

UNITED NATIONS

NATIONS UNIES

WORLD HEALTH ORGANIZATION

ORGANISATION MONDIALE DE LA SANTE

MALARIA CONFERENCE FOR WESTERN PACIFIC AND SOUTH EAST ASIA REGIONS

WHO/Mal/103.15 ✓
Taipei Conf./2.15
14 September 1954

Taipei, 15 - 27 November 1954



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ENGLISH ONLY

The Secretary of the Expert Committee on Malaria has the honour to communicate hereunder the following note:

INFORMATION ON THE MALARIA CONTROL PROGRAMME IN THAILAND

1. Present status of malaria control in the Country

1.1 The population of Thailand was estimated in 1950 as 18,662,000. It is believed that the present population approaches 20,000,000.

1.2 The population living in endemically malarious areas is estimated as about 6,000,000.

1.3 Malaria is not a notifiable disease. Reported malaria deaths and rates per 100,000 population, 1944-1951, were as follows:

<u>Year</u>	<u>Number</u>	<u>Rate</u>	<u>Year</u>	<u>Number</u>	<u>Rate</u>
1944	54,597	307.1	1948	44,215	250.7
1945	51,456	284.6	1949	38,046	210.5
1946	48,618	271.7	1950	35,808	194.9
1947	52,034	299.9	1951	34,225	183.4

1.4 The total population directly protected against malaria in 1953 was 3,016,808 occupying houses sprayed with DDT in 1953. An additional 63,727 people occupied houses in areas sprayed during 1950-1952, but omitted from the 1953 house-spraying campaign and maintained under protective surveillance. (See 1.7 and 3 below) Reports of the 1954 house-spraying campaign show 4,281,428 occupants of houses sprayed in this year and nearly 500,000 population in areas under protective surveillance.

1.5 (See map). The 1953 house-spraying campaign included areas in 20 (of 71) provinces: 7 northern, 4 northeastern, 5 central and 4 southern. In the 1954 house-spraying campaign, the work was distributed in 30 provinces: 7 northern, 12 northeastern, 5 central and 6 southern. Surveys and other activities are now in progress to extend the program into 48 provinces in 1955, reaching practically all important malarious areas in the country.

1.6 Detailed data on the annual house-spraying campaign are given in Annex 1.

1.7 A summary tabulation of survey findings in representative areas following the 1953 house-spraying campaign is presented in Table 1. The surveys were conducted in areas sprayed (or under protective surveillance) in 1953 and those to be sprayed in 1954, reaching a total of 2,424 villages. Of these surveyed villages 1,589 were in areas in various stages of control and 835 were in uncontrolled areas. These villages included well over one-fourth of the population protected in the 1953 and 1954 house-spraying campaigns. In the surveyed villages the field teams regularly examined over 10% of the population, inspected over 10% of the houses, and searched for anopheline larvae in adjacent streams and other suitable habitats.

From Table 1 it is evident that malaria and its identified vector, Anopheles minimus, occur at extremely low levels in controlled areas, disappearing in a large majority of the sprayed villages after the third year of control or earlier. Extensive surveys are routinely maintained in all operational areas; when the survey data show that no evidence of malaria transmission is found, that the disease is nil or clearly dying out, and that no immediate hazard of re-introduction of malaria or its principal vector exists, then it is the policy of the malaria control program to discontinue house-spraying in favor of protective surveillance. In 1952 this policy was effected in two districts and as shown in Table 1 there has been no indication of resurgence of malaria or A. minimus in these areas.

Table 1 also includes a column on areas under special control. These few areas are now in various stages of control by routine DDT house-spraying, but are separated from other areas due to early experimental work with various formulations and applications of DDT and BHC sprays. For sake of completeness of the status report, these areas are grouped and included in Table 1. It is interesting to note that one group of villages was sprayed with DDT emulsion in 1950 and spraying was then discontinued. These villages have been further safeguarded during the past four years solely by continuance of spraying in surrounding villages, 1951-1952, and by protective surveillance, 1952-present. Although malaria was high and Anopheles minimus numerous prior to the one spraying, surveys have shown no resurgence of malaria or its vector in these villages.

