned as a component of the overall epidemiology evaluation procedure to determine the long term effect of DDT residual spraying in control areas. However, only the entomological plan of work was implemented in some villages. The method of evaluation was to measure trends in the response of the malaria vectors to the control measures applied. The vectorial capacity was used as a tool for interpretation of results.

In the implementation of this activity, problems were faced in the collection of sufficient samples and interpretation of results. The reasons cited in this connection included selection of villages which did not meet the laid down criteria and faults associated with the entomological sampling methods and interpretation of the results achieved by employment of the theoretical parameters involved in the vectorial capacity



equation. As a result there was a constant change in the study villages but at the same time no attempts were made to revise or adjust the method of evaluation for a number of years. Gradually the number of study villages was reduced, and in 1983 the procedure of evaluation was revised. Accordingly, comparative observations were planned in DDT sprayed versus non-sprayed and DDT sprayed versus fenitrothion sprayed villages. One DDT sprayed village and a control were selected in each of Regions 1, 4 and 5 and two DDT sprayed villages and two fenitrothion sprayed villages selected in Region 2. Entomological activities include indoor and outdoor man biting collections, animal bait catch and indoor resting collections for six nights per month. Observations are in progress. The control village should have been unsprayed for the last 6 to 7 years.

Technically the revised plan is sound but the problem is to find a comparative control village which has not been sprayed for such a period of time in a highly receptive area. Also, with the exception of one study area in Region 2, the comparative villages in the other study areas are far apart, and in different Districts. The question here is whether these villages are comparable. In view of the time limitation the Team could not go into details concerning the selection of these villages in order to elaborate more on this activity.

2.2.4.2 Monitoring of vector susceptibility to insecticides in control areas

The susceptibility of malaria vectors and suspected vectors to DDT is monitored regularly in indicator villages by applying the standard WHO adult susceptibility test. Additional tests are also carried out in areas where vectors are encountered in sufficient numbers.

So far all malaria vectors are susceptible to DDT with the reservation that some degree of tolerance has been reported in few mosquito populations of An.minimus, An.balabacensis, An.maculatus, An.aconitus and An.philippinensis, particularly from the North. It is of interest to note that the level of tolerance, recorded some years ago in a population of An.minimus from Phrae, which remained at more or less the same level for a number of years has recently shown a decreasing trend. The reasons are not known and require investigation.

Tests carried out with other insecticides such as fenitrothion, malathion and dieldrin, although very limited, have shown that the primary and secondary vectors are susceptible to these compounds.



In 1984 a total of 39 susceptibility tests were conducted in the project against 60 in 1983 and 94 in 1982. These records show a significant decrease in the number of tests carried out during the last two years. The output of the different Regions in the number of tests carried out during the last two years is as follows:

Region	<u>Number of susceptibility tests, 1983/1984</u>			
	DDT	FNT	DLN	Total
1	9/3	1/1	-	10/4
2	27/13	3/1	-	30/14
3	7/6	1/2	-	8/8
4	9/7	-	-	9/7
5	2/6	-	1/-	3/6
Total	54/35	5/4	1/-	60/39

The Team recognizes that many of the entomological staff have long experience in conducting adult susceptibility tests but the Team also expresses concern regarding the inadequacy in the number of tests conducted. In the Thai Malaria programme where residual insecticide application is a major control measure using DDT and fenitrothion at the same time and in the same villages in some of the areas, it is essential to monitor adequately and regularly the susceptibility of malaria vectors and suspected vectors to these two compounds and possible alternatives as well.

The Team also noted that the form developed earlier by the project for the compilation of data and presentation of results obtained in a number of years to demonstrate trends in susceptibility to DDT and other insecticides in indicator villages is not in use or properly used except in Region 2. This form is not a replacement for individual test forms.

From the discussions made the Team noted the shortage of insecticide papers which used to be provided by WHO. The test papers were not ordered in time apparently due to administrative delays and the reduction of WHO assistance. In view of the continuing need for these materials, arrangements should be made to insure their regular supply.

2.2.4.3 Foci investigation in eradication areas

Previously, foci investigation including both entomological and parasitological components was the main activity of the zonal investigation teams, until the implementation of the current plan of work in 1978. According to past experience most of the investigations carried out during that period were not conducted in time and/or at the right place, and therefore the entomological results obtained were inconclusive.

In 1984 the number of foci investigated was only 27, representing an average of less than one per team. This number is considered inadequate especially in relation to the size of areas in the eradication programme and number of zonal teams, and, therefore, should be increased taking into account the two factors mentioned above.

2.2.4.4 Collection of data on receptivity in eradication areas

In 1976 a tentative criteria for mapping receptivity based mainly on the terrain was developed at the malaria project. The plans made at that time also called for entomological surveys to verify and up-date information concerning the estimated level of receptivity in villages in the eradication program. Records on the number of entomological surveys carried out in 1984 and the results obtained are shown in the following table:

Region	No. of villages Studies	R e c e p t i v i t y			
		High	Moderate	Low	Nil
1	19	5	1	10	3
2	7	3	4	-	-
3	17	2	7	7	1
4	14	5	6	2	1
5	<u>6</u>	<u>4</u>	<u>-</u>	<u>1</u>	<u>1</u>
Total	63	19	18	20	6

A special form ME5 for recording relevant information on the terrain and vectors in each village was developed for this purpose.

The Team noted that although all concerned at sector offices and zones are aware of the concept of receptivity and its value in the planning of their field operations especially in case of malaria outbreaks, the relevant form was either unavailable or not up-dated in many cases.

2.2.4.5 Spot check in control areas

This activity is carried out to determine the malaria vectors in control areas and to locate villages with high density of mosquitos for carrying out susceptibility tests.

In 1984 a total of 293 spot checks were carried out. An.maculatus was found in 149 villages, An.balabacensis in 33 villages and An.minimus in 144 villages.

2.2.4.6 Special studies

Special studies are usually carried out in connection with local problems. They are planned and conducted by the regional or zonal teams independently from headquarters, without proper protocols. A number of these studies are carried out every year. In 1985 a total of 17 studies are planned for implementation.

From the discussions made on some of these studies such as the one on "Resting habits of mosquitoes in connection with DDT spraying on tin roofs," where observations are carried out in sprayed house- rather than unsprayed ones, it is doubtful that the objectives of the study will be achieved.

Considering the time spent and manpower involved it would be advisable to devote more effort to the planning and implementation of these studies with clear objectives, adequate supervision, and in collaboration with Headquarters. Studies which are promising may be converted into research projects.

2.2.5 General remarks

There is no doubt that with the available manpower and qualifications and experience of those in charge of the entomological activities at headquarters and regional offices, the Malaria Division has the means to carry out a sound entomological program. Therefore, the low output of entomological activities in 1984 was rather surprising. In connection with the three activities carried out usually by the zonal investigation teams namely, foci investigation, receptivity studies, and spot checks, the average output per team amounted



to 0.8, 1.9 and 8.9 respectively. Also the number of susceptibility tests carried out by the regional teams and some of the zone teams was very low. As explained by some of the staff this situation was due to an increase in activities in connection with special studies and research projects which although true, in some of the cases, should not reflect to that extent on the other activities.

2.3 Field Operations - Residual Spraying

The plan of operations calls for residual house spraying once or twice a year depending on the epidemiological characteristics of the area. DDT is still effective and is the insecticide of choice with 75% DDT wettable powder being used except in areas of better houses where 25% DDT emulsifiable concentrate is used. Fenitrothion, 40% wettable powder is scheduled for villages bordering Kampuchea, Laos and Burma.

The Team examined the residual spray records at every office visited and soon discovered that the statistics as compiled were misleading, particularly for the past 2 years since a shortage of insecticides had developed.

2.3.1 Examples

In Zone A the 1984 Plan of Action target of population for spray coverage was 162,186, but the revised target was 97,466 and the actual population covered was 88,543. This was listed in the statistical report as 90.85% achievement of target with only 9.15% of the houses unsprayed. However, if the percentage was based on the number of houses which should have been sprayed, then the achievement of target was only 54.6% with 45.4% of the houses unsprayed.

In Sector B the Plan of Action for 1984 called for spray coverage for a population of 33,425 which was reduced to 17,431 in the final spray plan and a population of 16,483 was actually given protection by spraying. Reports showed this as 94.56% achievement of target including completely sprayed and partially sprayed houses. Actual achievement of target was 49.3% and 50.7% of the houses which should have been sprayed were completely unsprayed.

In Zone C the Plan of Action for 1985 (1st cycle) called for spray protection for a population of 90,000. The amended target was 43,000 and the actual population given protection was 41,000. Instead of 95.3% achievement of target, there was only 45.5% achievement of target.

2.3.2 Reasons for reducing spraying targets

The reason given for the reduction of the target population in most cases was shortage of insecticide, but other reasons included shortage of money or a lack of flexibility in hiring the required number of spraymen at the time needed, heavy rainfall and/or flooding, and security problems in border areas.

2.3.3 Incomplete spraying

The figures given above for Zone A; Sector B and Zone C still do not give an accurate picture of the performance of the residual spray program since the percentage of houses sprayed included those partially sprayed as well as those completely sprayed. According to the records examined in the field, the percentage of houses incompletely sprayed varied from 6% to 43% in the various Zones visited. In the compilation of statistics for the entire country in 1984, 27.4% of the houses were sprayed incompletely. Although records are kept to indicate whether an incompletely sprayed house has 25%, 50% or 75% of the sprayable surface covered, the figures were not readily available and were difficult to interpret. In interviews with field personnel, most of them indicated that the room most often refused was the bedroom and that in many cases the only surfaces sprayed were the eaves and under the house.

Careful examination of Annex 10 showing the results of spraying operations from 1980 to 1984 shows that there has been a small but steady increase in the percentage of completely sprayed houses and a corresponding decrease in the unsprayed and incompletely sprayed houses.

2.3.4 Criteria for spraying and withdrawal of spraying

Many Zone and Sector officers are having to make very difficult decisions since they are having to decide how many and which villages and houses to spray based on the availability of insecticides instead of on the criteria laid down in the plan. Fortunately most of them are making good decisions or the situation could be much worse. Priority is being given to farm huts and to villages with indigenous cases, but the degree to which the rest of the criteria for spraying are being observed varies from area to area. Most of the Zone chiefs appear to be aware of the importance of terrain, receptivity, presence of vector species and indigenous transmission

and perhaps take them into account sub-consciously, but nearly all of them indicated that the principle and in some cases the only criterion for spraying a village was the presence of an indigenous case in the previous year. Only one region considered the record for the previous 3 years.

2.3.5 Fenitrothion Spraying

With assistance from the Japanese Government the malaria project started the use of fenitrothion w.d.p. 40%, 1 g/m² since 1982 in some selected border localities. Some areas are receiving two rounds of fenitrothion spray per year and others are receiving one round of DDT in the first cycle and one round of fenitrothion in second cycle. The policy of insecticide spray in those areas is based on the availability of insecticides. The spray data relevant to fenitrothion for 1984 in the whole program is as follows:

	<u>Cycle 1</u>	<u>Cycle 2</u>	<u>Special Spray</u>
Total Population Actual	1,265	695,719	7,584
Spray Coverage			
Total Houses Actually Sprayed	303	145,334	1,606
% Completely Sprayed	84.74	74.86	91.08
% Incompletely Sprayed	9.66	18.56	5.03
% Unsprayed	5.61	6.58	3.89
Total Farm Huts Sprayed	-	112,958	3,509
FNT 40% WP used (Kg)	275	997,665	18,075

Considering that unlike DDT, fenitrothion exhibits air-borne as well as contact toxicity, providing relatively rapid knockdown and has no pronounced irritant action it was expected that the compound will have, greater effect on the malaria vectors and malaria transmission.

In 1982 observations were made to compare the effectiveness of fenitrothion versus DDT. From the entomological results obtained it was concluded that neither of the insecticides employed produced the dramatic impact on the overall population density of An.minimus which has been observed with other susceptible vectors in a number of other countries.

In the case of DDT, an important factor may be the irritant effect of this insecticide which would tend to reduce contact with the vector, thus reducing mortality. Also, this element could be operative at the fenitrothion sprayed villages because there was an underlying layer of DDT which had been applied earlier.

Now with the current policy of spraying DDT and fenitrothion in the same areas depending on their availability, it would be extremely difficult to make any conclusion on which of the insecticides is more effective.

2.3.6 Summary Statement on Inadequacy of Spray Coverage

The population in the control areas to be protected through residual house spraying was determined by an exhaustive stratification exercise covering the entire country during the years 1976 to 1978. These figures should be revised and up-dated every year based on the criteria given in the Guidelines for the Implementation of Malaria Control Measures. Unfortunately, in recent years the total spray coverage has been determined more by the availability of insecticide rather than by the established criteria.

