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DEPARTMENT OF STATE  
AGENCY FOR INTERNATIONAL DEVELOPMENT  
Washington, D.C. 20523

PROJECT PAPER

1487

Proposal and Recommendations  
For the Review of the  
Subcommittee on Bilateral Assistance

INDIA - MALARIA CONTROL

AIE/GAS-001

UNCLASSIFIED

DEPARTMENT OF STATE  
AGENCY FOR INTERNATIONAL DEVELOPMENT  
WASHINGTON, D.C. 20523

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AID/BAS-001

June 6, 1978

MEMORANDUM FOR THE SUBCOMMITTEE ON BILATERAL ASSISTANCE

SUBJECT: India - Malaria Control

Attached for your review are recommendations for authorization of a loan to the Government of India in an amount not to exceed Thirty-Eight Million United States Dollars (\$38,000,000) to help in financing certain foreign exchange costs of goods and services required for the Malaria Control Program. The Program is a large scale multi-donor, multi-year public health effort to meet an imminent, widespread outbreak of malaria and to reduce the incidence of malaria in India. The funds provided under the Loan will primarily finance the import of pesticides and sprayers to be used in urban malaria control operations.

This loan is scheduled for consideration by the Working Group on Bilateral Assistance on Friday, June 16, 1978, at ~~2:30 p.m.~~, in Room ~~3886~~ New State.

5951

10 am

Working Group on Bilateral Assistance  
Office of Policy Development and Program  
Review

Attachments:

Summary and Recommendations  
Project Analysis  
Annexes A - I

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AGENCY FOR INTERNATIONAL DEVELOPMENT

**PROJECT PAPER FACESHEET**

1. TRANSACTION CODE

**A**

A. ADD  
L. CHANGE  
C. DE. EYE

PP

2. DOCUMENT CODE

3

3. COUNTRY/ENTITY

India

4. DOCUMENT REVISION NUMBER

5. PROJECT NUMBER (7 digits)

386-0455

6. BUREAU OFFICE

ASIA

04

7. PROJECT TITLE (Maximum 40 characters)

Malaria Control

8. ESTIMATED FY OF PROJECT COMPLETION

81

9. ESTIMATED DATE OF OBLIGATION

A. INITIAL FY 78

B. QUARTER 3

C. FINAL FY 79

(Enter 1, 2, 3, or 4)

10. ESTIMATED COSTS - \$000 OR EQUIVALENT \$1 -

A. FUNDING SOURCE	FIRST FY			LIFE OF PROJECT		
	B. FA	C. LY	D. TOTAL	F. FA	F. LC	G. TOTAL
AID APPROPRIATION TOTAL						
GRANT						
LOAN	18,500		18,500	38,000		38,000
OTHER						
U.S.						
HOST COUNTRY		109,000	109,000			
OTHER DONORS	6,570		6,570		228,500	228,500
TOTALS	25,070	109,000	134,070	38,000	228,500	279,540

11. PROPOSED BUDGET APPROPRIATED FUNDS (\$000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH CODE		L. 1ST FY 78		M. 2ND FY 79		K. 3RD FY	
		C. GRANT	D. LOAN	E. GRANT	F. LOAN	G. GRANT	H. LOAN	I. GRANT	J. LOAN
1. PN	514B			28,000		10,000			
2.									
3.									
4.									
TOTALS				28,000		10,000			

A. APPROPRIATION	LIFE OF PROJECT		12. IN-DEPTH EVALUATION SCHEDULED
	M. 1ST FY	N. 2ND FY	
1. PN 104		38,000	
2.			
3.			
4.			
TOTALS		38,000	

MM DD YY  
01 8 01

13. DATA CHANGE INDICATOR WERE CHANGES MADE IN THE PID FACESHEET DATA BLOCKS 12, 13, 14 OR 15 OR IN PRP FACESHEET DATA BLOCK 12? IF YES, ATTACH CHANGED PID FACESHEET

2 NO  
YES

14. ORIGINATING OFFICE CLEARANCE

SIGNATURE: *Alexander R. Love*

TITLE: Alexander R. Love  
Director, ASIA/PD

DATE SIGNED: MM DD YY  
05 22 78

15. DATE DOCUMENT RECEIVED IN AID W. OR FOR AID W. DOCUMENTS. DATE OF DISTRIBUTION

MALARIA CONTROL  
PP

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GLOSSARY OF TERMS

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

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

BHC is an abbreviation of the common name Benzene Hexachloride, a chlorinated hydrocarbon type of residual insecticide.

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

Chemoprophylaxis is drug prophylaxis which implies the use of drugs before infection with the aim of preventing disease.

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

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

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

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

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

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

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

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

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

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

Malaria Eradication is the ending of the transmission of malaria and the elimination of the reservoir of infected cases in a campaign limited in time and carried out to such a degree of perfection that when it comes to an end there is no resumption of transmission.

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

Malathion is an organo phosphorus compound residual insecticide.

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

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

Passive case detection is a part of the surveillance activities in which the public health and medical services other than the regularly constituted malaria service, assist surveillance activities by actively searching for malaria cases by the collection of blood slides and epidemiological investigations.

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

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

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

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

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

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

Vector density is the number of female Anopheline mosquitoes in relation to the number of specified shelters or hosts or to a given time period specifying the method of collection.

Vector Susceptibility represents the degree to which a species of mosquito develops resistance to the effects of insecticides.

Water management involves the reduction or elimination of sources of mosquito breeding through filling, draining, diking, changes in water level, flushing, canal trimming and other engineering methods.

## Part I. Summary and Recommendations

### A. Borrower and Implementing Agency

The Borrower will be the Government of India. The executing agency for the Government will be the Ministry of Health and Family Welfare and within the Ministry the National Malaria Eradication Program (NMEP).

### B. Loan

#### 1. Amount.

Not to exceed \$38.0 million (tranche \$28.0 million in FY 78 and \$10.0 million in FY 79).

#### 2. Terms

Payment within forty (40) years from the first disbursement with a grace period on principal repayment of ten (10) years. Interest is payable in U.S. dollars at two (2) percent per annum during the grace period and three (3) percent thereafter on the disbursed balance and unpaid interest.

### C. Purpose

Higher Level Purpose. To bring malaria under control.

### D. The Project

The project is a large scale multi-year effort to reduce the incidence of malaria in India to a maximum of two cases per 1000 population per year country-wide. The Government Modified Plan of Operation presents a three pronged effort: the Government's field operations spraying, larviciding etc. peoples participation; and research and training. Program components for urban and rural programs include:

1. Spraying the vector resting places of homes with residual insecticide to reduce malaria transmission; larviciding, ULV spraying, civil improvement programs, etc.
2. Continuous surveillance of the population at risk to malaria to detect cases of the disease and plan operations;
3. Treatment of cases detected using anti-malarial drugs.
4. Training and supervision to insure modern, effective and safe malaria control techniques are implemented.

5. Research, both basic and field applied, to provide epidemiological and entomological knowledge on malaria in India,

6. Health education to familiarize the general public with the causes, methods of prevention and activities of the malaria control program

7. Evaluation of program effectiveness through annual evaluations and monitoring.

E. Purpose of AID Assistance

AID funds in this first loan will primarily finance the import during 1978 and 1979 of the residual insecticide malathion technical for formulation in India into 25% WDP; and DDT 75% WDP. Approximately \$75,000 will be used to finance ULV sprayers for urban malaria control operations. Some funds may also be used to finance limited short term participant training.