1.8 The malaria control effort is essentially a large-scale field program reaching directly into all classes of homes in all parts of Thailand. Its effective approach to difficult problems of organization, training, implementation and operation has done much to stimulate and assist the thinking and planning on other public health activities. Its successful and highly appreciated reduction of malaria and household pests has gained public respect and cooperation which also benefit other public health programs. The malaria control program provides direct assistance to other programs by its public information activity which distributes numerous printed materials and shows educational motion pictures throughout the operational areas. Official recognition has been given to the essential aid of the malaria control program in making possible the expansion of agricultural settlements in formerly highly malarious areas. The importance of malaria survey and control has also been officially recognized in connection with highway construction, irrigation projects, and various other important national problems and programs, including national defense.

The direct socio-economic effects of malaria control in Thailand will be better known at a later date with the completion of socio-economic surveys in areas where malaria was formerly hyperendemic. At present such effects must be judged by the general feeling widely expressed in controlled areas that much less time is lost from school and work. It is commonly noted that expenses for medicine and treatment for fevers have greatly decreased. The economic significance of malaria control in Thailand, essentially a rice-economy nation, is evident from conservative estimates that malaria before 1950 occasioned an annual loss of 15,000,000 man-days among agricultural workers alone. This is sufficient labor to plant and harvest 1,000,000 rai (400,000 acres) of rice-land in Thailand -- an acreage that should produce not less than 200,000 metric tons of paddy rice, yielding 150,000 metric tons of milled rice with an export value to the Thai Government of Baht 300,000,000 (\$15,000,000).

2. Organization, methods and training facilities

2.1 Organization

The Division of Malaria and Filariasis Control is an established Division of the Department of Health, Ministry of Public Health of Thailand. The present program operates with technical and economic assistance from the United States of America through the Foreign Operations Administration. Such assistance began in 1951 following the initial demonstration project assisted by WHO and UNICEF in 1950 and 1951.

For the purposes of the extended malaria control program, with the objective of reaching all major malarious areas in Thailand, the country is divided into four regions: northern, northeastern, central (subdivided into eastern and western areas) and southern. Lines of authority extend from the Central Office in Bangkok to the Regional Offices in the several regions. Within each region are several area headquarters of varying size and authority, responsible to the Central Office through the Regional Offices.

The General plan of ^{the} organization requires sufficient permanent personnel for approximately the following distribution: one medical officer for each three field teams, one such team for each unit of 100,000 population. The teams are made up of five technical assistants in areas which are uncontrolled or active in the over-all house-spraying campaign, while three technical assistants make up a team in areas which are under protective surveillance with limited house-spraying. Additional personnel may include senior assistants, clerks, drivers, mechanics and others according to the individual requirements of the area headquarters. The permanent staff carries on the technical surveys throughout the operational areas.

During the house-spraying campaign in the dry season each year, the field teams act as supervisors of temporary personnel employed and trained as follows: three foremen under each supervisor, three spray-men and one porter-mixer under each foreman. Thus each unit of 100,000 population is provided with five supervisors (permanent technical assistants) and 75 temporary workers: 15 foremen, 45 spraymen, and 15 porter-mixers. The house-spraying teams average well over 10 houses per sprayman-day and are thus able to complete an average 100,000 population unit (20,000 houses)

in less than two months. This permits a concentration of the house-spraying campaign each year in the dry season when it is most economical (due to less difficulty and expense in movements of personnel and transportation of equipment) and most effective (in preceding the malaria transmission period, largely coincident with the rainy season, by the shortest possible interval).

The present extended malaria control program is carried on by the Division with limited provincial and local assistance, due to the requirements of centralized operational authority for a rapid, well-coordinated and economical expansion of the program with frequent crossing of civil jurisdictional boundaries by personnel, equipment and supplies. In the future it is definitely part of the projected plans to promote an integration of the permanent malaria control program with the activities of regional and provincial health offices. Several municipalities have already embarked on their own programs of malaria and pest control with guidance and assistance by the Division. From the beginning of the program, the larger municipalities have contributed labor, buildings and various facilities to the malaria control effort. The program very generally receives important contributions from local sources in safe storage places for equipment and supplies, and working places and housing for field teams.

2.2 Methods of Malaria Control

2.2.1 Residual house-spraying is the only insecticidal method now being applied for malaria control in Thailand. Before the advent of DDT the Division did a limited amount of larviciding and water management for larval control in a few areas.