It is inevitable that after 20 to 30 years of residual house spraying in some areas, there would be a problem of people's resistance. However, field personnel have reported that in most villages where a concentrated health education campaign was carried out, the spray coverage was substantially improved.

2.4 Supplementary vector control measures

2.4.1 Larviciding

Larviciding with abate EC is applied on a very limited scale such as in Samet Island, Rayong Province, against An.sundaicus breeding in brackish rock pools and in 2 villages in Mae Sot Province against An.balabacensis breeding in ponds. In the first case, larviciding has been applied for a number of years, once every fortnight, but without any apparent decrease in the number of malaria cases. In the second case, larviciding was carried out only four times, once per month, from January to April 1984.

In the opinion of the Team the failure of larviciding against An.sundaicus is most likely due to inadequate coverage assuming that the vector is still susceptible to the compound. The susceptibility of An.sundaicus to abate

should be checked and monitored regularly. Concerning larviciding against An.balabacensis in ponds, this method if applied properly may have some effect provided that the natural breeding sites of the vector are limited as in the dry season.

2.4.2 Larvivorous fish

The malaria project is now engaged in extensive distribution of larvivorous fish in running streams for the control of An.minimus and An.maculatus. Prior and during the implementation of this program, studies were carried out in Regions I and IV to identify indigenous fish and determine their efficiency in the control of anopheline mosquitoes in running streams. However, results obtained were inconclusive and did not provide guidance on the effectiveness and use of this biological control method especially in running streams. At present there are five species of fish applied by the different regions;

- Poecelia reticulata - Regions I, II, III and V
- Rasbora lateristriata sumatrana - Region I
- Gambusia affinis - Regions III and V
- Panchax Spp. - Region IV
- Tilapia nilotica - Region IV

Considering the effort and time spent in this activity it is imperative that further studies should be carried out to determine the effectiveness of these fish in mosquito control in running streams. If results are favorable other studies should follow to establish the rearing and distribution methods.

2.4.3 Personal protection - mosquito nets, repellents and coils

Through health education, efforts are being made to stimulate the community in endemic malarious areas and raise their awareness in regard to the use of self-protection methods. Trials are being carried out in all regions utilizing the village health volunteers and village malaria volunteers in the distribution of mosquito nets and repellents with a price lower than in the market. The seller is allowed to earn a small profit as incentive. In Region II approximately 20,000 mosquito nets were sold in 1 1/2 years.

Apart from mosquito nets and repellents the use of coils is also being encouraged. At present, Region V is carrying out a trial on the use of coils by rubber tappers during their work at night time. Data presented to the assessment team is encouraging and the trial deserves further investigation and testing to determine its usefulness and practicability.

Considering the prospect of self-protection methods the World Health Organization is providing funds of \$28,000 for a trial on these methods to be conducted in 66 villages in 1985. In this project other methods of vector control involving the community such as source reduction and raising and distributing larvivorous fish will also be emphasized.

2.4.4 Space-spray Adulticiding

Fogging with swing fog machines is used, but on a very limited basis. The criteria under the "Guidelines" call for its use only when there is a severe outbreak of malaria, or an abrupt increase of mortality due to malaria or as a preventive measure under high risk conditions. Since by the time severe outbreaks are known and fogging can be carried out, the mosquitoes responsible are no longer present, such fogging could be wasted effort unless based on current entomological findings. Perhaps the best use of fogging would be as a preventive measure where the high risk of malaria is well known as in temporary camps of refugees, gem miners and farm laborers or wood cutters. Fogging, unless done at the right time, under suitable weather conditions with properly calibrated equipment can be very inefficient. Fogging should be done under adequate technical supervision.

2.4.5 Source Reduction

The criteria under the "Guidelines" give priority to the use of source reduction where applicable on the basis of the more permanent results. In view of the breeding habits of the malaria vectors in Thailand, source reduction would appear to have limited use. Only Anopheles sunaicus would appear to be amenable to the source reduction approach.

Only a few source reduction projects were identified to the Team in the field. These were largely confined to stream clearing with some filling and drainage. Any source reduction project should be based on a thorough knowledge of the breeding habits of the vector and current entomological findings.



2.5 Health Education

2.5.1 Organization

Health Education is an integral part of the Anti-Malaria program at the National Headquarters, Regional, Zone and Sector levels. In addition to the health education unit in Bangkok at the Division level, there are 3 to 5 health education personnel at each Regional Office. Usually one of the assistant zone chiefs is designated as being responsible for health education in his Zone and, in many cases, has already taken the 3 week special training course at Mahidol University. Additional personnel at the Zone level may be trained as audio-visual specialists. The zone health education staff work through the Sector Chief with the individual village chiefs.

2.5.2 Purpose

The purpose of the health education program is to obtain better cooperation from the villagers in allowing their houses to be sprayed; to persuade the villager to go to the village malaria volunteer, the village health volunteer or the nearest malaria clinic when they have fever; and to inform the villagers of measures they can take to avoid getting malaria.

2.5.3 Results

There is ample evidence that the health education program has been highly successful in achieving the first two objectives, but the third is difficult to assess. Nearly all of the Zone and Sector Chiefs interviewed by the Team could give examples of health education efforts which increased the number of houses sprayed as in the example from one of the more difficult areas in Yala:

<u>Houses Sprayed</u>	<u>Before Health Edu.</u>	<u>After Health Edu.</u>
Village A	45	115
Village B	122	288

The success of the village malaria volunteer program and the malaria clinics is apparent from the country-wide summary of case detection activities for 1984 which show that passive case detection accounts for 87.7% of all malaria positives even though taking only 54.3% of the slides. Obviously the villagers who have malaria have been persuaded to



visit the malaria clinics, the village malaria volunteers, health centers and other health facilities. Health education activities must be given a good share of the credit for this.

One sector chief said that he didn't think that health education did any good. He was the single exception. Every other Zone Chief and Sector Chief interviewed by the Team demonstrated his endorsement of the health education activities by requesting more support for the program. Items requested included: more slide projectors, more slides, more and different entertainment movies, a new and different malaria movie, more tape recorders with cassettes, more loud speakers, more posters (particularly one on self-protection from malaria), more pamphlets, cassette tapes in Karen Language, more training, particularly training of all personnel in how to get along with villagers.

2.6 Training

Training: Since the USAID Anti-Malaria Project was implemented in 1980, many training courses, workshops, seminars and conferences for various levels of malaria personnel and malaria voluntary collaborators (See Annex 11) were conducted. The team was informed by the staff at the Regional, Zone and Sector level that those training courses were very valuable to anti-malaria activities and there is a great need to continue this activity. At present, the program for training is drawn up on a yearly basis which has to be based on the budgeted funds available. Training which involves a large number of trainees, e.g., malaria volunteers has to be put off for lack of funds.

The Malaria Training Center at Praphuttabat, which is the most important nucleus for academic training, has conducted pre-service and in-service malaria training with RTG, USAID and WHO funding 59 times with 1,928 participants since its new building was opened in December 1982. Various Departments within the Ministry of Public Health have used the facilities and resources for training their staff 35 times with 1,437 participants. Various agencies such as Ministry of Education, Ministry of Agriculture and Cooperatives, Universities, National Statistic Offices, Provincial Water Works Authority, Ministry of Interior and others have conducted training 48 times with 1,840 participants. The WHO International Course in Malaria and Planning Malaria Control will also be held at this center from 14 October to 20 December 1985. For FY 1985, the budget allocated to this Center was Baht 489,000. In spite of this, this center needs to be staffed with more technical and administrative personnel and more funds are required for its efficient operation.



2.7 Research

2.7.1 Manpower

Professional staff in the research section at Malaria Headquarters consists of a senior scientist in-charge with Ph.D. in medical entomology, and two entomologists with M.Sc. degree. Two additional entomology positions were approved by the Civil Service Commission and are awaiting budgetary approval from BOB. Apart from the staff at headquarters there are no other staff designated as research workers in the regions.

2.7.2 Buildings

Complete details are mentioned in the assessment report of 1983.

2.7.3 Research projects

The Malaria Division is carrying our research projects in four areas; malaria chemotherapy, vector biology and control, socio-economic studies and epidemiology.

Research in malaria and its related fields is also carried out by a number of other national institutions and the Armed Forces Research Institute for Medical Science. Some of the scientists in these institutions are doing collaborative studies with the Malaria Division. Funds to support these studies come from USAID, WHO and other international agencies.

2.7.4 Research projects approved and funded by USAID

The eight research projects which received funds from USAID were commented upon in the assessment report of July 1983. At that time the first four projects as listed below were either terminated or completed. The other four projects were completed at a later date.

<u>Title</u>	<u>Status</u>
2.7.4.1 - The effectiveness of Radical Treatment Regimens for <u>P.falciparum</u> in various Regions of Thailand (jointly funded with WHO)	Completed



<u>Title</u>	<u>Status</u>
2.7.4.2 - Field study of the Efficacy of <u>Panchax</u> spp. as a Biological Control Agent of <u>An.maculatus</u> in the Hilly Areas of Thepa District of southern Thailand	Completed/ Terminated
2.7.4.3 - A study of the Biology of Naturally Occurring Larvivorous Fish in Thailand and the Development of a Mass Rearing Technique for the Selected Species	Completed
2.7.4.4 - A survey for the presence of Malaria and Antibody to <u>P.falciparum</u> in an Area of Partial Integration and an Area Under Control Measures	Completed
2.7.4.5 - A study of entomological Techniques for evaluation of the Impact of Anti-Adult Measures on Malaria vectors in Thailand	Completed
2.7.4.6 - A study on the Effectiveness of Radical Treatment Regimens for Falciparum Malaria in Thailand	Completed
2.7.4.7 - An Epidemiological Early Warning System for Malaria Control	Completed
2.7.4.8 - A study to Improve Spray Coverage	Completed
2.7.5 <u>Projects completed after the previous assessment</u>	
2.7.5.1 <u>Entomological Techniques for Evaluation</u>	

From the discussions made by the Team on the objectives of this project it appears that the title was not properly worded. It should have been "Entomological evaluation of DDT and fenitrothion indoor residual spraying in Thailand." Studies were carried out in three areas in Loei, Chumporn and Trat. The first and third were sprayed with fenitrothion and the second with DDT. The effect of these insecticides was studied on An.minimus in Loei and Chumporn and An.balabacensis in Trat. Results obtained appeared in

a report written in the Thai language. The main conclusions of the study are:

- Fenitrothion exhibited less irritant effect on An.minimus
- Fenitrothion spraying remained effective for 3 months.
- The appropriate timing of fenitrothion spraying in those areas was from middle April to early May and from late September to early October.
- Due to ecological changes in connection with An.balabacensis in Trat no conclusion could be made from that area.

2.7.5.2 Effectiveness of Radical Treatment

This study started in 1982 and was completed in April 1984. Three regimens were tested.

- a. Sulfadoxine-pyrimethamine single dose + primaquine 15 mg daily for 5 days.
- b. Quinine 600 mg t.i.d. for 3 days + Tetracycline 500 mg b.i.d. for 7 days + Primaquine 15 mg daily for 5 days.
- c. Quinine 600 mg t.i.d. for 7 days + Primaquine 15 mg daily for 7 days.

A total of 99 P.falciparum cases were tested with about 30 cases for each regimen. Results showed that only 36.67% of cases were sensitive to Regimen 1, 96.77% and 92.55% were sensitive to Regimens 2 and 3 respectively.

2.7.5.3 Early Warning System

The technique applied which appeared in the WHO/MAL/83,994 series has been under trial in most areas of Region II and one Zone each in Regions III, IV and V. The application of this technique provided useful information for operational purposes. In Region II the Regional Director is making use of this information in directing the attention of his staff to those situations which require investigation and remedial measures. In Zone Chumporn of Region IV the information provided resulted in the development of dialogue between the Zone and Sector chiefs regarding the situations which require investigation and possibly remedial action.



In the opinion of the Team and also those who have applied the technique it is a useful tool and, therefore, should be expanded to cover the rest of the program. It will also be necessary to develop criteria concerning the situations where remedial measures will be required and identify the responsible officers.

2.7.5.4 Spray Coverage

This project has been completed but the report not yet submitted.

2.7.6 Research projects funded from other sources

Aside from the research projects funded by USAID there are 22 other projects which are funded by WHO and other international agencies. A list of these projects and their status is shown in Annex 12.