F. Other Donor Assistance

During the two year period 1979-80 for which this proposed loan financed insecticides will assist the program, funding sources estimated in millions are as follows:

	<u>1979</u>	<u>1980</u>
GOI National Program	\$102.48	\$112.80
State Contributions	6.63	6.89
Swedish International Development Agency	5.40	5.40
WHO	.07	.07
UNICEF	.10	-
British Overseas Development Mission	1.00	1.00
U.S. Agency for International Development	<u>18.50</u>	<u>19.50</u>
TOTAL	18	\$144.46

G. Issues

All issues relating to the project have been integrated into the project design.

H. Statutory Criteria

The projects meets all applicable statutory criteria.

I. Summary of Findings

The technical design, the cost estimates and analysis of the project from the technical, financial, social, and economic standpoints indicate that the objectives can reasonably be met and will benefit the rural population of India.

J. Recommendations

That a loan of \$38.0 million be approved to assist the Indian malaria control program and that an initial tranche of \$28.0 million be authorized as early as possible in FY 1978.

## PART II: PROJECT BACKGROUND AND DESCRIPTION

### A. Background

#### 1. Introduction

Malaria has been identified as a major disease in India since ancient times; it persists to the present as the foremost public health problem in this country. Except for mountainous areas over 5,000 feet in altitude and some of the coastal plains, the whole of India is variably at risk to malaria transmission. The great size of the subcontinent, the variety of geographic and demographic conditions, and the immensity and mobility of the population contribute to a malaria control problem of staggering dimensions. As a primary cause of death, debilitation, and retarded application of human and natural resources, malaria is in constant conflict with social well-being and a deterrent of recognized importance to economic development.

After many years of struggling with the disease, mainly in the more populous centers, the Government of India was enabled by the advent of residual insecticides, chiefly DDT, to extend its antimalaria efforts throughout the country. The well-organized program, aimed toward control in the 1950's and eradication in the 1960's, achieved a huge success. Due to various administrative, operational and technical problems, the National Malaria Eradication Program (NMEP) met with increasing reverses in recent years. The 1970's find malaria occurring at high rates in large areas from which the disease had been totally extirpated at great cost in funds, materials, manpower and time. The Government of India attaches priority to renewed efforts to bring malaria under satisfactory control, with view toward eventual eradication.

#### 2. Malaria Endemicity

Prior to the organization of a comprehensive national control program in 1953, malaria was estimated to infect 75 million people and to cause 800,000 deaths annually. Even such an enormous drain on human resources could be greatly increased during epidemic years. The investigations which began early in this century (Section A.4 below) had extensively mapped the

endemic occurrence of the disease (Map 1). The areas originally free of malaria were mainly limited to the northern mountains and coastal bands. The tracts of variable and seasonal endemicity extended broadly along the western length of the country. The areas where malaria was deeply entrenched, with moderate to high endemicity, included the rest of India. Large portions of these areas were subject to epidemics, often appearing at cyclical intervals of several years.

The earlier malarimetric surveys were made in representative localities, providing a valuable record of malaria prevalence in terms of the percentage of malaria infections and enlarged spleens in the examined population. Beginning with the national malaria eradication effort in 1958, there was instituted a systematic total coverage of operational areas (practically all of India) with case detection services (surveillance). This unprecedented coverage obtained a record of malaria incidence in each community through each year. Expressed as the Annual Parasite Incidence (API, meaning the number of malaria cases detected per thousand population during one year), the surveillance results will show the status of the malaria problem within any selected geographic area on an annual basis (Map 2).

Comparison of the endemic conditions in the originally malarious areas from year to year shows the progress of the NMEP as dramatically successful through most of the 1960's. As recently as in 1970, an indepth review by international experts (Section A.6 below) estimated that 57% of the operational areas had achieved malaria eradication. However, the methods employed made little or no impact on the underlying ecological conditions which were favorable to the disease. The areas in large part would thus remain receptive to malaria introduction and re-establishment of transmission. Many areas would be vulnerable to malaria importation by infected people or mosquitoes from persistent malaria foci. The potential resurgence of malaria could only be prevented by a permanent

protective coverage, with case detection and treatment, epidemiological and remedial services, and effective vector control where necessary. The maintenance of numerous areas freed of malaria did not prove successful as planned, and the disease has returned to widespread incidence at high levels of endemicity and epidemics in the rural areas. (Table 1).

The urban malaria problems have assumed increasing importance through the 1960's to the present. At the beginning of the NMEP, malaria was predominantly associated with agriculture, irrigation and rural situations in general. A low point in urban malaria occurrence in the late 1950's was also contributory to the assumption that control in the larger cities could be left to local responsibility. The planned antilarval measures and other antimalaria activities were ineffectively conducted, the deficiencies being mainly attributed to insufficient provision of funds and manpower. The urban centers were unable to prevent the rising introduction and transmission of malaria and became an unexpected source for the transfer of the disease back into the rural areas. The growing problems brought about the inclusion of the urban areas in the NMEP, with an intensification of cooperative approaches to malaria control, emphasizing a variety of specialized urban anti-mosquito measures (Section B.2.d below).

### 3. Malaria Parasites and Vectors

Malaria infections in India occur in the three classic forms caused by Plasmodium vivax, P. falciparum and P. malariae. The first of the plasmodial species as named here is generally predominant and the last much less common, but the three may occur anywhere individually or in occasional mixed infections. P. falciparum is by far of the greatest concern to the malaria control program, since it is the most severe in clinical effects, with a greater potential for fatalities. This species has also shown a strain with a moderate level of resistance to chloroquine in some Districts in the eastern part of the country. The drug resistance problem is of limited known extent and requires much more study for an

adequate comprehension of its dimensions in India.

There have been indications of an increasing proportion of P. falciparum cases in various rural and urban areas (Table 2). The districts which show this species as causing 10% or more of the malaria cases are being given special attention in the national plan of operations (Map 3). An effort is being made to contain and reduce P. falciparum through intensified research and control in the districts most affected (Section B.4. c below).

The anopheline mosquitoes recorded in India include 40 species, but relatively few can be regarded as malaria vectors of major importance. Map 4 the most important vector species in rural areas, Anopheles culicifacies, has shown varying degrees of resistance to DDT in widely distributed localities. This species has also been recorded as resistant to BHC in several states and to Malathion to a lesser extent where these insecticides are being applied as alternatives to DDT. The common urban malaria vector, A. stephensi, has shown resistance to DDT and BHC in some parts of the country. The tests thus far in rural and urban areas, using the standard WHO kits, <sup>are</sup> representative but not comprehensive in assessment of vector resistance to insecticides.

With both drugs and insecticides, the level of parasite or vector resistance varies greatly, and control effectiveness is not necessarily ruled out completely by low or moderate resistance. The problems of this nature are being studied in India for demarcation of the areas affected, determination of the characteristics and degree of resistance, and development of alternative methods as may be indicated (Section B.4 below).

#### 4. Antimalaria Programs

The Malaria Institute of India (MII) was established at Kasauli as the Central Malaria Bureau in 1909, expanded as the Malaria Survey of India in 1927, and reorganized in Delhi as the MII in 1938. With further expansion and reorganization of the MII, the National Institute of Communicable Diseases (NICD) was established in 1963. In a long history of malaria investigations, control operations, training programs and scientific interchange,

India has made numerous important contributions of international significance to the principles and methods of antimalaria campaigns.