2.2.2 Antimalarial drugs are widely distributed in Thailand to supplement the residual house-spraying campaign for malaria control. While the drugs are dispensed only to individuals with evidence of malaria, antimalarial drug distribution is also considered to have important effects in securing public appreciation and cooperation and in offering tangible evidence of the public health objective of the house-spraying campaign.

The drugs used are principally chloroquin disphosphate (Aralen) and chloroquin sulphate (Nivaquine); mepacrine or atabrine are very occasionally used, and camouquin and caraprim are being used experimentally. Records of field teams from 1951 through February 1954 show 977,351 tablets of chloroquin drugs used in treatment of 251,508 individuals, mostly school children. These treatments were given during the malaria surveys following each house-spraying campaign. In addition the Division records also show issues of chloroquin drugs to hospitals, health centers and other authorized distributing agencies throughout Thailand, amounting to approximately 10,000,000 tablets through the past three years.

2.3 Training Facilities

It is the policy of the Division to send the medical officers (and a few senior assistants) to the Malaria Institute of India for advanced training in malariology. An effort is being made to send the medical officers also to the United States, and in some cases other places abroad, for further training and experience in tropical medicine and vector-borne disease control.

Training facilities for medical officers in Thailand are at present limited to the basic curricula of two medical schools and one School of Public Health in Bangkok.

A training center for malaria control assistants, established in Chiangmai with American assistance, has facilities for laboratory and field training of approximately 50 students. An 18-months course of study and practice was set up in July 1952 and the first group of students graduated early in 1954. The necessary temporary workers for the house-spraying campaign (foremen, spraymen and porter-mixers) are recruited and trained locally by the technical field teams, largely through demonstration and practice, but also with brief lectures and the use of poster-books and other illustrative facilities.

3. Plans for the Future

(See map). A summary of the national malaria control plans, projected to the completion of the American-assisted extended malaria control program and to the point where the permanent program can be established to function without further external assistance, is given in the attached supplement entitled "A Projection of the Malaria Control Program in Thailand."