As regards projects of malaria research and its related fields carried out by other institutions it was not possible for the Team to make a complete list of all the projects under study. However, in reviewing areas of research in which these institutions are involved it can be noted that there are two areas which are left entirely to the Malaria Division, namely vector control and epidemiology, which will need greater input from the Malaria Division.

2.7.7 General remarks

There is no doubt that with the complexity of the problems facing malaria control in Thailand, and the need to develop effective and practical methods of control, it is essential that the Malaria Division have a Strong Applied Field Research Section, and that the research projects are carried out according to sound scientific experimental design. Although part of the resources have been spent on some projects which did not achieve their main objectives, due to faults in study design, implementation or supervision, nevertheless, it should not be taken as a total loss in view of the experience gained by young scientists in the program.

During the past years USAID and WHO provided considerable assistance in the area of research through the construction of laboratories and other facilities, provision of research grants, supplies and equipment, training and technical guidance. Now, with the termination of USAID assistance in the area of research, and with withdrawal of WHO technical staff it is very important to continue support of research and obtain assistance from all available sources.

2.8 Transportation

Motor vehicles used in anti-malaria programs are subjected to much greater than normal "wear and tear." When UNICEF was providing vehicles and maintenance advisory services for many malaria programs throughout the world, advice was given to replace vehicles after 6 years of continuous use in the field. Many mosquito control programs in the United States feel that the cost of repair and maintenance for vehicles 5 or more years old is prohibitive and not cost effective.

The Thailand' Malaria fleet of vehicles is comprised of 768 jeeps, passenger cars, trucks and vans. Of this total only 281 are less than 6 years old. 486 of them are 6 years old or more and 182 are 20 to 30 years old (See Annex 13).

It is amazing and a tribute to the malaria mechanics that they have been able to keep this many vehicles in operation for so long. However, as the USAID vehicle overhaul program demonstrated, it is not cost effective to do so.

Although motorcycles have not been in use for as long, there are a substantial number that have already been in service for 10 to 15 years.

2.9 Multi-Purpose Malaria Workers

Discussion

Having realized the fact that malaria control activities vary from area to area and the persons conducting the activities should be thoroughly familiar with the areas, Region 2 has developed a trial to assign a definite working area to each individual malaria field worker. This individual is responsible for looking after all anti-malaria activities in the assigned area which include:

- Regular visits to all PCD posts.
- Investigating and giving radical treatment to every positive case.
- Follow-up radically treated malaria cases.
- Supervising spraying operations.



- Performing special case detection in the event that PCD activities failed in any area to produce slides for 3 consecutive months
- Detecting foci of transmission occurring outside the villages and implementing remedial measures
- Motivating and supporting the community participation in malaria control.

Having interviewed some of workers from Sector 1 Li of Zone 1 Chiang Mai and Sector 7 Denchai of Zone 3 Prae, the Team was informed that most of them were satisfied with this new assignment with exception of complaints regarding the excessive work-load from some workers. This problem was corrected by either readjusting the assigned area or providing additional support from Sector or Zone.

3. EXTENT OF ACHIEVEMENT OF MALARIA CONTROL OBJECTIVES OF HEALTH DEVELOPMENT PLAN NO. 5 (1982-1986)

The general objectives of Health Development Plan No. 5 in Malaria Control Program are to reduce the malaria morbidity and mortality, to prevent the recurrence of malaria in the country and to support and encourage a primary health care system suitable to the community. In this plan the following specific objectives were laid down.

3.1 Main Objectives

- 3.1.1 To reduce mortality caused by malaria from 9.7/100,000 (1978) to less than 8/100,000 in 1986.
- 3.1.2 To reduce morbidity caused by malaria in control areas from 16 per 1,000 in 1980 to less than 12 per 1,000 by 1986.
- 3.1.3 To prevent transmission in eradication areas and to reduce the morbidity to not more than 1 per 10,000 by 1986.
- 3.1.4 To establish and support the Village Voluntary Collaborators in order to obtain better control and operational procedures.
- 3.1.5 To have at least 50% of VVCs productive every month.

3.2 Secondary objectives

- 3.2.1 To obtain public cooperation and assistance from all health centers in the detection and control of malaria cases. Military units, police forces and community leaders will be contacted to obtain such cooperation.
- 3.2.2 To activate local people to participate in the programme by expanding health education and providing more rapid and widespread health service.
- 3.2.3 To control transmission along the border areas.
- 3.2.4 To increase the efficiency and dedication of malaria personnel in field operations.
- 3.2.5 To study and analyze operational procedures and introduce new technologies to solve the problems and obstacles that may be occurring.
- 3.2.6 To control, coordinate and supervise personnel at all levels.

3.3 The achievement of the program as against the specific objectives can be discussed as follows:

3.3.1 Mortality: It is apparent that malaria mortality in the country (Annex 5) is on a declining trend since 1976 and the maximum target for the plan was reached in the same year when this Development Plan was implemented and it went further down in 1983. However, the up-to-date mortality statistics are not available for evaluation but it might be speculated that by the end of the Fifth Health Development Plan, the target on malaria mortality could be met.

3.3.2 Morbidity: From the statistics available in the Malaria Division's Annual Report of Malaria Case Detection, the API of control area in FY 1980 was 20.4 per 1,000 pop. In subsequent years, the APIs of control area were available on fiscal year basis and the figures are as follows:

<u>FY</u>	<u>API/1,000 POP</u>
1981	23.55
1982	25.1
1983	15.0
1984	17.3



However, the Team has the same opinion as of the comments made by the Final Evaluation Team in 1983 that the actual malaria morbidity should also include malaria cases which were detected elsewhere but contracted malaria from control area. By assuming that 95% of total cases in the country originated in the control area, malaria incidence would be as follows:

<u>FY</u>	<u>API/1,000 POP</u>
1981	42.0
1982	42.2
1983	23.4
1984	25.4

As the trend of malaria incidence for the past 3 years indicated, the target for reduction of morbidity in the control area may not be achieved as planned but a considerable reduction has been obtained.

3.3.3 Prevention of transmission in Eradication Area:

During FY 1982 to 1984, malaria incidence in the eradication areas of the country was as follows:

<u>FY</u>	<u>Consolidation</u>		<u>Partial Integration</u>	
	<u>Overall API</u> (per 1,000)	<u>Specific API</u> (per 10,000)	<u>Overall API</u> (per 1,000)	<u>Specific API</u> (per 10,000)
1982	15.6	0.48	7.0	0.12
1983	7.3	0.22	3.6	0.23
1984	5.5	0.08	3.6	0.13

The figure of specific API in the eradication area shows that the target has been exceeded and the resumption of malaria transmission in these areas can be prevented.

3.3.4 Village Voluntary Collaborators: As of May 1985, the program had 41,084 malaria voluntary collaborators working in both control and eradication areas (See Annex 9). These collaborators are regularly contacted by malaria field workers who will collect blood slides, replenish antimalarials and provide information. The contribution of these collaborators in terms of blood smear production was above the target. During FY 1984, 63% to 73% of collaborators were producing blood slides each month.

3.3.5 Secondary objectives: These objectives may not be evaluated quantitatively but the following achievements were made.

3.3.5.1 All Health centers and hospitals in control and eradication areas are cooperating in malaria case detection. During FY 1984, Health centers and hospitals in Regions II and III had detected about 36% and 27% out of total malaria cases detected in the regions respectively.

3.3.5.2 Health education activities were strengthened. Every Zone has a mobile health education unit equipped with movie projectors. Most of the malaria clinics (410) have Radio/Tape recorder for presenting health education to the people attending the clinic. All sectors were also provided with loud speakers for public announcements. Extensive health education in all regions was carried out through school health education, exhibitions, group meetings, TV and Radio broadcasting, newspapers, Mobile malaria clinics, and distribution of posters and printed materials.

3.3.5.3 Community participation was motivated along the lines of community and self protection against malaria. This achievement illustrated by public participation in rearing and releasing larvivorous fish, donation of equipment, land and buildings for malaria clinics and other activities. A village fund for Malaria Self Protection Project was set up with WHO assistance. This project is aimed to obtain more community participation through an organized committee.

3.3.5.4 The efficiency of malaria personnel was enhanced by input of pre-service and in-service training and the detailed list of training courses is shown in Annex 11.

3.3.5.5 Research and field studies were conducted in order to solve problems and introduce new technologies. Some of the results of these studies were introduced for antimalaria operation, e.g., MSP is used as a new line drug for malaria treatment to overcome the problem of P.falci-
parum resistant to previous anti-malarials used in the programs.

3.3.5.6 In controlling malaria along the border areas, the project was assisted by the Japanese government in providing supplies and equipment for anti-malaria operations in Thailand-Kampuchea-Laos border areas during 1981 and 1983. However, the constant movement of population in border areas complicated field operations.



3.3.5.7 A new system of supervision has been recently developed and implemented. This system stresses the line of supervision from Division-Region-Zone-Sector to Field workers.

4. RESULTS OF USAID PROJECT

4.1 Description of the Project

The USAID Anti-Malaria Project was designed to assist the Royal Thai Government (RTG) in nationwide anti-malaria activities during the four-year period from FY 1980 through FY 1983. The project purpose specifically was aimed at developing the RTG institutional capacity for providing continuing malaria services to 9.3 million rural inhabitants living in endemic, high-risk malarious areas of Thailand; primarily by improving technical, operational and managerial capabilities of the Malaria Division in the Communicable Disease control Department of the Health Services of Thailand.

The Project Agreement for this project was signed August 29, 1979 with a completion date of September 30, 1983. However, the Project was extended until December 31, 1984. The USAID project provided funding assistance of \$500,000 in grant funds and \$4,000,000 in loan availabilities for a total of \$4,500,000 in financial assistance. No additional funds were required for the extension, due in large part to changes in the currency exchange rate.

This project provided assistance components to all levels of the Malaria Division - National, Regional, Zonal/Unit and Sector. The primary emphasis of the project focused on interventions at the first point of contact in the malaria control service delivery system to improve these services to Thailand's rural inhabitants. The project provided assistance to the RTG's Malaria Division through provision of (1) technical assistance; (2) fellowships; (3) training of malaria volunteers, malaria clinic workers, Malaria Division Sector and Zonal staff in a variety of anti-malaria skills; (4) research; (5) capital improvements in the construction of research, training and field unit buildings; (6) commodities, including sprayers, microscopes, volunteer kits, audio-visual equipment, research and training equipment, malaria clinic furniture and other such items; (7) vehicle overhauls; (8) health education materials; (9) provision of a revolving fund for motorcycle hire/purchase; and (10) RTG motorcycle procurement.



4.2 Individual Elements of the USAID funded Anti-Malaria Project (for details see Annex 14).

4.2.1 Technical Assistance

The Project has benefited from the services of long term project monitors both of whom were thoroughly familiar with Thailand and the Malaria Program through their former service as Peace Corps Volunteers with the Thailand Anti-Malaria Program. After the extension of the project in April 1982 there was only one project monitor until the completion of the project in December 1984.

Short term consultants were effectively utilized in the areas of transportation, health education and training as indicated in the Final Evaluation Report of 1983.

Assessment: The technical assistance provided to the project was more than adequate. The performance of the project monitors must be considered outstanding, particularly in the case of Mr. Richard Kalina who continued with the project for its entire duration and contributed substantially to the achievement of the project objectives.

In hindsight, it would appear that greater benefit may have been derived from the use of more short term consultants, particularly in the areas of applied field research and the use of supplementary and alternative vector control measures.

4.2.2 Fellowships and Observation Tours

Under the project 2 MPH candidates completed their training at U.S. universities, 8 M.Sc. candidates completed their training at Thai universities, 12 senior officials of the malaria project completed observation tours in the U.S. and 53 Unit (Zone) officials completed third country observation tours.

Assessment: The planned targets for in-country academic training, U.S. observation tours, and third country observation tours were met or exceeded, but only 2 of 7 planned U.S. academic fellowships for the MPH degree were completed.

The third country observation tours were considered highly successful and very popular as evidenced by requests from every region for additional such tours for the remaining Zone Chiefs and Assistant Zone Chiefs not yet receiving such training as well as for Sector Chiefs.



Training of this kind should be considered a continuing activity. In view of the short fall in candidates for the MPH degree and considering the imminent retirement within the next year of two of the most experienced regional malariologists, a special effort should be made to locate qualified candidates for such training.

4.2.3 Training

The USAID project provided funding for pre-service and in-service training in a wide variety of subjects for a total of 57,913 participants. Courses were given for malaria clinic workers, village voluntary collaborators, instructors of trainers, trainers of volunteers, school teachers, rural health service workers, zone chiefs, sector chiefs, health educators, audio-visual techniques, automobile repair, financial management and research (For a detailed list of courses see Annex 14).