Initial trials of the new residual insecticide DDT began in India in 1945-46 after release of the material from the armed forces for civilian use. DDT house-spraying was found to be highly effective against the malaria vectors and the pilot projects were rapidly expanded to control application in numerous areas. In 1953 the Government of India, assisted by USAID and WHO, launched the National Malaria Control Program (NMCP) under MII direction and coordination. The encouraging results of the NMCP in reduction of malaria, plus the recognition of the possibility of developing vector resistance, caused the Government to convert the organized effort to a National Malaria Eradication Program in 1958. This program was established under a Directorate separate from the MII and responsible to the Directorate General of Health Services.

In the conversion of the NMCP to the NMEP, the new objective became the eradication of the disease by interrupting transmission (principally through house-spraying) and eliminating the malaria reservoir (through case detection, treatment and other measures) in a campaign limited in time. A permanent system of vigilance would necessarily follow to prevent the introduction and redistribution of malaria in areas freed of the disease. The salient features of the conversion were not so much in the alteration of the basic methods of attack on the malaria parasite and vector, but in the perfection of organization, administration, operation and evaluation to assure the required effective coverage of all malarious areas. The conversion doubled the population covered.

##### 5. Achievements and Reverses

The NMEP was organized in India in full accordance with the internationally accepted principles and guidelines for planning country malaria eradication campaigns. These standard approaches were established by WHO for the world-wide malaria eradication program launched in 1958. India provided an important share of the experience and expertise which was utilized in the development of the global antimalaria effort. The expansion of

house-spraying to cover all malarious areas in India was followed by the extension of case detection and treatment (surveillance) within these areas. Planned to reach every community and household repeatedly with the antimalaria activities, the NMEP of India became by far the largest public health effort in history.

The NMEP divided the malarious areas into operational units (eventually totalling 393) of approximately 1,000,000 population, constituted within natural and epidemiological boundaries in each State. (The unit was originally fixed geographically and the population would thus be subject to change.) Each unit was scheduled to progress through the standard four phases of operations in a malaria eradication campaign: preparatory (initial planning, reconnaissance and implementation); attack (interruption of malaria transmission by total-coverage house-spraying), consolidation (elimination of the malaria reservoir, principally through total-coverage surveillance), and maintenance (of the achieved malaria eradication by the permanent State health services). The preparatory phase in the Malaria Units was accelerated by the previous history of malaria investigations and large-scale control operations. By 1961 the NMEP had advanced entirely into the attack phase and by 1965 had phased 170 units (203 million population) into consolidation and 143 units (170 million population) into maintenance. Only 80 units (93 million population) continued in the attack phase in 1965; during this year surveillance in all areas detected about 100,000 malaria cases, a reduction of over 98% from the estimated 75 million cases annually prior to the NMCP. From the early 1950's to the early 1960's, malaria mortality had been similarly reduced from an estimated 800,000 deaths to nil.

With such unparalleled achievements in malaria reduction and program advances, the Government of India had reason to feel confident of eradicating malaria as planned in a time-limited campaign. The operational phasing continued to advance additional units into consolidation and maintenance; however, in 1965 and 1966 some areas began to experience malaria outbreaks which could not be eliminated by focal remedial measures. Malaria incidence was correspondingly increased year by year, and

large areas and populations were reverted to the attack phase with total-coverage spraying. While the status of the NMEP as reported in 1975 continued to show the majority of units and population under consolidation and maintenance, the 5.1 million malaria cases detected in that year occurred in large numbers in all phases of operations.

#### 6. Independent Appraisals and Strategy Reviews

The status of the malaria eradication program throughout India has been constantly under detailed study and evaluation by the central Directorate and the six Regional Coordinating Offices of the NMEP since the inception of the program. A meeting of State Malariologists is convened annually for a thorough review of the State programs and an exchange of experience and information. In addition India was to the forefront in providing for the independent appraisal of operational units which are proposed for entry into consolidation and maintenance phases.

Each year (or other interval as required) the Government of India has constituted a consultant panel and a number of Independent Appraisal Teams. The membership of a team has included a Director of Health Services from another State as team leader, Defense personnel, and representatives of WHO, UNICEF, USAID and other assisting agencies. The appraisal has been conducted in the field and at headquarters through observations of actual operations, as well as review of collected data. Recommendations have been made on operational phasing, improvement of activities, solution of problems, and like matters.

The Government of India has also sought a thorough exploration of the current situation, future prospects and advisable strategy in malaria eradication through special committees and multi-disciplinary reviews. The most notable of these are usually referred to as the Hinman Review (1960), the Chadha Committee (1963), the Madhok Committee (1969), the first In-depth Review (1970), and the second In-depth Review and the Consultant Committee of Experts (1974). The reports of these specific intensive studies have provided many useful observations, opinions and recommendations on the India program.

The earlier reviews were concerned with suggesting improvements of the antimalaria program and solutions of identified problems as a contribution toward eradication. The recommendations were generally accepted in principle, but were applied with various degrees of implementation and success. Difficulties grew in projecting and achieving the operational phasing targets, requiring repeated large-scale revisions, and malaria outbreaks became increasingly serious. By 1974, with the existing malaria situation and the available counter measures, a time-limited eradication campaign on a national basis was considered impracticable in India, as in numerous other countries. Accordingly, the objective was shifted to a concentration on effective control for the foreseeable future, keeping viable the possibility of long-term eradication as conditions may be improved. A modified plan of operations has been prepared in conformance to the change in objective.

#### 7. Factors in Program Setbacks

The reasons for the reversals in the malaria eradication effort in India are difficult to formulate in a well-defined list on an overall national basis, due to the size and complexity of the program and the variety of conditions affecting operations. To be considered also are the shifting degrees of importance among the inter-acting determinants of success or failure, both in time and place. The Government of India has applied much time and effort to this subject, through the special malaria committees and strategy reviews, assisted by WHO, USAID and other agencies. The major factors involved in the setback have been generally identified as follows:

##### Administrative

Shortage of man-power (staff over-turn, restrictions on recruitment, lack of realistic staffing for surveillance and laboratory services, insufficient entomological staff).

Inadequate supply of insecticides (non-availability, inadequate funding, increases in costs, delay in procurement and delivery, lack of buffer stock, increases in numbers of houses, inadequate provision for focal spraying in consolidation and maintenance units).

Inadequate supply of drugs (non-availability, inadequate funding).

Insufficient financial support (gap between technical requirements and financial allocation, wage increases, delays in procedures of release and use of funds).

Deficiencies in work (complacency among malaria workers at all levels, inadequate supervision, non-involvement and inadequacy of local health services).

#### Operational

Inadequate transport (old and unserviceable vehicles resulting in limited mobility of staff).

Problems in public cooperation (locked houses, refusal of spraying on religious grounds, belief that malaria has been eradicated, mud-plastering of walls after spraying, nomadism and migration of labor population, outdoor sleeping habits).

#### Technical

Insecticide resistance (affecting two major vector species, in some localities, one in rural and one in urban areas).

Chloroquine resistance (affecting falciparum malaria in some areas).

Outdoor biting and resting habits of vectors in some areas.

Resurgence of malaria in urban areas.