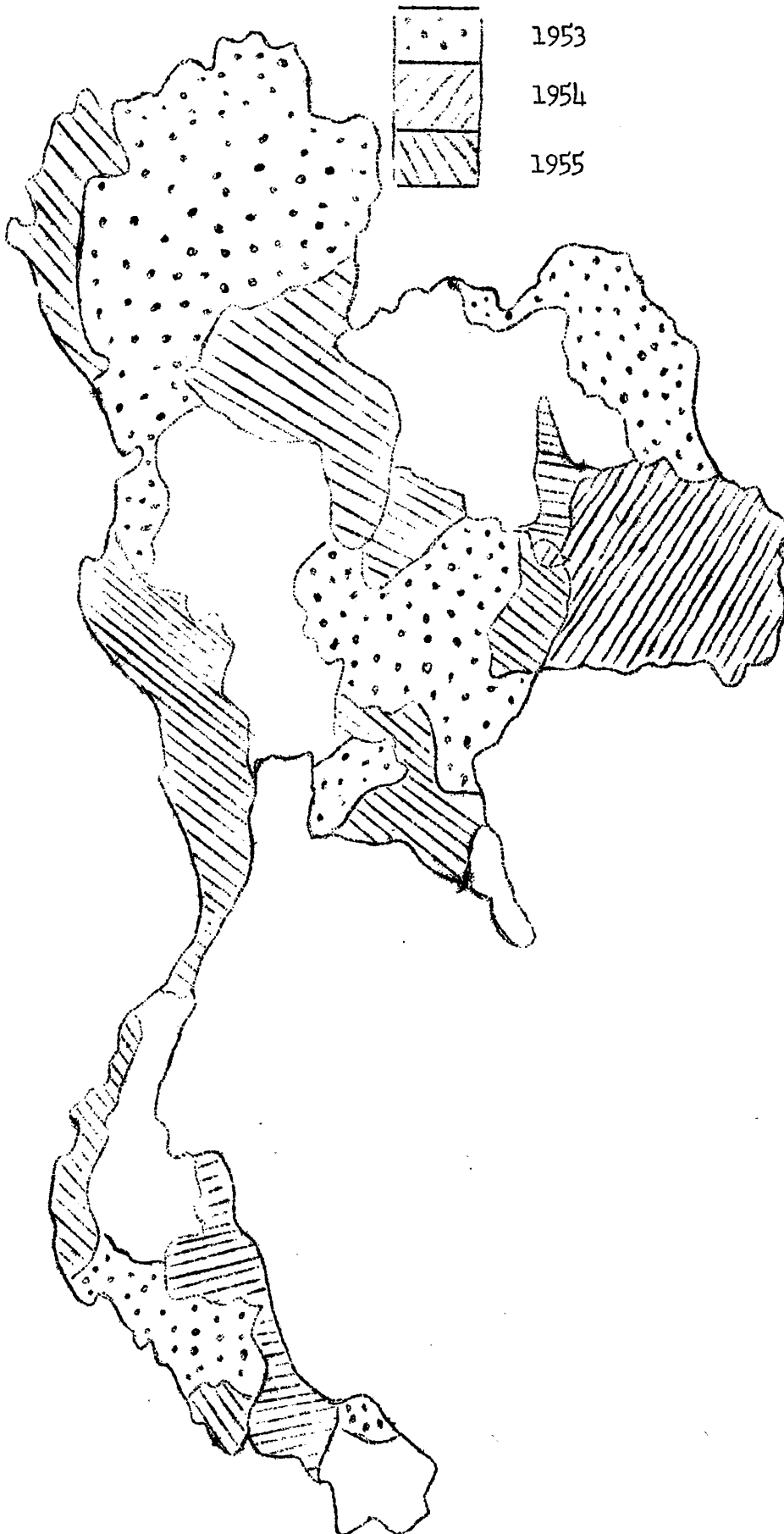
TABLE 1

APPENDIX Summary Tabulation of Malaria Surveys in representative Areas of Thailand, June 1953 to February 1954

Status of Control:	Uncon- trolled	1st Year Control	2nd Year Control	3rd Year Control	4th Year Control	Sur- veillance	Special Control
Villages surveyed	835	758	338	334	31	54	64
Population of villages surveyed	467,140	325,331	216,306	194,632	9,087	20,697	38,208
Houses in villages surveyed	86,404	78,248	43,936	40,857	2,096	4,833	8,474
Houses inspected	11,358	9,100	3,989	8,370	946	1,719	1,598
With <u>Anopheles minimus</u> Infestation rate	1,587 13.97%	46 0.51%	1 0.03%	11 0.13%	0 0.00%	0 0.00%	1 0.01%
Dips taken in larval habitats	58,881	44,229	18,510	63,264	9,630	3,000	7,324
<u>Anopheles minimus</u> found Average per 100 dips	3,042 5.17	360 0.81	68 0.37	53 0.08	0 0.00	0 0.00	52 0.71
Children (age 2 to 9 years) examined	52,717	36,279	20,054	19,443	1,644	2,551	2,448
With enlarged spleen	20,434	7,670	1,588	753	53	67	161
Spleen rate	38.76	21.14%	7.92%	3.87%	3.22%	2.63%	6.58%
Infants (age 1 to 12 months) examined							
Born before 1st house-spraying	8,310	849	-	-	-	-	-
With malaria parasites	1,406	36	-	-	-	-	-
Infant parasite rate	17.29%	4.24%	-	-	-	-	-
Born after 1st house-spraying		3,436	1,461	1,775	141	439	636
With malaria parasites	-	36	5	2	0	0	0
Infant parasite rate	-	1.05%	0.34%	0.11%	0.00%	0.00%	0.00%
Others (over 1 year of age) examined	21,108	30,910	12,207	8,188	1,141	538	570
With malaria parasites	5,320	1,055	388	71	9	0	0
Parasite rate	25.20%	3.41%	3.18%	0.87%	0.79%	0.00%	0.00%

The areas under special control were in various stages of control by DDT house-spraying, but differed from other areas in having had experimental treatment with various formulations and applications of DDT and BHC sprays. The areas under protective surveillance were sprayed for the 3rd time early in 1952 and were then omitted from the house-spraying campaign in 1953.