Assessment: The training program sponsored by the USAID project exceeded the target of 52,125 participants by 5,788 for a total of 57,913 trained. Of this total, 56,313 were directly involved in the detection and treatment of malaria cases since they were the malaria clinic workers, the village voluntary collaborators, the school teachers and rural health service workers. Training must be considered one of the most successful elements of the USAID-sponsored project contributing substantially to achievement of the objectives of the malaria and Vector-borne Disease Control program of Health Development Plan Number 5.

4.2.4 Research

The USAID project funded eight applied field research projects all of which were completed by December 1983. An analysis of the usefulness of these projects was provided in the 1983 Final Evaluation Report which stated that the impact of these research projects on the accomplishment of the USAID project goals was minimal - with one exception and that was the study on the radical treatment of malaria in various regions of Thailand which was jointly funded with WHO.

Assessment: The Team finds itself in substantial agreement with the findings of the Final Evaluation Team of 1983 with minor exceptions. In addition to the anti-malaria drug studies which yielded valuable and immediately useable results, the study on "An Epidemiological Early Warning System for Malaria Control" was well designed and carried out and has considerable potential for future use. The System is being used on a routine basis in Region II, but on a limited basis in the other regions.



All of the other research projects produced information which may be of value in the future, but did not contribute substantially to the project objectives. Reasons varied for each project, but may have included some of the following: (1) inadequate protocols were developed or were not followed; (2) controls were inadequate or nonexistent; (3) objectives were not clear; (4) experimental design was inappropriate to obtain the information desired; (5) supervision and/or technical guidance were inadequate.

In spite of these apparent faults, there is a positive side to the research picture. There is a healthy attitude towards research throughout the program. Many of the Zone and Sector personnel are devoting considerable time and effort in the attempt to solve problems through applied field research and deserve credit for doing so. However, their work would be far more productive of useable results with closer supervision and more technical guidance from the Regional and National Headquarters.

4.2.5 Capital Improvements: Construction

This component of the USAID project resulted in the construction of 7 new buildings and the renovation and improvement of 4 existing buildings. The Team was favorably impressed by the new training center in Phraphuttabat which consists of a large conference room, 2 lecture halls, a teaching laboratory, a library, dormitories for students and visiting staff, a recreation room, laundry facilities, kitchen, cafeteria and offices. The original dormitory has been renovated and is also being fully utilized so that the center can now handle up to 58 students and 10 visiting staff members at the same time. Two separate classes were being conducted simultaneously at the time of the Team's visit.

Most of the other construction was of 3 zone (or unit) offices modeled after the research buildings, but with additional office space instead of laboratories. Existing insectaries in Bangkok and Phraphuttabat and the old training facility in Chiang Mai were renovated.

Assessment: The team visited 5 of the new buildings and all of the renovated facilities and could see for themselves that they were being put to good use by the Malaria Program. Completion of this construction schedule on time as planned without cost overruns is quite a creditable achievement. This element of the USAID project has contributed to the objective of institutional development by making it possible for the Malaria Program to provide better service to the rural population of Thailand.



4.2.6 Commodities (for complete list see Annex 14)

Assessment: The equipping of the malaria clinics, provision of malaria volunteer kits, health education equipment, sprayers and nozzles, and equipment for the conduct of the training and research programs all contributed greatly to the objectives of the project.

4.2.7 Vehicle Overhaul

Although the original plan called for overhaul of 400 vehicles, on advice of the transportation consultant, this target was reduced to 200 and a total of 196 vehicles were actually repaired.

Assessment: In view of the advanced age of many of the vehicles, particularly the Jeeps nearly all of which are from 10 to 30 years old, it is not surprising that further repairs were considered not cost-effective. However, the funds were used to improve the vehicle situation by purchasing additional motorcycles. What is needed is an accelerated vehicle replacement schedule. This will be addressed in the section on needs and recommendations.

4.2.8 Health Education Materials (for complete list see Annex 14)

Materials developed and provided included malaria clinic handbooks, voluntary collaborator handbooks, posters, pamphlets, cassette tapes, tape recorders, malaria films, entertainment films, slides, flip charts, audio-visual equipment, mobile loud speaker sets, tec.

Assessment: All of the materials met a need in the program and were used to good advantage in the field in obtaining better cooperation from the villagers. Most of the zone chiefs and sector chief interviewed by the Team indicated that a special health education effort in a particular village utilizing the available materials resulted in an increased percentage of houses sprayed.

4.2.9 Motorcycle Revolving Fund

697 motorcycles have been purchased under the procedures established for the "Motorcycle Revolving Fund." Monthly installment payments are being received at the Malaria Division. It is planned that an additional 100 motorcycles will be purchased each year until the final year of the revolving fund in 1992.



Assessment: This element of the USAID Project has been highly successful and very popular in the field and has contributed to better supervision and conduct of the surveillances operations at the Sector level.

Only 2 complaints were heard in regard to the Motorcycle Revolving Fund. One was to the effect that it was sometimes difficult to obtain the necessary guarantor's signature. The other was to the effect that the Revolving Fund had not yet been made available in some Sectors.

4.2.10 RTG Motorcycle Procurement

The additional funds which became available as a result of the revised target for vehicles to be overhauled were used to purchase 300 motorcycles which have been used at the Sector level.

Assessment: This procurement, based on a recommendation of the USAID transportation consultant has had a positive and beneficial effect in increasing flexibility at the sector level in the provision of better supervision of field activities.

4.3 Overall assessment of the contribution of the USAID-Funded Anti-Malaria Project to the Achievement of the RTG Anti-Malaria Program

4.3.1 Summary Statement

All of the 10 elements of the USAID Funded Anti-Malaria Project as listed above have contributed positively to the successful achievement of the objectives of the RTG Anti-Malaria Program. Worthy of special mention is the training component which in combination with the construction of facilities and procurement of commodities resulted in a tremendous expansion of the malaria clinics and the malaria village volunteer network. As an indication of the value of this approach in finding and treating malaria cases one Zone in Region IV reported that in 1984 passive case detection (largely malaria clinics and volunteers) accounted for 91% of all positive cases while taking only 56% of the total slides. In another Zone in Region V passive case detection accounted for 76% of the positives while taking only 40% of the slides. Throughout all of Thailand passive case detection accounted for 88% of the total confirmed malaria cases while taking only 54% of the slides. This is an indication that the program is moving in the right direction.



The research element which had a high potential for accomplishment reached this potential in only a few of the projects attempted. This will be discussed in greater detail under the section on unmet needs and recommendations.

The most disappointing element of the project was the vehicle overhaul program. However, the re-allocating of funds made it possible to purchase 300 motorcycles which have been put to good use. On the positive side, the difficulties involved in repairing overage vehicles demonstrated that it is not cost-effective to attempt repairing vehicles beyond a certain age and emphasized the need for an adequate regular vehicle replacement system.

A final aspect worthy of comment is in relation to the operational residual house spraying program. Although support of this aspect of the program was not included in the USAID project, except for provision of limited equipment for the spray program and indirectly as a beneficiary of the health education program, residual spraying of houses is still the most cost-effective method of controlling malaria and is still the primary method of choice in all countries of the world except those which have serious problems of vector resistance to residual insecticides which Thailand does not.

Examination of the Project Identification Document (PID) and the Project Paper (PP) for the AID Anti-Malaria Project show that a strong vector control support element was originally included, but was later deleted.

The Team through its field visits and examination of records has come to the conclusion that the residual spraying is one of the weakest elements of the program. The AID Project approach of strengthening the malaria case detection and treatment program while highly successful on its own, would have been far more successful in reducing the total amount of malaria if it had been combined with a more effective residual spray program.

5. FUTURE REQUIREMENTS OF THE NATIONAL MALARIA CONTROL PROGRAM (UNMET NEEDS) AND RECOMMENDATIONS

5.1 Need: To develop a strategy to improve the effectiveness of the program.

Discussion:

Although substantial progress has been made on a countrywide basis in reducing the incidence of malaria from



the high API of 10.0 (per thousand) in FY 1981 to the FY 1984 level of 6.1 (per thousand), in some areas the incidence of malaria started back up again in 1984 and so far in 1985 some areas have shown an increased incidence of malaria even before the normal peak malaria season. In view of this threatened increase of malaria and in consideration of the continuing problems which are impeding further progress in the reduction of malaria which have been identified in the USAID Anti-malaria Project Mid-term and Final Evaluation Reports, the assignment reports of the USAID Project Monitor and in reports of the Malaria Division, the Evaluation Team is of the opinion that the over-riding need is to develop a plan which will lead to a solution of these problems and thus increase the effectiveness of the program.

5.2 Problems and Recommendations

5.2.1 Malaria Control Strategy

Discussion:

The document entitled "Guidelines for the Implementation of Malaria Control Measures in Thailand" was issued in 1978. Although there have been many changes in the malaria situation as well as changes in the interpretation and implementation of these "Guidelines" since then, the document itself has not been changed.

Recommendations:

5.2.1.1 The "Guidelines for the Implementation of Malaria Control Measures in Thailand" should be revised and up-dated in light of experience since these guidelines were prepared. Since WHO personnel were involved in the original preparation of these guidelines, it would appear to be logical to request WHO to provide short-term assistance for this task.

5.2.2 Persistent high malaria transmission rate in certain control areas

Discussion:

During the field visits, the team spent most of its time in the Zones and Sectors where problems of malaria



control are rather critical. In spite of the great effort that was given in these areas, malaria transmission still persists at a high level. It may be assumed that at present, these core areas are mainly responsible for the overall incidence of malaria in the country.

Recommendations:

5.2.2.1 Priority in terms of qualified personnel, operational funds, commodities and vehicles should be given to these areas to maximize the control activities.

5.2.2.2 In-depth epidemiological review of malaria status and its control are problems which should be regularly assessed by the technical team or teams assigned by the Headquarters.

5.2.2.3 Technical field supervision should be strengthened to assure the maximum quantity and quality of work in these areas.

5.2.2.4 A model of efficient control operations for these areas should be developed and tried as a pilot study. This study should seek assistance and cooperation from other internal and external resources.

5.2.3 Inadequate Residual House Spray Coverage

Discussion:

Given the present level of residual spray coverage in relation to what is needed as determined by application of the current criteria for spraying, there is little prospect that the residual spray program will be able to successfully cope with the presently rising incidence of malaria in the problem areas.

Recommendations:

5.2.3.1 A realistic 5-year plan of operations and the initial year's Plan of Action should be drawn up utilizing the accepted criteria to determine which villages and how many houses should be sprayed. The budget request should reflect the amount of insecticide required to carry out the proposed spray program.

5.2.3.2 An accelerated health education campaign should be conducted in areas of high transmission where the refusal rate is high.

5.2.3.3 Special surveys should be carried out to determine to what extent the supervision of the spray program in the field is adequate and steps should be taken to formalize and improve supervision wherever necessary.

5.2.4 Improvement of Operational Entomology

Recommendations:

5.2.4.1 In view of its importance to epidemiological and operational evaluation, the current entomological network and reporting system should be expanded and its efficiency continually improved by regular supervision and annual refresher training, allowing some degree of flexibility in the planning of activities whenever needed. The contents of the refresher courses should be job oriented.

5.2.4.2 The susceptibility of malaria vectors and suspected vectors to DDT and fenitrothion, the two insecticides in operational use should be adequate and continuously monitored, and susceptibility to alternative insecticides regularly carried out.

5.2.4.3 Development of tolerance to DDT in some of the vector populations should be clarified and followed up.

5.2.4.4 Considering that the majority of the population of Thailand are in the eradication program, more emphasis should be given to investigation of malaria foci with particular attention to the two factors of time and place.

5.2.4.5 In view of the considerable time and effort spent in special studies, it is important that relevant plans are discussed with staff from the Entomology and Research sections at headquarters and only those which are promising should be continued after modification of the experimental design if required (See also Recommendation No. 5.2.7.8 in the research section).

5.2.4.6 The receptivity studies which contributed greatly to the phasing of the program should be pursued and relevant information recorded in the form designed specially for this purpose, and up-dated. The information provided should be utilized in planning of field operations in connection with malaria outbreaks in eradication areas.

5.2.4.7 The form developed earlier for consolidation of data on insecticide susceptibility studies in indicator areas is a very useful tool in illustrating trends in susceptibility and therefore should be used regularly at the Regional and Zonal offices.