The findings and recommendations of the first international In-depth Evaluation team, constituted by the Government of India in 1970, are worth particular note. This comprehensive review of the NMEP was made on data extending through the critical period during which the future of the program was being determined by the progress being achieved. The review had the advantage of previous intensive studies by the Chadha Committee and the Madhok Committee. Though the broad general recommendations of the 1970 report numbered only 26, many more specific

suggestions and recommendations occur throughout the extensive description and discussion.

The 1970 review concluded that the NMEP plan of operations was basically sound and malaria eradication was demonstrably feasible. Improvements would be required in some of the essential features of support including: flexibility of planning to meet unusual situations; recruitment and training of personnel; timely supply of insecticides and drugs and provision of adequate transport; strengthening of the NMEP administrative structure; simplification and streamlining of the governmental procedures for release and use of budgeted funds; and increasing health education to obtain public cooperation and participation.

The 1970 report gave special attention to the areas of persistent malaria transmission and attempted to map out an effective strategy for areas in all phases of operations. A prompt and determined effort to adopt and apply all that was useful in the first in-depth evaluation might have stemmed the tide of reversal or at least have diminished the setback and its economic and social costs.

## B. Project Description

### 1. Modified Plan of Operations

The NMEP in India is now being conducted under a modified plan of operations, based on the recommendations of a Consultant Committee of Experts. This advisory group was convened by the Government of India in 1974 to determine alternative strategies for the program. The recommended modifications were approved by the Ministry of Health and Family Welfare, the Planning Commission and the Ministry of Finance. Following initial development, the modified plan was put into effect in April 1977; the actual application has thus been recognizably brief, and adjustments may be expected with further experience.

There are at present no specific formalized international principles and guidelines for planning a national malaria control program. In view of the increase of malaria in a number of countries, and the technical and financial problems involved, WHO has indicated the intention to reorient its malaria program and develop a strategy for malaria control to be submitted to the World Health Assembly in May 1978. WHO and other assisting agencies, such as USAID, UNICEF and SIDA, cannot at this time expect governments to provide detailed standardized planning approaches for malaria control, as were required for the time-limited malaria eradication campaigns in 1958 and following.

The modified plan of operations in India continues in many important respects with close similarity to the original NMEP plan in administrative, operational and technical features. The ultimate goal is still considered to be malaria eradication, though it is to be reached through long-term efforts. The immediate objective is to achieve effective malaria control with three principal results in view: (1) reduction of malaria incidence and prevention of deaths due to malaria; (2) retention of the gains made against malaria thus far; and (3) contribution to industrial growth and agricultural production. The plan of operations is envisaged as a "three-pronged attack" on the disease through the Government program, participation by the people, and malaria training and research.

The NMEP is centrally established as a Directorate within the Department of Health of the Ministry of Health and Family Welfare. (See Organizational Chart.) A high-level Malaria Executive Board advises the Secretary of Health regarding the program. The Director

of the NMEP is assisted by three Deputy Directors (Medical, Entomology, Logistics and Administration), the central administrative and technical staff, and six Regional Coordinating Offices in field locations. The State Governments are responsible for their health programs, including malaria; the NMEP is organized in each State within the Department of Health and Family Welfare.

The State Director of Health Services is provided with an Assistant Director (Malaria) and in some States with one or more Zonal Officers (Assistant Entomologists) of the NMEP. The field operations are supervised by the District Medical Officers, assisted by the District Malaria Officers. Responsible to the District level are the Assistant Malaria Officers in charge of the Malaria Inspectors who supervise the spraying squads. Also responsible to the District level are the Medical Officers in charge of the Primary Health Centers who supervise the Surveillance Inspectors and Workers and the Laboratory Technicians attached to the centers.

The Government of India has evidenced the high budgetary priority accorded the antimalaria campaign by investment of as much as 75% of the annual health budget in the NMEP during former years. Though a drastic reduction in available financing occurred in 1974, the present allocation has regained a level based on the projected requirements. The central NMEP and Regional Coordinating Offices will continue to provide technical guidance and support to all State Programs and the central budget will include provisions for equipment and supplies (insecticides, drugs, sprayers, vehicles, microscopes, slides, etc.), operational research, and specified malaria control employees.

As part of the modified plan of operations, the central Government budget is now bearing nearly all costs of the NMEP in areas classified as remaining in the attack and consolidation phases. The exception would be the expenses of such staff and facilities as may be in place and functioning as part of the general health program, including malaria control responsibilities. The State Governments are to bear all costs of the continuing antimalaria program in the maintenance areas, except for any quantity of insecticide exceeding 5 metric tons in the areas reverted to large-scale spraying.

The modified plan of operations states the principle that the central Government assistance to the States under the NMEP is closely linked to the expected performance and results to be achieved under each State plan. The State malaria control programs will continue to be assessed by the Independent Appraisal Teams constituted by the Government of India annually or at such interval as may be required.

In conformance with Government policy, much greater dependence will be placed on decentralized malaria control services and cooperative activities. These will reach through all levels of State and District offices to the community development Blocks of the villages. A broader spectrum of malaria control methods is expected to be developed in rural and urban areas, involving increased local responsibilities and self-help principles. The reorientation of the program and augmentation of the staff are recognized as requiring an expansion of specialized training. The solutions to the technical problems and the needs for new control methodology are seen as demanding extensive research and development.

The modified plan of operations includes several distinctive changes from the original plan of the NMEP. Those which stand out in a brief review include the following features:

a. The Malaria Units are being reorganized to conform to the geographic boundaries of the Districts in each State. Correlative to this move, the field operations come under the supervisory responsibility of the District Health Officer and the Chief Medical Officers of the Primary Health Centers within the community development Blocks of each District.

b. The Laboratory Services are being decentralized into the Primary Health Centers. This is directed toward enhancing the facilities for prompt examination of blood slides for malaria parasites and to enable an early treatment of positive cases.

c. The surveillance procedures have been modified to distinguish the fever cases most typical of malaria for priority in blood examination and radical treatment. This appears as an accommodation to the current insufficiency of laboratory services for routine

handling of the volume of blood slides. For future development, active case detection and presumptive treatment are planned to be conducted by the multi-purpose Basic Health Workers of the Primary Health Centers. Passive case detection and distribution of antimalarial drugs will emphasize voluntary collaboration, as well as the participation of the general health services.

d. The insecticidal spraying operations are to be undertaken in all rural areas in which surveillance shows malaria incidence as equalling or exceeding API 2.0 (2 cases per 1,000 population per year). This is to be done irrespective of the previous classification of the areas in attack, consolidation or maintenance phases according to malaria eradication criteria. For future development, voluntary collaboration is to be encouraged in the spraying work.

Other elements of the modified plan of operations represent the greatly increased emphasis on various principles and activities which have a considerable background in the original plan. These include the establishment and strengthening of entomological teams at the 72 Zonal Offices, involving a much wider range of investigations and services; the phased development of specialized urban malaria control programs; the effort toward enlisting public cooperation and participation on an effective continuing basis; and the planned expansion of research, training and motivation in support of the national anti-malaria program.