MAP OF THAILAND SHOWING
UNITED STATES OPERATIONS MISSION TO
THAILAND



ANNEX 1

1953

	<u>NORTHERN REGION</u>	<u>NORTH EAST REGION</u>	<u>CENTRAL REGION</u>	<u>SOUTH REGION</u>	<u>ALL REGIONS</u>
1.	49,203 sq km	16,356	20,382	12,306	99,985
2.	370,351	80,388	66,075	79,372	596,186
3.	1,798,246	446,754	364,561	407,247	3,016,808
4.	-	-	-	-	-
5.	1	1	1	1	1
6.	DDT water dis- persible equiva- lent to 100% technical grade 60,280 kgm	DDT wettable powder 75% equivalent to DDT technical grade 100% 19,281 kg	17,761	18,615	119,204
7.	DDT (in terms of technical grade) 2.27 g	2.23	2.2	2.1	2.27
8.	Compression sprayer "Hudson" and "Lofstrand"				
9.	Yes	Yes	Yes	Yes	Yes
10.	14.7 sq m	19.4	23.2	21.8	17.47
11.	<u>Cost of residual spraying operations</u>				
11.1	2,451,233 Bahts	575,316	718,361	661,935	4,406,845
11.2	34.23	46.65	34.42	39.15	37.66
11.3	1.36	1.39	1.97	1.63	1.46
12.	<u>Cost of operations by other methods of anopheles control, if any</u>				
12.1	-	-	-	-	-
12.2	-	-	-	-	-
13.	<u>Cost of control operations by drug prophylaxis, if any</u>				
13.1	-	-	-	-	-
13.2	-	-	-	-	-
14.	Comments	-	-	-	-

ANNEX 2

1954

	<u>NORTHERN REGION</u>	<u>NORTH EAST REGION</u>	<u>CENTRAL REGION</u>	<u>SOUTH REGION</u>	<u>ALL REGIONS</u>
1.	74,312 sq km	126,098.141	20,381.46	26,819.5	247,611
2.	349,379	339,774	70,982	92,820	850,955
3.	1,758,933	1,889,094	386,088	454,253	4,488,368
4.	-	-	-	-	-
5.	one	one	one	one	one
6.	DDT water dispersible 75% equivalent to DDT technical grade 100% 71,331.38 kgm	84,049.5	23,503	19,396.20 Dieldrin 192.17	198,280
7.	DDT (in terms of technical grade) 2.2 g	2.78	2.2	Dieldrin 0.52 g	2.4 g 0.52 g
8.	Compression sprayers, "Hudson" and "Lofstrand"				
9.	Yes	Houses, churches & schools	yes	yes	yes
10.	18.4 sq m	15.9	27.1	20.95	18.3
11.	<u>Cost of residual spraying operations</u>				
11.1	2,278,850.83 Bahts	2,320,007	735,444.63	723,753.93	6,058.057
11.2	43.57	50.43	44.49	48.12	45.56
11.3	1.29 Baht	1.22	1.90	1.59	1.35
12.	<u>Cost of operations by other methods of anopheles control, if any</u>				
12.1	-	-	-	-	-
12.2	-	-	-	-	-
13.	<u>Cost of control operations by drug prophylaxis, if any</u>				
13.1	-	-	-	-	-
13.2	-	-	-	-	-
14.	Comments				

APPENDIX

A Projection of the Malaria Control Program* in Thailand
 operated by the Thai Ministry of Public Health
 assisted by the U.S.A. Operations Mission

1954- 1958

This projection is based on the plan of an extended malaria control program of residual house-spraying in each area of control for three successive years -- a period which has been demonstrated as sufficient to eliminate malaria transmission and cause the disease to die out in most areas of Thailand. This intensive control effort is to be followed by a permanent continuing program of protective surveillance and incidental control operations to complete the elimination of malaria and to guard against resurgence of the disease.

The objectives of the program as here projected are (1) to reach all major malarious areas (an estimated 6,000,000 population) with the required three successive house-spraying campaigns, (2) to establish all field headquarters, train all personnel and fully implement all activities, and (3) to develop the permanent continuing program on the regular Thai Government Budget.

The American-assisted Malaria Control Project in Thailand basically is removing an immense over-burden of malaria from the country in general, exposing and isolating a relatively limited number of places with special requirements in control and surveillance. Within the next three years the malaria problem should be so reduced and the malaria control organization so strengthened that further activities of malaria prevention can be maintained by the Thai Government without external assistance.

Projection in Terms of Population.