5.2.5 A more efficient reporting and information management system

Discussion:

Anti-malaria programs in general are known to compile tremendous amounts of information and the Thailand program is no exception. At every facility visited the Team was provided with an abundance of information - annual reports, special reports, statistical reports, tabulations, summaries, special investigations, etc. There are nearly 100 separate report forms in regular use in the program. The filling out of these forms and tabulation of the information represents a huge investment of time and money. It is doubtful that all of the information being gathered is really necessary but some information of value to the program is not being compiled or is somewhere in the files, but not readily available.

Recommendations:

5.2.5.1 A study should be undertaken to determine the desirability and feasibility of establishing a computer-based information management system for the Thailand Anti-Malaria Program.

5.2.5.2 If it is considered both desirable and feasible, a proposal for such a project should be prepared and external funding sought.

5.2.5.3 A complete review should be made of all report forms to include an assessment of the care and accuracy with which they are completed in the field, the essential nature of the information, and how the information is used. The changing needs of the malaria program may make it advisable to revise some forms, drop others and add some new ones.



5.2.6 Acceleration of health education activities

Discussion:

Although health education activities are having a favorable impact on the spray program when and where an intensified campaign is carried out, it is not possible to reach all problem villages with the limited manpower available.

Recommendations:

5.2.6.1 All personnel assigned health education duties should be given specific task oriented training with an emphasis on influencing village leaders.

5.2.6.2 A series of health education workshops should be organized to provide for free exchange of innovative ideas for promoting better cooperation from the villagers.

5.2.6.3 A health education element should be included in the training courses for all types of personnel. Every employee of the malaria program should be considered to have health education duties and be a public relations agent for the program.

5.2.6.4 In order to insure continuing support for the health education activities, a 5-year plan and budget should be prepared which would provide for maintenance and repair of equipment, replacement of broken or worn-out equipment, purchase of new equipment as needed, purchase of additional posters, pamphlets, flip charts, etc., as needed, replacement of old movies, preparation of a new up-dated movie on malaria, preparation of 35 mm slide sets, preparation of new cassette tapes as needed, etc.

5.2.6.5 The Peace Corps volunteer in Chiang Mai observing that every village had a supply of comic books which were well read by adults as well as children has suggested a comic book on malaria. A plot similar to that in the malaria movie might well interest the commercial comic book publishers. The idea is considered worth exploring.

5.2.7 Long-range planning for continuous training program.

Recommendations:

5.2.7.1 A long term plan (e.g., 5 years) for various training courses should be drawn up and submitted for commitment of financial support.

5.2.7.2 The Praphuttabat Malaria Training Center should receive full support so that it can be run independently without interfering with the staff engaged in anti-malaria operations.

5.2.7.3 The following training courses are suggested:

- Intensive course in malaria and malaria control planning for candidates who will be promoted to Zone and Assistant Zone Chief. This course should be compulsory and be used for career promotion.
- Pre-service training course in malaria entomology and epidemiology should be provided to those who will be assigned to supervise entomological activities either at the Regional or Zonal level and followed up by annual refresher course.
- Refresher course for Zone and Assistant Zone Chiefs (MII) and Sector Chiefs (MI) should be continued and course curricula should be revised to give more emphasis on practical control techniques, epidemiology and data analysis. The course for Sector chiefs may be provided at the Region in order to train all Sector and Assistant Sector Chiefs in a shorter duration.
- Refresher course for malaria clinic workers, malaria voluntary collaborators, should also be continued and the interval of training should be adjusted to the appropriate resources.
- Instructor courses should be given in order to expand the training capability.

- Training course for malaria field workers should be developed and the model of multi-purpose malaria worker employed in Region II may be considered in developing the course curriculum.

5.2.7.4 Academic fellowships to study abroad in public health and vector borne disease control should be made available to potential candidates. These qualified professionals are badly needed to fill the gap of Malariologists who will retire in the near future.

5.2.8 Strengthening capabilities in research

Discussion:

The recommendations of this assessment team in the area of research should be read in conjunction with those made earlier in the final evaluation of the USAID Anti-Malaria Project, July 1983.

Recommendations:

5.2.8.1 To develop and implement a sound research program it is essential to strengthen the capabilities of the Field Applied Research Section. Funds should be made available for the two new posts approved earlier by the Civil Service Commission. In filling these posts, and any other similar posts which may become available in the future, greater attention in selection should be given to the suitability for and interest in field applied research.

5.2.8.2 Collaboration with other research institutions in malaria and its related fields should be strengthened and expanded. Assistance in the development of experimental design including write up of protocols and analysis of data should be sought regularly from national institutions and international agencies. Considerable assistance has been provided in the area of chemotherapy but not in vector biology and control.

5.2.8.3 Considering the successful results achieved in implementing the findings of the research project entitled "An Epidemiological Early Warning System for Malaria Control," in the three study Zones in Regions 3, 4 and 5 and in Region 2 in general, the next step is to put the system into wider operational use with the development of criteria on the action and steps to be taken when the situation arises.



5.2.8.4 A course on experimental methodology should be held annually with assistance from research institutions within or outside Thailand.

5.2.8.5 Research projects should be supervised directly by the principal investigator and not left to local field staff.

5.2.8.6 A national malaria research meeting should be held bi-annually as a follow-up to the successful one held in 1983.

5.2.8.7 Apart from the current research projects already approved and in progress the following is a list of some additional topics recommended for study:

- Effectiveness of larvivorous fish as biological control agents against An.minimus and An.maculatus in running streams. In view of the difficulties encountered in carrying out earlier studies in this field, it would be advisable to consult a specialist.
- Role of suspected vectors in malaria transmission in eradication areas.
- Malaria vectors in the highly endemic area of Mae Sot in Northwest Thailand and their role in high altitudes.
- Village scale trials with alternative insecticides for indoor residual spraying.
- Studies on the bionomics of An. annularis and its role in malaria transmission in Northwest Thailand.
- Studies on the genetics of DDT resistance in different populations of An.annularis.
- A village scale trial with bed nets impregnated with insecticide as a supplementary measure in malaria control.



- Studies on the effectiveness of health education campaigns in improving the residual spray program.
- Studies of villagers attitudes towards the malaria program.
- Studies of the cost-effectiveness of various methods of vector control.

5.2.8.8 Some of the observations carried out under "Special Studies" on self protection methods which appear promising may be converted into proper research projects.

In the planning and implementation of any of the research projects the Team wishes to emphasize the importance of the steps which appeared in the evaluation report of July 1983, copy of which appears as Annex No. 16 in this report.

5.2.9 The Refugee Problem

Discussion:

Mass influx of refugees across the border during the fighting which has happened periodically has led to an increase of malaria cases in the border areas. The Team visited two refugee camps in Khao-I-Dang of Taphya District and Khoa Ta Ngok of Klong Had Sub-District of Prachinburi province. The first one is an old settled camp with about 25,000 refugees and malaria did not seem to be a problem in this camp. The second one is a new camp settled by 40,000 refugees about 4 months ago. Malaria prevalence among the refugees was about 10% and no control measures were provided except treatment of symptomatic malaria cases. It is pertinent that the congregation of a large numbers of people provides a reservoir of infection which will contribute to the increase of malaria transmission in the area and consequently will affect the local villagers.

Although efforts to control malaria in these camps have been made by malaria control program personnel, these camps are not always accessible to malaria personnel.

Recommendations:

5.2.9.1 Authorities who are responsible for control and relief work in the camps should be contacted and persuaded to provide malaria control measures in the camp.



5.2.9.2 Malaria statistics among refugees in the camps should be collected periodically from the medical and health unit of the camp. These statistics are important for epidemiological analysis of malaria in these areas.

5.2.10 Vehicle Replacement

Discussion:

There is an immediate need to replace all of those vehicles which are not economical to repair and maintain.

Recommendations:

5.2.10.1 A long range plan should be developed with a vehicle replacement schedule aimed at immediate replacement of the oldest vehicles for which maintenance and repair is not cost effective and an annual replacement schedule for replacing vehicles when they reach an uneconomical age. Although the standard 6 year replacement may not be realistic in Thailand, it should be possible through careful study of maintenance and repair records to determine a suitable vehicle retirement age.

5.2.11 Development of Multi-Purpose Malaria Workers

Discussion:

Multi-purpose malaria workers carrying out all malaria activities in a designated number of villages have been used to good advantage in Region II.

Recommendations:

5.2.11.1 This approach may fit with the future plans for the integration of malaria control into primary health care. The Team recommends that a proper evaluation of this trial should be carried out and that similar trials should also be conducted in other regions.

5.2.12 Permanent Zone and Sector Offices

Discussion:

As malaria control is a long term program which requires continuing activities, Zone and Sector offices will definitely need permanent buildings for their accommodation to facilitate their work. Several Zone and Sectors had the unfortunate experience of being moved frequently because of rented buildings. At present 9 Zones out of 33 need permanent accommodations.



Recommendation

5.2.12.1 The Team recommends that budget should be made available for the construction of all 9 Zone offices.

6. RESOURCES FOR MEETING FUTURE REQUIREMENTS

Solutions to the problems discussed in Section 5 above come in several categories. Some can be implemented by the Malaria Division and the Ministry of Public Health. Others will require that additional funds be budgeted and some will require external technical assistance and/or external funding. In general, development assistance funding agencies are reluctant to provide for recurring costs on the basis that this is properly the responsibility of the individual country. However, there have been exceptions to this unwritten policy on a one-time only basis when there was an urgent need.

The Team is not in a position to identify specific sources of the required external assistance, but will suggest areas of activity discussed in Section 5 which are considered suitable for external assistance. The team will also provide a list of those governments and agencies which are providing assistance to anti-malaria programs now or have done so in the past and to the extent feasible will discuss the nature of such assistance.

6.1 Future Requirements Suitable for External Assistance

Discussion

Some of the needs are simple and direct and only involve the purchase of commodities. Fortunately, some donors prefer to provide their assistance in this manner. Other needs are more complex, involve technical assistance, planning and the development of a project or a series of projects. The list given below is not intended to be complete, but is given only for illustrative purposes.

6.1.1 Vehicle replacement

6.1.2 Purchase of insecticide to provide for a reserve supply

6.1.3 Improvement of the research program

6.1.4 Expansion of the training program

6.1.5 Acceleration of the health education program



6.1.6 Development of a computerized information system

6.1.7 A series of demonstration projects

- Multi-purpose malaria workers in all regions
- Development of health services based on a multi-purpose malaria worker system
- Integration of malaria and the primary health care program in selected eradication or partially integrated areas

6.2 Potential Donor Agencies

6.2.1 World Health Organizations (WHO)

WHO has a long history of support of anti-malaria programs on a worldwide basis in terms of technical assistance, research, training and limited amounts of commodities for training, research, or emergency situations. In recent years WHO has channeled much of its funding in support of primary health care. However, it was recognized in the Alma Alta declaration that where an endemic disease is a serious problem, then control of that disease must be a part of primary health care. WHO has the responsibility for the mobilization and coordination of support for malaria programs on a worldwide basis.

6.2.2 United Nations International Children Emergency Fund (UNICEF)

During the period from the mid 1950s until 1973 UNICEF was a major supplier of commodities for malaria programs for which WHO provided technical assistance. UNICEF provided motor vehicles, insecticides and laboratory supplies and equipment as well as advisory services on fleet management, and maintenance and repair of motor vehicles. In 1973 UNICEF announced that it would no longer assist malaria control programs as such, but only in the context of primary health care.

6.2.3 United Nations Development Program (U.N.D.P.)

UNDP has provided limited assistance to some malaria programs in conjunction with other donors.



6.2.4 United Nations Environmental Program (U.N.E.P.)

UNEP has provided some funding for a workshop on bio-environmental control of malaria and has had some funds available for support of research on problems relating to the environment.

6.2.5 United Nations Industrial Organization (U.N.I.D.O.)

UNIDO has provided some funding in support of the development of DDT manufacturing plants.

6.2.6 The United States

The U.S. Agency for International Development and its predecessor agencies have provided assistance to malaria control/eradication programs in Asia, Africa and Latin America for nearly 40 years. This assistance has been in the form of loans and grants totalling more than one billion dollars and has provided technical assistance, commodity assistance, support of training, support of research and local currency support to some 36 countries directly and to twice as many indirectly through other agencies.

AID issued a revised agency guidance for malaria control in July of 1984. This new guidance covers AID malaria policy, criteria for AID assistance to anti-malaria programs, and the role of primary health care. AID's malaria program assistance emphasizes research, training, program design and donor coordination particularly in relation to multi-donor assistance. A copy of the Agency guidance on malaria control should be available through the local USAID office.

6.2.7 United Kingdom has provided both technical assistance and commodity assistance in support of malaria control programs.