## 2. Detailed Description

### a. Spraying Operations (Areas with API 2.0 or more)

All field operations will be conducted in sections of each District, established as large compact operational areas made up of contiguous community development Blocks. The demarcation of these areas is the responsibility of the State programs, assisted by the NMEP Regional Coordinating Offices. The operations are staffed and implemented with sprayers, insecticides and other equipment and supplies through central financing. The house-spraying will be carried out under the supervision of the District Malaria Officer and 4 to 8 Malaria Inspectors (Section B.1 above), according to the size of the District and difficulty of field working conditions. For 1,000,000 population the pattern of spraying staff will be about 44 Superior Field Workers and 230 Field Workers, employed for about 2 1/2 months for each required spraying round of all houses in the communities.

DDT is to be applied in 2 rounds of total-coverage house-spraying annually, unless the vector is refractory to this insecticide, as shown by intensive entomological studies. Where vector resistance to DDT is established, BHC (HCH) is to be applied in 3 rounds yearly. Where both DDT and BHC resistance are present, Malathion is to be used in 3 rounds of spraying at intervals of 6 weeks. Timing of the spraying in all cases is to afford fullest possible protection during the entire period of malaria transmission.

The dosages of insecticides are to continue (in technical grade or "100%" equivalents) as DDT 100 mgm/sq ft. BHC 20 mgm/sq ft. and Malathion 200 mgm/sq ft. Estimated supply requirements per 1,000,000 population are 100 metric tons of DDT 75% water dispersible powder (WDP), or 336 metric tons of BHC 50% WDP, or 900 metric tons of Malathion 25% WDP. In areas having serious outbreaks of malaria, the States are to be provided with 10% reserve stocks (DDT only). An increase to 15% reserve is made in some southern areas, due to transmission conditions.

The local self-government bodies at the Block level (Panchayats) intending to take up spraying operations with financial aid from the District level may be encouraged on an experimental basis. Panchayats using their own financial resources or voluntary groups (such as youth organizations and students) may be given equipment, technical help and guidance for undertaking the spraying work. As noted above, the entire costs of the NMEP total-coverage spraying operations are to be born by the central budget.

#### b. Surveillance and Remedial Measures

Areas with less than API 2.0 will not be under total-coverage housespraying but will be covered by full scale surveillance. For 1,000,000 population the surveillance staffing pattern will be about 25 to 32 Surveillance Inspectors and 100 to 125 Surveillance Workers, according to the difficulty of the areas. The present active case detection and presumptive treatment is to continue through fortnightly surveillance visits to all houses. Blood slides are to be taken from all individuals showing fever or with recent fever history, and antimalarial drugs (chloroquine) are to be administered to each such person on the spot. Wherever malaria cases are discovered, mass blood surveys will be conducted around the sites by the Surveillance Inspectors, supervised by the Malaria Inspectors. Focal spraying is to be undertaken by

the Malaria Inspectors around the sites of falciparum cases detected during the transmission season.

The vivax cases are to be given 5-day radical treatment with chloroquine and primaquine; the falciparum cases are to be treated with a single dose of chloroquine and daraprim. A single dose combination of chloroquine and primaquine may be used in selected areas in consultation with the Regional Coordinating Offices. Epidemiological investigations of all malaria positive cases are to be undertaken by the Malaria Inspectors, and 25% of the case investigations are to be verified by the District Health Officer or Malaria Officer. Radical treatment is to be followed up with blood examination of monthly intervals for 12 months.

Passive case detection is to be intensified in all institutions. The fever cases attending hospitals and dispensaries should have blood examination, and the slide collection should include at least 15% of the daily outpatient cases. Radical treatment is to be given to all detected malaria cases. For fever cases not personally attending at the health institutions, but represented by relatives and friends, chloroquine tablets may be issued for single dose treatment.

The Auxiliary Nurse Midwives at the sub-centers of the Primary Health Centers will be involved in the collection of blood smears, distribution of antimalarial drugs during their regular field visits in the villages, and the radical treatment of detected malaria cases.

Areas with API 2.0 or more will be under total-coverage housespraying as discussed above. The fortnightly surveillance will be continued in all such areas, but with differences in priority of blood examination, radical treatment, and remedial measures where malaria cases are detected. In some isolated areas within the Districts, even with the high incidence of API 2.0 or more, there may be the possibility of accelerating reduction of malaria by maintaining intensive surveillance, much as in areas with a lower API. Few such isolated areas are anticipated, but the plan of operations covers their possible identification with provision for stepping up the surveillance activities.

In most areas with API 2.0 or more, the collection of blood slides from fever cases is likely to be greatly increased during the transmission season, straining the laboratory and treatment capacities. Priority in blood examination will be given to those slides obtained from passive case detection and from cases showing typical malaria symptoms (high fever, chills, sweating and periodicity). Positives detected from these cases will be given priority in radical treatment; and in such treatment priority will be given to falciparum cases of all ages and vivax cases up to age 14 years.

It is expected that the blood examination and radical treatment of positives detected from the less typical cases will be completed during the period of least malaria transmission (generally November to February). Except in the few isolated areas of intensive surveillance, epidemiological investigations would be beyond staff capacity or practical application and will not be conducted. Passive case detection will be intensified in all areas, under the priority considerations of blood examination and radical treatment discussed above.

c. Distribution of Antimalarial Drugs by other Agencies

The NMEP plan of operations proposes an extensive involvement of the voluntary agencies, such as the Panchayats, youth organizations, women's organizations, school teachers, students, village level child welfare workers, and others, as well as the general medical practitioners. In addition fever treatment depots are to be established, with suggested financial support by the State Governments, in remote and inaccessible localities, including the tribal areas. Teachers and social workers are to be in charge of these depots and will be expected to collect blood slides and administer presumptive treatment. The voluntary agencies will generally give chloroquine tablets to fever cases without taking blood slides, except in areas where malaria infections might be eliminated with intensified surveillance.

All antimalarial drugs are supplied through the malaria field staff of the Primary Health Centers which will collect the records of fever cases treated and the blood slides when such are taken, in connection with the issuance of the drugs. The Government of India is thus attempting to provide a network of responsible parties throughout all communities, making drugs freely available to all fever cases for the presumptive treatment of malaria.

#### d. Urban Malaria Control

The growing seriousness of the urban malaria problems has been indicated (Section A.2 above). The organization and methodology of malaria control in the municipalities differs necessarily from the rural areas. This is due originally in part to the prohibitive difficulties of residual insecticidal spraying in the congested areas. The concentration of population, the multiplicity of mosquito breeding places, and the constant movements of people in and out of the urban areas require a high order of administrative, technical and operational efficiency in specialized malaria control operations.

The National Institute of Health and Family Welfare in 1977 listed 2,648 towns in India, 148 with a population in excess of 100,000, and 9 with more than 1,000,000 population. The smaller towns would of course be included in the rural NMEP operations, and the larger towns vary greatly in their malaria control requirements. The NMEP plan since 1971 has provided for direct central assistance in instituting or intensifying the urban malaria control programs. By 1975 the urban areas included in the plan numbered 28, and expansion to an additional 38 is now in progress, with projection to reach 132 towns by the end of the Sixth Five Year Plan (1978-83). The areas to be included are selected in order of priority with respect to the urgency created by high malaria incidence and receptivity and vulnerability to further malaria introduction with outbreaks of the disease. Map 5.

The towns are being brought into the NMEP modified plan of operations, subject to the promulgation of model by-laws for mosquito control in domestic and peridomestic situations. The central assistance is also conditioned on the effectiveness of the control operations carried out by the towns. The NMEP provides technical services and materials, including a variety of the newer chemical larvicides (such as Abate, Fenthion, and pyrethrum-based emulsifiable concentrates), as well as larvicidal oils and Paris Green for the control of the mosquito larvae. Other control approaches are encouraged and assisted, including the use of larvivorous fish (gambusia and guppies) and efforts at source reduction through engineering methods of protection, alteration or elimination of water collections and conduits which may serve as mosquito breeding places.