Calendar Year	'54	'55	'56	'57	'58
	(Population in thousands)				
January-June					
Sprayed 1st time	1,500	1,500	-	-	-
Sprayed 2nd time	1,500	1,500	1,500	-	-
Sprayed 3rd time	1,000	1,500	1,500	1,500	-
July-December					
Under surveillance	<u>500</u>	<u>1,500</u>	<u>3,000</u>	<u>4,500</u>	<u>6,000</u>
Total protected population	4,500	6,000	6,000	6,000	6,000
Added survey requirements					
Pre-spray survey	1,500	-	-	-	-
Post-spray survey	4,00	4,500	3,000	1,500	-

Projection in Terms of Operational Costs (Counterpart Budget).

Costs of residual house-spraying are estimated @ Baht 1.00 per capita during the spraying period (January-June). Costs of surveying (July-December) are estimated @ Baht 0.50 per capita before the 1st spraying and @ Baht 0.25 per capita after the 1st, 2nd and 3rd sprayings (and during the continuing program of surveillance to be borne on the regular Thai Government Budget). Additional operational

costs include establishing of field headquarters and training of personnel.

Calendar Year	'54	'55	'56	'57	'58
	(Costs in thousands of Baht)				
January-June					
House-spraying	4,000	4,500	3,000	1,500	-
July-December					
Pre-spray survey	750	-	-	-	-
Post-spray survey	1,000	1,125	750	375	-
New Field headquarters	500	-	-	-	-
New personnel	500	-	-	-	-
Counterpart Budget	6,750	5,625	3,750	1,875	-

Projection in Terms of Thai Government Budget

The Thai Government Budget for the Division of Malaria and Filariasis Control in 1954 amounts to approximately Baht 3,575,000. The average budget during the four Calendar Years 1951-1954 amounted to Baht 3,333,000 annually.

To attain the objectives set out in the introductory paragraphs, the costs of protective surveillance and incidental control operations should be absorbed each year by the Thai Government Budget. This is necessary so that at the conclusion of the American-assisted Malaria Control Project an effective permanent control program will remain in operation.

Provision should also be made in the regular Thai Government Budget for the final major expansion of the malaria control organization beginning in 1955.

Calendar Year	'54	'55	'56	'57	'58
	(Costs in thousands of Baht)				
Regular Budget	3,375	4,000	4,000	4,000	4,000
Surveillance	125	375	750	1,125	1,500
Control operations	75	125	250	375	500
Thai Government Budget	3,575	4,500	5,000	5,500	6,000

Projection in Terms of American Assistance

STEM assistance has included the dollar costs of advisory services, advanced training fellowships, and equipment and supplies to implement the expansion of the malaria control program. The dollars expended for these purposes since 1951 amounted to well over \$2,000,000 (Baht 40,000,000) as of March 31, 1954.

The program is now approaching full implementation with such equipment as vehicles, sprayers, microscopes and other technical and operational requirements. Dollar costs for such requirements are accordingly decreasing. Technical assistance through advisory services and advanced training fellowships may also be reduced as the program approaches full staffing with well-trained personnel.

Calendar Year	'54	'55	'56	'57	'58
	(Costs in thousands of dollars)				
January-June					
Advisory services	33.0	37.5	30.0	22.5	-
Training fellowships	7.5	7.5	7.5	5.0	-
Equipment and supplies	50.0	FY 30.0	FY 25.0	FY 22.5	-
July-December					
Advisory services	37.5	30.0	22.5	-	-
Training fellowships	7.5	7.5	5.0	-	-
Equipment and supplies	30.0	25.0	22.5	-	-
STEM Dollar Budget	165.5	136.5	112.5	50.0	-
Baht equivalent	3,310	2,730	2,250	1,000	-

Summary of Projection in Terms of Population and Costs

Calendar Year	'54	'55	'56	'57	'58
	(All figures in thousands)				
Population in Areas					
Being sprayed	4,000	4,500	3,000	1,500	-
Under surveillance	500	1,500	3,000	4,500	6,000
Population protected	4,500	6,000	6,000	6,000	6,000
Counterpart Budget	6,750	5,625	3,750	1,875	-
Thai Government Budget	3,575	4,500	5,000	5,500	6,000
STEM Budget (as Baht)	3,310	2,730	2,250	1,000	-
Total costs	13,635	12,855	11,000	8,375	6,000
Total costs per capita	3.03	2.14	1.83	1.40	1.00

*Related activities of the Thai Division of Malaria and Filariasis Control, such as filariasis control, yellow fever prevention and the like, are included along with malaria control in this projection.