6.2.8 Netherlands has also provided both technical assistance and commodity assistance to malaria programs.

6.2.9 Japan has assisted malaria programs through the provision of commodities such as insecticides, vehicles and equipment. It is understood that Japan has appointed a committee on malaria control assistance and may adopt a more formal policy.



6.2.10 Canada, Sweden and Denmark have assisted malaria control through support of training or operational field programs.

6.3 Multi-Donor Assistance

There is an example of a multi-donor funded malaria program given as a model in the 1977 USAID report on Strategy for Control of Malaria in Asia. The Government of Sri Lanka after preparing a 5-year operational plan and budget invited representatives of a number of embassies to a meeting in which they presented their proposed program together with requirements and in effect asked, "Who can help us?" This resulted in a multi-donor funded anti-malaria program assisted by the USAID WHO United Kingdom and the Netherlands.

It is suggested that the possibility of multi-donor funding be explored.

7. Acknowledgements

The Team wishes to express its sincere appreciation to the Director of the Malaria Division and his headquarters staff for providing much information of value. In addition, the Team wishes to express special thanks to the five Regional Malariologists and their Regional, Zonal, and Sector staff for all of their assistance, courtesy, and hospitality.

The Team also wishes to acknowledge with appreciation the assistance provided through the support of the Director General of the Department of Communicable Disease Control, and the Director of the USAID Office of Health, Population and Nutrition.

Special thanks and appreciation is also owed to Mr. Narintr Tima, USAID Project Officer and Mr. Richard Kalina, former Project Monitor.

ANNEX 1
MALARIA PROJECT EVALUATION (JUNE-JULY, 1985)
SCOPE OF WORK

1. Evaluate the degree to which the National Malaria Control Program has obtained its stated objectives (1982-1986). Identify any objectives which will probably not be achieved by the end of 1986, give reasons for lack of achievement and make recommendations for follow-up actions.
2. Assess the contributions of the USAID-funded Anti-Malaria Project to the achievements of the RTG Anti-Malaria Program, e.g., the impact of training programs as well as the establishment of local malaria clinics. Also assess the status of current malaria morbidity and mortality as well as problems of parasite resistance to drug treatment, changing vector behavior or other factors likely to bring about changes in the current/future incidence of malaria.
3. Review current and projected RTG Anti-Malaria Program resources as well as assistance from external sources such as WHO, Government of Japan, etc.
4. Identify unmet needs in the Anti-Malaria Program and make recommendations on:
 - how the program can improve its effectiveness in achieving 5th Plan objectives;
 - what kind of actions should be taken prior to phasing into the 6th Plan;
 - strategies that should be pursued during the 6th Plan period (1987-1991);
 - what types of external assistance are likely to be required;
 - what are likely sources of required external assistance; and
 - what policy adjustments, if any, would serve to help achieve program objectives.
5. Prepare a report describing the above-mentioned issues for the Malaria Division, MOPH and USAID.

ANNEX 2
DETAILED ITINERARY

June 17-20 Malaria Division Headquarters - Briefing

June 20 Leave: Bangkok - by car
 Visit - Region 1, Malaria Training Center, Praputthabat
 - MVCs - Vill.1, Kok-Toom, Muang, Lopburi
 - Vill.8, Nikom, Muang, Lopburi
 Night: Praputthabat

June 21 Leave: Praputthabat - by car
 Visit - Sector 76 Kaengkoi
 - MVC - Vill.5, Cha-om, Kaengkoi, Saraburi
 - Zone 7 Pak Chong
 - Malaria Clinic - Moo Si, Pakchong, Nakornrajsima
 Night: Khao Yai

June 22 Leave: Kaho Yai - by car
 Visit - Sector 3 Prabinburi
 - Zone 2 Prachinburi (Sakaeo)
 Night: Aranyaprathes

June 23 Visit - Aranyaprathes Community Hospital
 - Sector 1 Aranyaprathes
 - Refugee Camps - Khao Ta-Ngok, Thai-Udom
 Klong-Had, Prachinburi
 - Khao-I-Dang, Nongwang,
 Taphya, Prachinburi
 Night: Aranyaprathes

ANNEX 2
(Continued)

June 24 Leave: Aranyaprathes - by car
 Visit - Sector 8 Wang Nam Yen
 - Wang-Nam-Yen Community Hospital
 - Pong-Nam-Ron Community Hospital
 - Sector 3 Pong-Nam-Ron
 - MVCs - Vill. 1, Tabsai, Pong-Nam-Ron, Chantaburi
 - Vill. 2, Pong-Nam-Ron, Chantaburi
 Night: Chantaburi

June 25 Leave: Chantaburi - by car
 Visit - Zone 6 Trad
 - Trad General Hospital
 - Bor-Rai Community Hospital
 - Sector 4 Bor Rai
 Night: Chantaburi

June 27 Leave: Chantaburi - by car
 Visit - Zone 5 Rayong
 - Malaria Clinic - Pluak Dang, Rayong
 Night: Bangkok

June 28 Visit - Region V (Bangkok)

July 1 Leave: Bangkok - by plane
 Visit - Region II Chiang Mai
 Night: Chiang Mai

July 2 Visit - Sector 1 Li
 Night: Chiang Mai

ANNEX 2
(Continued)

July 3 Leave: Chiang Mai - by car
Visit - Sector 7 Denchai
- MVC - Vill. 3 Hua-Fai, Soongmen, Prae
- Zone 3 Prae
Night: Prae

July 4 Leave: Prae - by car
Visit - Zone 1 Tak
- MVC Vill. 1, Mae Tor, Muang, Tak
Night: Mae Sot

July 5 Visit - Sector 4 Mae Sot
- Malaria Clinic & Health Center - Vill. 5
Ban Sanparai, Mae-Cha-Rao, Mae-Pa-Mat, Tak
- Sector 3 - Mae-Ra-Mat
- Sector 5 - Tha-Song-Yang
Night: Mae Sot

July 6 Leave: Mae Sot - by plane to Bangkok
Night: Bangkok

July 8 Leave: Bangkok - by plane
Visit - Region IV Songkhla
Night: Haad Yai

July 9 Visit - Zone 1 Yala
- Sector 5 Yala
Night: Haad Yai

ANNEX 2
(Continued)

July 10 Visit - Zone 2 Songkhla
Leave - Haad Yai by plane
Night: Bangkok

July 11 Leave: Bangkok by plane
Visit - Region III Khon Kaen
Leave Khon Kaen - by car
Visit - Malaria Clinic - Vill.6, Kok-Phoo, Huad Bak,
Sakhon Nakon
Night: Sakhon Nakon

July 12 Leave: Sakhon Nakon by car
Visit - Sakhon Nakon Provincial Health Office
- Sakhon Nakon Liver Fluke Control Unit
- Sakhon Nakon General Hospital
Night: Khon Kaen

July 13 Leave: Khon Kaen - by plane
Night: Bangkok

July 15-26 Bangkok - Writing report, and final discussions. During this period the Team also visited the Armed Forces Research Institute for Medical Science (AFRIMS) and the School of Tropical Medicine of Mahidol University.

ANNEX 3

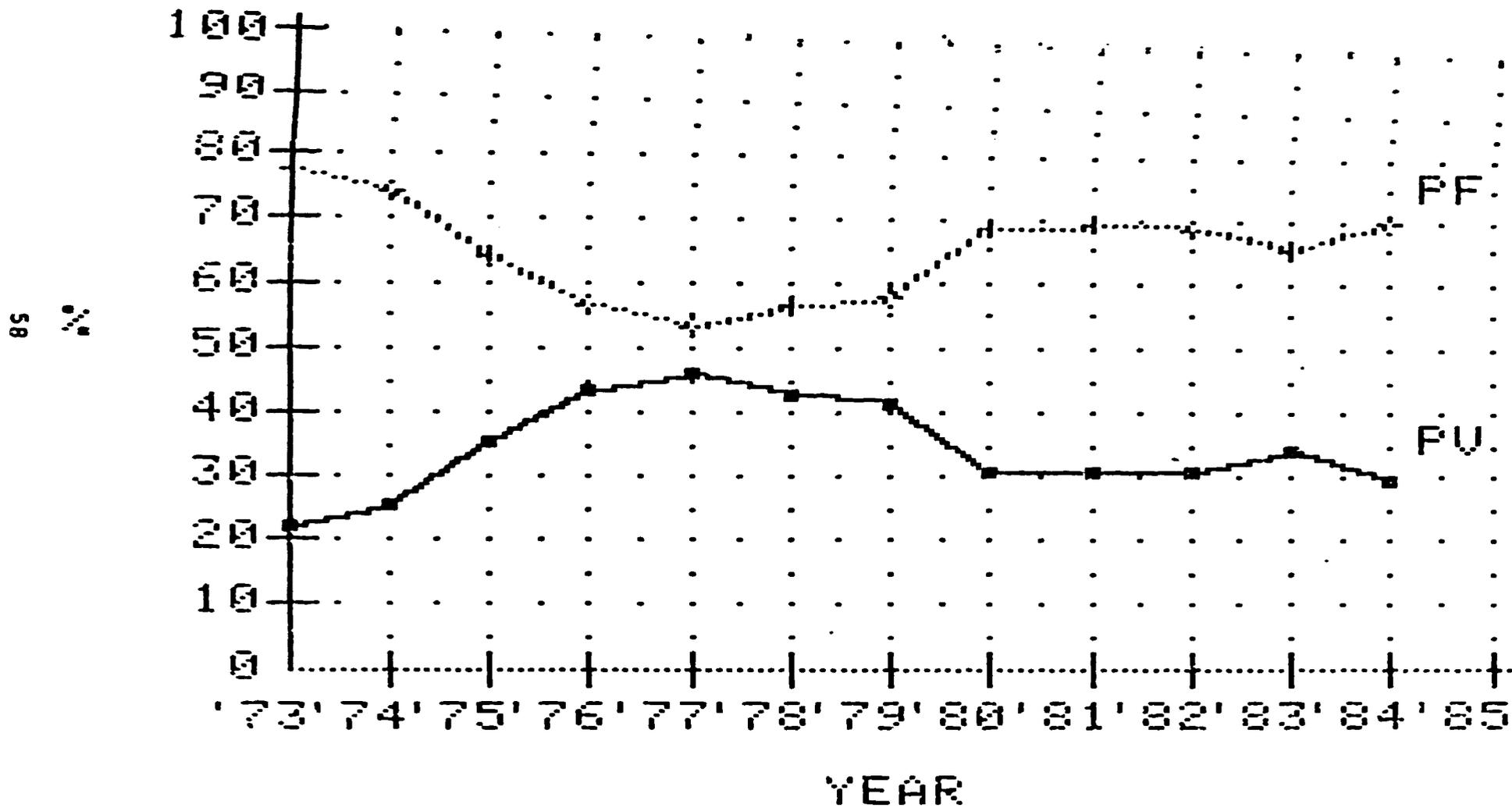
RESULTS OF MALARIA CASE DETECTION BY REGION
(FY 1980 - FY 1985)

Fiscal Year	Region I			Region II			Region III			Region IV			Region V			Country Total		
	No. Slide Exam	No. Pos	API	No. Slide Exam	No. Pos	API	No. Slide Exam	No. Pos	API	No. Slide Exam	No. Pos	API	No. Slide Exam	No. Pos	API	No. Slide Exam	No. Pos	API
1980	935,511	82,307	8.9	1,513,022	33,103	4.6	836,859	34,562	3.7	772,039	118,034	22.6	659,117	105,854	9.3	4,734,602	371,860	8.4
1981	1,005,532	104,534	11.3	1,763,064	32,541	4.5	850,040	48,006	5.1	820,547	134,272	25.0	863,891	129,803	9.6	5,303,074	449,151	10.0
1982	1,172,055	119,395	13.5	2,035,128	43,335	5.9	1,016,103	47,274	4.8	818,506	113,273	20.7	1,016,869	141,076	10.2	6,068,657	464,353	10.1
1983	974,100	57,122	5.8	2,066,187	24,310	3.2	996,600	31,780	3.2	902,082	70,530	12.6	1,026,710	82,891	5.9	5,965,679	266,633	5.7
1984	1,112,297	58,220	6.8	2,213,017	24,472	3.2	1,043,087	21,713	2.1	968,914	64,773	11.2	1,278,120	118,461	8.0	6,615,425	297,639	6.1
1985 (Oct. 24 - April 85)	735,948	52,977		1,319,863	15,225		666,851	13,600		552,792	21,774		826,429	70,277		4,111,874	177,853	

Source: Malaria Division's Reports of Summary of Surveillance.
API = Annual Parasite Incidence per 1,000 population.