The mosquito and malaria control program being conducted in the Municipal Corporation of Greater Bombay is worthy of special note as a valuable prototype for urban campaigns in India. This program is utilizing and expanding methods dating back to the Bombay Municipal Corporation Act of 1888, with subsequent modifications, and to the manual on "Malaria in Bombay" published by G. Covell in 1928. The activities are now conducted by the Public Health Department in accordance with well established provisions for regulation, inspection and correction of all possible sources of mosquito-breeding.

Greater Bombay includes 6.5 million population, 3 million in the congested area of 69 sq. km. and the remainder in suburbs of 369 sq. km. An exemplary routine system functions to assure coverage of wells, water tanks, ponds, fountains, drains and other water collections. Specific guidelines are provided for construction and management of any potential breeding place. Approval by the Public Health Department is required in all cases. The Bombay mosquito control program employs 684 permanent workers: 303 anti-larval, 30 anti-adult in the city; 319 antilarval, 32 anti-adult, and 228 seasonal workers in the suburbs where the operations are similar to those in rural areas. The NMEP provides some larvicides, other supplies and equipment, and financial assistance. The methods of the Bombay program are being adopted in the phased development of urban malaria control.

### 3. Training

For many years India not only maintained a high standard of training for its own leadership and subordinate levels in the anti-malaria programs, but also was widely known as an international training resource in malaria control and eradication. The specialized professional courses were conducted first at the MII and later at the NICD. With the dramatic reduction of malaria throughout the country, interests and emphasis shifted proportionally to other subjects in orientation and preparation for professional careers and work objectives. The resurgence of malaria has now confronted the Government of India with massive needs in training and reorientation of personnel at all levels, as well as in education and motivation of the people, to meet the requirements of the NMEP modified plan of operations.

The specialized training appropriate to the planned scope of activities within the framework of the NMEP extends through the National and Regional structure, 22 States and 8 Union Territories, and 381 Districts (NMEP 1976 Annual Report) to reach some 5,300 Community

Development Blocks. Specific NMEP responsibilities could include positions numbering more than 100 at the National, Regional and State levels, 1,000 at the District Health Offices, and 10,000 in the Primary Health Centers of the Blocks. The top levels require broader training in administration and management, as well as in malariology. The medical officers and senior malaria staff of District and Block levels will need increasing amounts of specialized technical and operational expertise in headquarters, field and laboratory functions.

In addition to the above, paramedical and cooperative workers at the Block level can be expected to number some thousands, with a wide range of training requirements. It must be kept in view that the NMEP modified plan of operations is directed toward eventual complete integration of the antimalaria operations into the developing network of general health services, as rapidly as the local staff and facilities can assume the responsibilities. The multi-purpose Basic Health Workers of the Primary Health Center will become the key figure of actual operational contacts and coverage of all communities. In this connection there is a large training resource in the 7 Central Training Institutes and 60 Health and Family Welfare Training Centers which could be developed to cover a significant part of the future malaria training requirements at this level.

The basic discussions and recommendations leading to the NMEP modified plan of operations gave major attention to training, recognizing the needs apparent in the planned augmentation of staff, reorientation to control objectives and techniques, and application of methods alternative to residual insecticidal house-spraying. Consideration has been given in the planning to basic, refresher and re-orientation courses; seminars on specialized features of the program activities; and fellowships for observation and study in other countries. It has been strongly suggested that the long-term basis of the modified plan is ample justification for increased involvement of the 106 medical colleges in India in orienting and preparing professional personnel for careers in malariology and public health. The British Overseas Development Agency is considering some assistance to the colleges, with a specific malaria interest.

The resources now established and functioning to meet the NMEP training requirements for senior officials from the National through the State to the District level are now mostly concentrated in

the NICD, cooperating with the central NMEP. The NICD malaria courses are presently offered twice a year, accommodating about 30 students in each course. An additional NICD course in medical entomology is planned, but the total annual capacity must be greatly increased to permit the top leadership to be available in any reasonable number of years. A workable approach to this problem is believed to be practicable through expansion of the training staff and facilities at the 6 NICD Field Stations together with the 6 NMEP Regional Coordinating Offices at various locations in India.

As well-trained senior officials become available in increasing numbers, the organization of training at subordinate levels should be facilitated. A great deal of expertise exists in the current staffing of the NMEP which could be applied in such training. About 60% of the staff at State, Zonal and District levels has received specialized training, though requiring some reorientation; however, it may be noted that the continuing field and laboratory techniques are basically unchanged at this stage of the NMEP modified plan of operations.

Though the training requirements of the national malaria control effort has received much attention in planning, a specific plan of multi-year projection has not been formalized. The Government of India has recently invited a WHO team to assist with this problem; a report has been prepared by the team and is now under Government consideration. The financial allocation for training in the national antimalaria program budget seems thus far extremely low and disproportionate for the urgent requirements. This may be due at this time to the early stage of developing malaria training plans.

#### 4. Research

The contributions of India to malaria research extend over many years and throughout the world. It was in this country at the turn of the century that the anopheles mosquito was incriminated as the transmitter of the disease, thus providing the preeminent basis for subsequent antimalaria campaigns. The principles and techniques of diagnosis, malariometry, epidemiology, entomology, therapy and vector control owe much to the Indian malaria researchers. From the 1930's through the 1950's, the Malaria Institute of India (now the National Institute of Communicable Diseases) was among the most productive institutions in its field. From the early stages of the global

malaria eradication effort, the basic tenets of organization and evaluation of a national program have been investigated and demonstrated on an unparalleled scale in India, contributing stimulus and methods to the world-wide program.

The past accomplishments of malaria research in India are in contrast with the recent studies in progress, not in quality but in volume. Here as elsewhere there was for many years an overwhelming dependence on DDT and other residual insecticides to stop malaria transmission and on the use of the newer antimalarial drugs to scour out the malaria reservoir. Malaria research and training were fields of diminished professional interest in a time-limited campaign, and resources were turned to other endeavors. It is now widely recognized that the problems of malaria resurgence urgently require detailed and practical investigation, with emphasis on alternative methods of control and operational improvement. The limitations of financial support and available manpower necessitate the careful study of research objectives and the establishment of priorities.

In the extensive in-depth and consultative reviews of the NMEP in India, a significant amount of attention has been given to the malaria research needs. The subjects have included both short-term and long-term objectives, the former being concerned with the early solution of the most pressing organizational, technical and operational problems and the latter with the development of improved and alternative methods for effective malaria control. A Consultative Meeting on Malaria was convened by WHO in New Delhi in April 1976 and strongly indicated priority for applied research in Southeast Asia.

The Government of India is responding to the urgency of its malaria problems and research needs by establishing a planning and coordination framework and initiating a series of new malaria research projects to be added to the few in progress.

a. The Indian Council of Medical Research (ICMR) in February-March 1977 reconstituted its Malaria Expert Committee and convened a meeting of 8 Task Forces, each comprised of outstanding research workers in their respective fields. The following areas of malaria research were given detailed discussion and analysis:

1. Operational aspects of malaria control.
2. Ecology and control of vectors of malaria.
3. Chemotherapy of malaria.
4. Drug resistance in malaria parasite.
5. Serology of malaria.
6. Cultivation of malaria parasites.
7. Immunological aspects of malaria.