ANNEX 4

MALARIA PARASITE SPECIES FORMULA-THAILAND



ANNEX 5

NUMBER AND RATE OF DEATHS FROM ALL CAUSES AND MALARIA

Year	No. of		Crude Death Rate/1000	Malaria Death Rate/100,000	Proportional Mortality Rate/1000
	Total Deaths	Malaria Deaths			
1949	190,401	38,046	10.1	205.5	199.8
1950	184,455	35,819	9.4	183.1	194.2
1951	193,897	34,225	9.6	169.1	176.5
1952	199,211	29,115	9.0	139.2	153.9
1953	183,066	21,451	8.5	99.3	117.2
1954	192,595	16,473	8.6	73.9	85.5
1955	189,666	14,520	8.2	63.2	77.4
1956	202,017	12,617	8.5	53.3	62.5
1957	207,142	10,458	9.0	43.0	47.9
1958	208,866	9,462	8.3	37.8	45.3
1959	206,129	8,530	8.0	33.2	41.4
1960	221,858	7,960	8.4	30.2	35.9
1961	210,709	6,636	7.8	24.5	31.5
1962	221,157	6,739	8.0	24.3	30.5
1963	233,192	6,488	8.2	22.8	28.0
1964	231,095	5,278	7.9	18.2	23.0
1965	216,830	4,522	7.3	15.2	21.0
1966	236,243	4,490	7.8	14.7	19.0
1967	230,622	4,015	7.4	12.9	17.4

ANNEX 5
(Continued)

Year	No. of		Crude Death Rate/1000	Malaria Death Rate/100,000	Proportional Mortality Rate/1000
	Total Deaths	Malaria Deaths			
1966	232,116	3,308	7.3	10.4	14.2
1969	243,444	3,450	7.3	10.4	14.2
1970	223,899	3,437	6.5	10.1	15.5
1971	227,990	4,401	6.4	12.5	19.3
1972	248,676	4,147	6.8	11.3	16.7
1973	239,151	5,350	6.2	14.2	22.3
1974	246,459	6,113	6.2	15.8	24.8
1975	234,550	5,746	5.9	14.4	24.5
1976	237,062	4,919	5.5	11.5	20.8
1977	236,788	4,771	5.4	10.9	19.6
1978	233,216	4,595	5.2	10.2	18.7
1979	241,111	3,787	5.2	8.2	15.7
1980	247,970	3,755	5.3	8.1	15.3
1981	239,423	4,071	5.3	8.6	16.3
1982	247,402	3,779	5.1	7.8	15.3
1983	252,592	2,898	5.1	5.9	11.5

ANNEX 6

GRAPH SHOWING MONTHLY DISTRIBUTION OF
MALARIA CASES IN THAILAND (1980-1985)

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ANNEX 7

ANALYSIS OF BLOOD SLIDES AND MALARIA POSITIVES
BY ACTIVITIES FOR FY 1984

	REGION I	REGION II	REGION III	REGION IV	REGION V	COUNTRY TOTAL
Total No. Blood Slide	1,112,287	2,213,017	1,043,087	968,914	1,278,120	6,615,425
Total No. Malaria Positive	68,220	24,472	21,713	64,773	118,461	297,639
ASER per 100 pop.	11.2	29.06	9.23	16.78	20.64	13.2
API per 1,000 pop.	6.8	3.2	2.1	11.2	19.0	6.1
<u>Percentage of Blood Slide</u>						
<u>Contributed by</u>						
- Malaria Clinic	13.7	6.0	12.6	20.0	13.4	13.3
- PCD Posts	52.9	37.0	60.4	30.9	30.0	41.0
- ACD & Other	34.4	57.0	27.0	49.1	56.6	45.7
Total	100.0	100.0	100.0	100.0	100.0	100.0
<u>Percentage of Malaria Positives</u>						
<u>Contributed by</u>						
- Malaria Clinic	42.5	35.9	54.9	63.8	46.9	49.2
- PCD Posts	46.2	52.3	40.2	27.5	34.2	38.5
- ACD & Other	11.3	11.8	4.9	8.7	18.9	12.3
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Malaria Division's Summary of Surveillance. Quarterly Reports. (October 1983 - September 1984)

ANNEX 8
DISTRIBUTION OF MALARIA CLINICS
AS OF JUNE 1, 1985

DIVISION/ REGION	NO. OF ESTABLISHED MALARIA CLINICS					
	Division HQ	Regional HQ	Zone Office	Sector Office	Out Post	Total
Division	1	-	-	-	-	1
Region I	-	1	6	51	26	84
Region II	-	-	3	53	21	77
Region III	-	-	5	55	51	111
Region IV	-	1	7	57	21	86
Region V	-	-	7	54	12	73
	1	2	28	270	131	432

Source: Malaria Division's Laboratory Service Station.

ANNEX 9
 DISTRIBUTION OF MALARIA VOLUNTARY COLLABORATORS
 By Region and Phase
 (As of May 1985)

REGION	NO. OF MALARIA VOLUNTARY COLLABORATORS		
	Control Area	Eradication Area	Total
I	3,061	6,702	9,763
II	6,676	4,500	11,176
III	4,151	6,242	10,393
IV	3,766	2,025	5,791
V	3,233	692	3,925
Country Total	20,887	20,161	41,048

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Source: Malaria Division's Epidemiological Section.

ANNEX 10
RESULTS OF SPRAYING OPERATIONS - CYCLE 1

	1980	1981	1982	1983	1984
Total Population for Spray Coverage (Plan of Action)	3,340,000	3,370,000	4,300,000	3,690,000	3,520,000
Total Population - Actual Spray Coverage	3,201,000	3,416,117	3,544,340	3,349,788	2,380,204
Total Houses Actually Sprayed	711,478	704,161	792,118	717,367	569,569
% Completely Sprayed	58.4	59.9	64.0	64.9	65.2
% Incompletely Sprayed	32.8	31.3	28.8	27.0	27.4
% Unsprayed	8.8	8.8	7.2	7.9	7.4
Total Farmhuts Sprayed	284,092	351,448	373,564	332,726	296,200

ANNEX 10 - Continued
RESULTS OF SPRAYING OPERATIONS - CYCLE 2

	1980	1981	1982	1983	1984
Total Population for Spray Coverage (Plan of Action)		- not available -		2,130,000	2,030,921
Total Population Actual Spray Coverage	1,668,952	1,813,504	2,110,518	1,851,291	1,552,765
Total Houses Actually Sprayed	370,364	395,585	476,442	397,142	366,753
% Completely Sprayed	62.1	61.7	71.3	67.6	69.8
% Incompletely Sprayed	30.7	31.9	21.4	25.6	23.0
% Unsprayed	7.2	6.4	7.3	6.7	7.2
Total Farmhuts Sprayed	250,567	279,660	276,802	153,621	253,757

ANNEX 11
RESULTS OF TRAINING ACTIVITIES
(As of 30 June 1985)

TRAINING COURSE	Place of Training	Number of Personnel Trained/Period of Days					
		1980	1981	1982	1983	1984	1985
<u>Pre-Service</u>							
1. Public Health Officer	MTC	17/60	45/60	-	10/50	-	-
2. Malaria Clinic Workers	MTC	63/50	93/50	73/50	98/50	59/50	56/50
3. Peace Corps Volunteers	MTC	8/12	5/12	5/12	6/12	7/12	-
4. Radio Receiver-Transmitter Use and Main.	MTC	-	-	114/3	-	60/3	-
<u>In-Service</u>							
1. Malaria II	MTC	-	188/7	-	-	23/15	20/15
2. Malaria I	MTC	-	-	66/15	200/15	38/15	-
3. Malaria Clinic Workshop	Region 4	54/5	-	-	-	-	-
4. Malaria Clinic Workers Refresher	Regions	45/5	103/5	97/5	156/5	121/5	81/5
5. Financial Management	H.Q.	39/2	-	-	-	-	-
6. Personnel and Administration Training	H.Q.	-	-	-	-	35/3	-
7. Automotive Repair	H.Q.	60/21	-	-	-	-	60/10

ANNEX 11
(Continued)

TRAINING COURSE	Place of Training	Number of Personnel Trained/Period of Days					
		1980	1981	1982	1983	1984	1985
8. Health Education Workshop	Region 5	45/5	-	-	-	-	-
9. Instructors of Trainers	Region 2	92/5	-	-	-	21/10	-
10. Trainers of Volunteers	Regions	522/5	-	-	-	-	-
11. Malaria Volunteers	Zones & Sectors	-	-	22,083/2	24,627	5,676	-
12. A/V Equipment Use and Maintenance	MTC	-	32/5	80/5	54/5	-	-
13. Malaria Research Workshop	Region 5	-	54/2	-	189/3	-	-
14. Entomology	MTC	60/5	-	-	-	-	-
15. Entomology/ Epidemiology	Region 2	-	60/5	-	-	-	-
16. Drug - Resistant Research Refresher Training	Zone 1 Sriracha	-	-	-	-	6/5	-
17. Health Education Techniques	School of Public Health	-	-	55/10	-	-	-

ANNEX 11
(Continued)

TRAINING COURSE	Place of Training	Number of Personnel Trained/Period of Days					
		1980	1981	1982	1983	1984	1985
18. Seminar or Meeting for Malaria Unit Chiefs		-	-	127/5	212/5	-	160/5
19. Fenitrothion Spraying and Cholinesterase T Testing	Region 5	-	50/5	-	-	-	-
20. Workshop on Fenithrothion Use Loie and Surin	Loie & Surin	-	-	-	-	135/3	-
21. Refresher Training on Radio Receiver Transmitter	MTC	-	-	-	-	75/3	-
22. Microscope Repair	MTC	-	-	-	-	27/10	-
23. National Malaria Conference	Haad Yai & Chiangnai	-	300/3	330/3	-	-	-
24. School Teachers and Rural Health Services	Zones	-	-	-	-	-	2,886

Note: Period of Days - Only working days counted.

ANNEX 12

MALARIA DIVISION APPLIED RESEARCH PROJECTS
(Not Funded by USAID for Research Project)

TITLE	PRINCIPAL INVESTIGATOR	TIME	FUNDED BY	STATUS
1. Regional collaborative studies on drug-resistant malaria.	Mrs. Laksami Suebsang	1977-1983	WHO/SEARO	In progress
2. Studies to determine the effectiveness of the presumptive treatment regimen at present in use.	Dr. Somthas Malikul	1978-1983	TDR/FIELDMAL	Completed
3. A small scale trial of Bendiocarb (PICNM) against <u>An. balabacensis</u> .	Dr. Chusak Prasittisuk	1980-1981	Chesterford Park Research	Completed
4. Field research on the development of the micro-culture test kits for assessing the sensitivity of <u>P. falciparum</u> to chloroquine and mefloquine in Thailand.	Mrs. Laksami Suebsang	1980-1983	TRD/CHEMMAL	Completed
5. A study of the effect of different levels of coverage of intradomiciliary spraying on the <u>An. animulus</u> in a foothill malaria control area of Thailand.	Mr. Suthas Nutsathapana	1981-1983	TRD/FIELDMAL	Completed

ANNEX 12
(Continued)

TITLE	PRINCIPAL INVESTIGATOR	TIME	FUNDED BY	STATUS
6. Colonization of <u>Anopheles minimus</u> (Theobald) and its insecticide resistance status (M.Sc. Thesis).	Miss. Nilobol Vanicha	1981-1982	USAID Fellowship	Completed
7. The role of <u>Anopheles maculatus</u> (Theobald, 1901) in malaria transmission in Thailand (M.Sc. Thesis).	Mr. Dakorn Limratana	1981-1982	WHO Fellowship	Completed
8. Clinical trails with mefloquine.	Dr. Surin Pinichpongse	1982-1983	Roche Foundation	Completed
9. Clinical trails with mefloquine: double blind randomized comparative trail with mefloquine versus mefloquine and sulfadoxine/pyrimethamine in outpatients suffering from symptomatic falciparum malaria.	Dr. Surin Pinichpongse	1982-1983	TDR	Completed
10. A small scale trail of <u>Bacillus thuringiensis</u> versus <u>israelensis</u> against <u>An. minimum</u> in slow-running streams.	Dr. Chusak Prasittisuk	1982-1983	SANDOZ LTD. Switzerland	Completed

ANNEX 12
(Continued)