The consideration given by the Malaria Expert Committee and the Task Forces to the above subjects is comprehensive in treatment and coverage of the malaria research requirements in India. The sources of support for approved specific projects include funds made available through the Malaria Executive Board and the ICMR. The list of projects currently receiving support from the Board numbers 19, all of which were sanctioned in the latter part of 1977. Three additional projects have ongoing support from the ICMR, sanctioned in 1974-75. These 22 projects are distributed among 11 institutions and the sanctioned budgets total approximately Rs. 5,165,000. While this would seem proportionally quite low with respect to the importance of this major element and the total budget of the national malaria program, it must be recognized as an early stage of research development. (See also the large research input of WHO and SIDA discussed below.)

The above projects may be grouped (Table 5) under the principal areas of malaria research developed by the ICMR advisory bodies. It is apparent that the majority of planned effort and financial backing is going appropriately toward those objectives which are likely to achieve results with the most immediate purpose and application in the field. This recognition of the priority for practicality in the malaria research investment augurs well for future developments.

b. The National Institute of Communicable Diseases (NICD), in addition to participation in the special projects as discussed above, contributes to malaria investigations through the normal functions of the NICD, such as in its Divisions of Biochemistry, Epidemiology, Medical Entomology and Vector Control, Microbiology, and Training and Malariology. Studies are conducted both in the laboratories and at the Field Stations, in cooperation with the NMEP, the State Governments and other agencies.

c. The National Malaria Eradication Program has of course a primary responsibility to proceed with a variety of local investigations of immediate application to the problems met in the planned

operations. In this connection, the placing of entomologists at each of the 72 Zonal Offices distributed among the States should greatly increase the capacity for much needed studies of the malaria Vectors and the transmission cycle. A Workshop on South East Asia Regional Program for Applied Research in Malaria Control was convened by WHO in New Delhi in March 1978. The India NMEP presented an extensive list and planning schedule of proposed field research activities. Some of the more formalized projects have been indicated (Table 5).

An operational research effort of considerable size and importance is being launched with technical assistance by WHO and financial support from SIDA, amounting to more than \$17 million over 5 years (1977-82). This project has two major parts: (a) Plasmodium falciparum containment program, consisting of intensified control operations in areas where this species occurs at especially dangerous levels; and (b) operational field research to develop effective control methods in various epidemiological situations. The WHO/SIDA assisted project is conducted by the NMEP in close cooperation with the NICD, ICMR and the State Health Services.

PROJECT DESIGN SUMMARY  
LOGICAL FRAMEWORK

Life of Project: \_\_\_\_\_  
From FY 78 to FY 83  
Total U. S. Funding 38,000  
Date Prepared: 3/30/78

Project Title & Number: INDIA - Malaria Control

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>Program or Sector Goal: The broader objective to which this project contributes:</p> <p>To reduce morbidity and mortality from endemic diseases through the establishment of a responsive, effective and efficient nationwide health services.</p>	<p>Measures of Goal Achievement:</p> <ol style="list-style-type: none"> <li>1. Measurable significant reductions in mortality and morbidity directly attributable to interventions of the health service.</li> </ol>	<p>Evaluation of statistics from the National and State Ministries of Health and other health organizations both - public and private.</p>	<p>Assumptions for achieving goal targets:</p> <ol style="list-style-type: none"> <li>1. Sustained economic growth to support national health services.</li> <li>2. Continued Government commitment to supporting its health services.</li> </ol>
<p>Project Purpose:</p> <p>To bring malaria under control.</p>	<p>Conditions that will indicate purpose has been achieved: End of project status.</p> <ol style="list-style-type: none"> <li>1. Reduction of the annual incidence of malaria to less than 2.0 per 1000 API.</li> <li>2. Control of P.falciparum</li> </ol>	<p>NMEP report and health institution records with validation by NMEP.</p>	<p>Assumptions for achieving purposes:</p> <ol style="list-style-type: none"> <li>1. Resistance to malathion does not develop until year 6.</li> <li>2. Resistance to drug does not develop.</li> <li>3. Alternative control methods implemented.</li> </ol>
<p>Outputs:</p> <ol style="list-style-type: none"> <li>1. Modified Plan of Operation</li> <li>2. Trained Personnel</li> <li>3. Community support programs implemented.</li> <li>4. Spraying operations effectively executed.</li> <li>5. Laboratories effectively operating.</li> <li>6. Drug distribution centers and fever treatment depots operating.</li> <li>7. Required equipment available and operating.</li> <li>8. Research schemes executed.</li> <li>9. Alternative control methods executed.</li> </ol>	<p>Magnitude of Outputs:</p> <p>The GOI has set forth specific targets/requirements in the Modified Plan of Operation on a state and district (zonal) basis.</p>	<ol style="list-style-type: none"> <li>1. Annual Evaluations.</li> <li>2. Program monitoring and reporting.</li> </ol>	<p>Assumptions for achieving outputs:</p> <ol style="list-style-type: none"> <li>1. GOI support for NMEP.</li> <li>2. States follow modified plan.</li> <li>3. State support.</li> <li>4. Other donor/AID support.</li> <li>5. Required drugs and insecticides available on timely basis.</li> </ol>
<p>Inputs:</p> <p>Insecticides Drugs Spray and laboratory equipment NMEP/State Personnel Personnel for training Vehicles</p>	<p>Implementation Target (Type and Quantity)</p> <p>* See detailed budget Part III.B.</p>	<p>Program and financial reports and evaluation</p>	<p>Assumptions for providing inputs:</p> <p>Malaria is epidemic in most of India. 1977 about 6 million positive cases reported and an estimated 40,000 deaths.</p>

### PART III. PROJECT ANALYSIS

#### A. Technical Feasibility

##### 1. General

The Government of India is extending and strengthening the antimalaria campaign under the National Malaria Eradication Program in the Sixth Five Year Plan (1978-83). The title of the program is retained, as an indication of the ultimate long-term goal, though the immediate objective is to achieve and maintain effective malaria control. A number of serious problems in the current malaria situation must be dealt with expeditiously and successfully to attain the NMEP objective and to forestall further increase of difficulties.

Unfavorable factors:

- (1) Resurgence of malaria has mounted steadily, including areas where transmission had been stopped and where the disease had been eradicated.
- (2) Receptivity and vulnerability to the introduction and spread of malaria is generally high in the originally malarious areas.
- (3) Urban malarious areas have greatly increased in their proportion of the total malaria incidence and in their importance as malaria reservoirs.
- (4) Vector resistance to insecticide occurs in numerous areas, though of variable significance requiring study.
- (5) Falciparum malaria infections are being detected in unusual proportions of cases in many districts. Falciparum resistance to chloroquine has been observed in limited localities.
- (6) Operational problems have been identified in inadequate transport and lack of public cooperation. These problems vary in importance and require detailed study in the State programs.
- (7) Administrative problems have included deficiencies in manpower, provisions of supplies, financial support, and personnel performance.

(8) Shortage of insecticides until indigenous production can be developed threatens to leave a large proportion of the population unprotected against malaria transmission.