TITLE	PRINCIPAL INVESTIGATOR	TIME	FUNDED BY	STATUS
11. Preliminary studies on the control of <u>Anopheles minimus</u> (Theobald, 1901) larvae in natural running streams by drip application of Temephos (OMS-786) (M.Sc. Thesis).	Mr. Suchart Phatipongse	1982-1983	WHO	Completed
12. Development of seroepidemiology capability in the anti-malaria program using immunofluorescent antibody test.	Dr. Surang Tanpradist	1982-1984	TDR/FIELDMAL	Completed
13. Study of the effectiveness of radical treatment of <u>P. falciparum</u> by four different brands of sulfadoxine/pyrimethamine.	Dr. Krongthong Thimasarn	1983	Malaria Division	Completed
14. Studies on the use of some medicinal plants as a mosquito-repellent.	Miss. Nilobol Vanicha	1982	Malaria Division	Completed
15. <u>In vitro</u> study on the anti-malaria action of plants upon <u>Plasmodium falciparum</u> (M.Sc. Thesis).	Mr. Chawalit Tassanaswang	1982-1983	USAID Fellowship	Terminated

TITLE	PRINCIPAL INVESTIGATOR	TIME
16. Large-scale field trail of mefloquine to combat multi-drug resistant falciparum malaria in Thailand (TMP).	Dr. Surin Pinichpongse	1983-1985
17. Studies on the bionomics of <u>An. maculatus</u> and its role in malaria transmission.	Dr. Suchart Upatham & Dr. Chusak Prasittisuk	1983-1985
18. Comparison of two <u>in vitro</u> techniques for culture of <u>Plasmodium falciparum</u> in the production of antigen for immunologic evaluation of malaria endemicity by a national malaria service.	Dr. Udom Chitprarop	1983-1985
19. Primary Health Care components of a Malaria Control Programme: An evaluation of alternative systems.	Dr. Krongtong Timasarn	1984-1985

ANNEX 12
(Continued)

TITLE	PRINCIPAL INVESTIGATOR	TIME	FUNDED BY	STATUS
20. Malaria self-protection practices of Northern Thai Villagers.	Dr. Udom Chitprarop	1985-1986	TDR/SER	In progress
21. Center for the Development and Evaluation of Tests for the Assessment of Drug response of <u>P. falciparum</u> .	Mrs. Laksami Suebsang	1984-1985	TDR/CHEMMAL	In progress

ANNEX 13
NUMBER OF MOTOR VEHICLES
(excluding motorcycles)

Received	R1	R2	R3	R4	R5	HQ	Total
1955	0	0	0	1	1	0	2
1956	0	1	0	0	0	0	1
1957	0	5	0	0	1	0	6
1958	0	0	0	1	1	0	2
1959	0	0	0	0	0	0	0
1960	2	6	0	2	2	0	12
1961	5	9	1	4	4	0	23
1962	13	13	4	5	12	0	47
1963	1	2	1	0	8	0	12
1964	1	3	1	0	1	0	6
1965	13	8	4	23	21	2	71
1966	24	23	6	17	8	0	78
1967	0	3	2	0	1	0	6
1968	1	1	1	1	3	0	7
1969	13	16	13	18	11	1	72
1970	9	9	10	11	9	0	48
1971	0	0	2	0	0	1	3
1972	0	0	0	0	1	0	1
1973	2	2	1	0	0	0	5

ANNEX 13
(Continued)

Received	R1	R2	R3	R4	R5	HQ	Total
1974	0	0	2	0	1	0	3
1975	1	0	0	1	2	0	4
1976	2	2	2	2	1	1	10
1977	4	3	1	3	2	1	14
1978	4	6	5	4	5	1	25
1979	4	7	5	8	5	0	29
1980	6	6	6	6	9	0	33
1981	25	31	40	5	36	3	140
1982	3	4	3	13	4	3	30
1983	4	3	4	5	4	0	20
1984	8	11	11	14	13	1	58
Total	145	174	125	144	166	14	768

ANNEX 14*

LIST OF INDIVIDUAL ELEMENTS OF USAID ANTI-MALARIA PROJECT

(1) Training (Loan Fund)

<u>Course</u>	<u>Total Planned Participants</u>	<u>Actual</u>	<u>Comments</u>
Malaria Clinic Workshop	20	54	4-8 February 1980
Malaria Clinic Workers	310	400	12 ten week courses
Malaria Clinic Workers Refresher Prototype	45	45	3-7 November 1980
Malaria Clinic Workers Refresher	310	545	35 Five day courses
Financial Management	39	39	20-21 October 1980
Automotive Repair	60	60	1 April - 3 May 1980
Automotive Repair Refresher	60	61	Oct. - Nov. 1984
Health Education Workshop	25	45	15-19 April 1980
Instructors of Trainers	50	92	19-23 May 1980
Trainers of Volunteers	400	522	14 July - 19 Sept. 1980
Village Voluntary Collaborators	20,000	22,083	Nov. 1980 - March 1982
Village Voluntary Collaborators Refresher (1)	25,000	24,627	Dec. 1982 - April 1983

*Adapted from assignment report by R. Kalina.

ANNEX 14
(continued)

<u>Course</u>	<u>Total Planned Participants</u>	<u>Actual</u>	<u>Comments</u>
Village Voluntary Collaborators Refresher (2)	3,000	5,676	June - August 1984
Malaria II Zone Chiefs	188	183	17-23 June 1981
Malaria I Zone Chiefs	302	266	7 three week courses
Health Education Techniques	55	50	19-30 April 1982
Audio-Visual Equipment Use and Maintenance	30	32	23-27 Nov. 1981
Research Workshop	35	54	28-29 July 1981
Electrical Equipment Repair	3	3	3 Dec. 1980 - Sept. 1981
Operational Research Workshop	68	68	21-22 Oct. 1982
A/V Refresher	55	68	2 three week courses in 1984
Malaria II Zone Chiefs	60	49	2 three week courses in 1984
School Teachers and Rural Health Services	<u>2,000</u>	<u>2,886</u>	Oct.-Nov. 1984
Total	52,125	57,913	

ANNEX 14
(continued)

(2) Fellowships (Grant Funded)

Because of a lack of qualified candidates, the U.S. Academic fellowships were reduced to 2. The progress achieved for all fellowships under the USAID project is as follows:

Type	Total Planned	Revised	Actual	Comments
U.S. Academic-M.P.H	7	2	2	1 completed at Tulane University, 1981
				1 completed at University of Hawaii, 1982
In-country Academic M.S.	7	8	8	4 completed April 1982 4 completed April 1984
U.S. Observation Tour	12	12	12	4 completed Oct. 1980 5 completed Nov. 1981 3 completed Sept. 1983
Third Country Observation Tour	35	53	53	6 completed Dec. 1980 6 completed Jan. 1981 4 completed Dec. 1982 4 completed July 1983 9 completed Aug. 1983 8 completed Sept. 1983 8 completed Oct. 1984 8 completed Dec. 1984

ANNEX 14
(continued)

(3) Commodities (Loan Funded) - USAID Project

All commodities provided for under the project have been delivered and distributed. This component of the project has filled an important and long standing need for adequate and sufficient equipment necessary to carry out an effective malaria control operation. A detailed description of the impact of these commodities on the overall programme is found in the final evaluation report. Following is a list of the items received under the project.

Item

Sprayers, Spare Parts (3,000)	Training Equipment 2)
Spray Tips (40,000)	Malaria Clinic Furniture (360 sets)
Microscopes, Spare Parts (360)	Automobile Repair Equipment (39 sets)
Volunteer Kits (50,000)	Malaria Clinic Patient Cards (100,000)
Volunteer Signs (35,000)	Malaria Volunteer I.D. Cards (50,000)
Tape Recorders for Malaria Clinic (410)	Zone Office Equipment (33 sets)
Audio-Visual Equipment (35 sets)	Electronic Calculators (30)
Mobile Loudspeaker Sets (214)	Plain Paper Copier (1)
Research Equipment 1)	Interval Time Clocks (427)

- 1) Research equipment consisted of refrigerators, deep freezer, magnetic stirrer, blender, heater/circulators, incubator, oven, microscopes, centrifuge, balance, tissue culture hood, clippers, programmable calculator, air pumps, and photo micrographic system.
- 2) Training equipment consisted of overhead projectors, plain paper copier, stencil scanner, stencil duplicators, and typewriters.

ANNEX 14
(continued)

(4) Vehicle Overhauls (Loan Funded) - USAID Project

The original project plan was to overhaul 400 vehicles, but at the advice of the transportation consultant this target was lowered to 200 vehicles. The money saved by this change was used for motorcycle procurement. Of the 200 vehicles targetted, 196 were actually repaired. With the provision of Japanese pick-up trucks from other sources, it was felt that any further overhauls would not be cost effective. The actual number of vehicles repaired, by region, is as follows:

<u>Region</u>	<u>Planned</u>	<u>Revised</u>	<u>Completed</u>
1	40	36	36
2	40	30	30
3	40	47	47
4	40	41	41
5	40	40	40
H.Q.	-	2	2
Total	200	196	196

ANNEX 14
(continued)

(5) Health Education Materials (Loan Funded) - USAID Project

Following is a list of health education materials received under the project for both training and public awareness activities:

Malaria Clinic Handbook, Draft (500)
Malaria Clinic Handbook, Final (1,200)
Jeep Repair Manual (65)
Handbook for the Identification of Anopheline Larvae (1,500)
Voluntary Collaborator Handbook (25,000)
Voluntary Collaborator Handbook Revision (18,200 in Thai, 3,500 in Yawi)
Posters (899,600)
Pamphlets (1,080,000 in Thai, 31,000 in Yawi)
Staple Guns (342)
Cinema Slides (1,550)
Cassette Tapes (2,985)
Reel to Reel Tapes (10)
Voluntary Collaborator Meritorious Achievement Certificates (20,000)
Health Education Slides (1,657)
Textbooks (62 titles)
School Flip Charts (4,000)
Information Films (16 copies)
Film Maintenance Equipment (6 sets)
Educational Film Clips

ANNEX 14
(continued)

Financial Status

The following 2 tables reflect the financial status of both grant and loan funds as of December, 1984.

GRANT FUND STATUS
(in U.S. Dollars)

Line Item	Current Obligation	Estimated Expenditures	Projected Balance
Technical Assistance	\$183,550.09	\$183,550.09	\$2,500
Training	233,329.47	232,000.00	
Health Ed. Materials	59,357.84	59,357.84	
Evaluation	23,762.60	23,762.60	
Total	\$500,000.00	\$498,670.53	\$2,500

ANNEX 14
(continued)

LOAN FUND STATUS
(in Baht)

Line Item	Current Obligation	Expenditures	Balance
Training	816,837,446	816,510,657.14	8326,788.86
Research	1,184,122	1,184,121.11	0.89
Capital Improvements	20,994,320	20,994,108.000	212.00
Commodities	24,897,551	24,878,033.94	19,517.06
Vehicle Overhauls	3,398,250	3,398,250.00	-
Health Education	6,390,436	5,871,055.86	519,380.14
Revolving Fund	10,012,000	10,012,000.00	-
Motorcycles	4,398,000	4,398,000.00	-
Contingency	132,618	-	132,618.00
Total	888,244,473	87,246,226.05	8998,516.95

ANNEX 15

BUDGET INPUT FOR ANTI-MALARIA PROGRAM
(FY 1980 - 1985)

Fiscal Year	Source of Budget				
	Government		External Aid		
	Regular M.Baht	Poverty Area M.Baht	USAID		Japanese Government M. Yen
			Loan M.Baht	Grant M.US \$	
1980	173.30	-	} 88.24	0.50	700.00
1981	188.67	5.25			
1982	217.95	2.48			
1983	246.15	18.48			
1984	252.81	9.24			-
1985	268.84	10.44	-	-	-

Source: (1) Malaria Division's Financial Section.

(2) Kalina, R. B.: (1984) Assignment Report. USAID. Anti-Malaria Project No. 493-0305.

(3) Malaria Division's Annual Reports.

ANNEX 16
STEPS IN RESEARCH

1. A clear identification and statement of the problems to be investigated.
2. A tentative formulation and statement of the major objectives.
3. Analysis of the reasons and justifications for undertaking the work on this topic.
4. A thorough review of the published literature supplemented by any other sources of information available, to determine what is now known on this and directly related subjects and specifically the points at which information is lacking and further research needed.
5. A re-statement of the objectives in light of the above.
6. Formulation of tentative hypotheses as to the direction in which the solution may be found or the basic principles which might seem to be applicable.
7. In light of the above, design of specific experiments which will give clear evidence as to the extent to which these hypotheses may apply.
8. Experimentation, with ruthless adherence to objectivity in making and recording observations.
9. Analysis of the data and its interpretation.
10. Publication of data and conclusions.

ANNEX 17
 MAP OF THAILAND