Balanced against the unfavorable factors in the malaria situation are encouraging resources which are proceeding on the course toward the program objective with capability and determination. India has a long history of distinguished accomplishments in the elimination of malaria from large areas of the country and has made many contributions to training and research in malariology. The application of this background of antimalaria activities, together with the development of new malaria control approaches and capacity as planned, should greatly enhance the prospects of success.

Favorable factors:

(1) Achievements in malaria reduction by the NMEP remain impressive in spite of the setbacks.

(2) Knowledge of malarious areas has been accumulated through many years of investigations and antimalaria work.

(3) Methods of demonstrated effectiveness can still be applied in most parts of the country.

(4) Experienced staff members are available at all levels of administration and operation as nuclei for further development.

(5) Planning to meet training requirements is being given major attention.

(6) Research coordination and development has identified areas of required investigation and is initiating the most urgently needed studies.

(7) Government priority and high-level relationships have been established with increased budgetary support.

(8) WHO and other agency assistance is available for training, research, evaluation and some other requirements.

## 2. Technical Review

### Modified plan of operations

The NMEP of India is continuing substantially with the basic relationships and methods of the original plan. The national effort is composed of the State operational programs, unified and supported by the central NMEP assistance in planning and implementation. The NMEP Directorate within the Ministry of Health and Family Welfare retains high priority in the Government of India administrative structure and budgetary provisions. The organization has a demonstrated capacity to control and eradicate malaria extending over many years.

The plan has undergone modifications in the conversion from a sharp focus on malaria eradication in a time-limited campaign. While the original objective remains an ultimate goal, it is now visualized in India as obtainable only in the indefinite future. The present objective is to achieve effective malaria control, including prevention of deaths, promotion of economic growth, and retention of the past gains of the eradication effort. This seems generally in keeping with the international strategy being developed under WHO auspices in numerous countries where malaria eradication is not currently feasible.

The basic attack on the malaria vectors continues with residual insecticidal house-spraying and the treatment of infections with antimalarial drugs. The identified problems of insecticide and drug resistance in some areas do not at this time prevent effective use of the foregoing methods in vector control and malaria treatment. The case detection services of active and passive surveillance are being conducted throughout the operational areas. The State staffing patterns are supplemented as before with specific malaria personnel at all supervisory levels. Independent evaluation teams, with the participation of WHO and other agencies, will be convened at annual or other required intervals to assist with recommendations on the antimalaria operations.

### Organization

The NMEP Malaria Units, established originally in each State program as specially constituted operational areas of about 1,000,000 population, have been reorganized to conform with the geographic District boundaries. The line of primary responsibility for antimalaria activities, as well as other public health requirements, passes from the State Director

of Health through the District Health Officer to the Medical Officer in charge of each Primary Health Center in a Development Block. The State, District and Block officers supervise the specific malaria personnel provided by the central funding. The direct participation and responsibility of the officials of the State health services at all levels is a valuable and necessary development in the new plan of operations.

The laboratory services are in process of decentralization to provide a unit at each Primary Health Center. This should facilitate an early examination of blood slides taken from fever cases and contribute toward the essential promptness of radical treatment for malaria infections. Another noteworthy augmentation of the technical resources in the field is the addition of an Entomologist at each of the 72 Zonal Offices distributed among the States. This will enhance the professional capacity of the NMEP to conduct much needed scientific studies on the bionomics, insecticidal resistance and alternative methods of control of the malaria vector species. A general effort, both administrative and technical, is being made to strengthen the State antimalaria organizations for the national program goals.

#### Spraying coverage

The long familiar phases of operational status (attack, consolidation, maintenance) are being discontinued, together with the criteria which were applied in determining the phasing. All areas, however previously classified, which show a malaria incidence equalling or exceeding API 2.0 (2 cases per 1,000 population) will be sprayed with DDT or BHC or Malathion at standard dosages and intervals. The selected critical level of API 2.0 would not seem to have a clear basis in epidemiological study and experience. It is 10 times the criterion (API 0.2) believed admissible for reversion of consolidation or maintenance areas to attack in the original malaria eradication campaign. The fact that the objective has been changed to control does not alter the signal of resumed malaria transmission which underlay the API 0.2 level.

Even the high level of API 2.0 is obviously straining the Indian resources in materials, manpower and funds available for the insecticidal coverage. It may not in practicality be possible at this time to lower the criterion for total-coverage spraying below API 2.0. Focal spraying is planned in all areas where malaria outbreaks occur. It seems problematical whether transmission can be satisfactorily contained without a more general routine spraying coverage until malaria

incidence is reduced to a level well under API 2.0. This feature of the modified plan deserves careful study.

#### Surveillance coverage

In operational areas with malaria incidence less than API 2.0, surveillance is being continued with provisions for active and passive case detection services, presumptive treatment of fevers, laboratory examination of blood slides from all fever cases, radical treatment of detected malaria infections, focal spraying and epidemiological investigation. These are well-tried methods in India and should remain effective where properly employed. The obvious reservation is that malaria incidence approaching API 2.0 may outstrip the ability of the antimalaria organization to contain malaria transmission or even to carry out the surveillance procedures adequately.

In areas with more than API 2.0, and thus under total-coverage spraying, the basic ACD and PCD procedures are similar to the above, with modifications in the accompanying follow-up of blood slide collection. In these areas it is well recognized that the volume of blood slides, especially during the transmission season, will most probably exceed the capacity of the laboratories for microscopic examination. Priorities are therefore established requiring the surveillance workers to recognize the fevers most typical of malaria, mark the slides from such individuals, and record them separately for earliest possible examination. Malaria positives from such cases will receive priority in radical treatment, especially falciparum cases and those vivax cases up to age 14 years. The apparent requirements and possible complications of training, motivation and supervision would seem formidable in attempting to assure the reliability and workability of these modifications at the field operational level.

#### Public cooperation

This subject is appropriately considered in some detail in a review of the sociological aspects of the project. It is obviously of technical importance in the emphasis given to involving people at the community level as participants, rather than recipients, in the national malaria control effort. The modified plan of operations sets forth specific guidelines for the development of the antimalaria activities. The Government contributions are spelled out, including training, literature, public relations materials, supervision and guidance, and

materials and equipment as may be required. Voluntary collaborative resources are sought to be applied through the cooperation of the Panchayats, establishment of local Fever Treatment Depots in remote areas, and the involvement of civic organizations, schools, general medical practitioners, and others.

The proposed activities may include such operational features as health education, vector control, blood slide collection, distribution of antimalaria drugs, treatment of malaria infections (by the medical practitioners), and maintenance of records. The requirements of training, supervision and guidance are correspondingly high, in order to assure that public cooperation will be a coordinated and effective part of the total national antimalaria program.

The planned development of a "people's program" in malaria control is based on evident practical considerations and sociological principles. It is thoroughly in keeping with Government policy of self-help developments. The implementation of this element of the modified plan of operations would seem deserving of encouragement and support as supplementary to the NMEP and State operational programs. It may go without saying that the development will require some years and its contributions will most probably be highly variable in local situations and complications for some years to come.

#### Urban malaria control

The malaria problems in the larger towns of India have been a growing threat, both to the occupants of the urban centers and as a reservoir for export of the disease. Since 1971 the urban areas have been included gradually in the NMEP, now reaching a total of 28 of a goal of 132 by the end of the Sixth Five Year Plan (1978-83). Assisted towns must promulgate anti-mosquito bylaws to control domestic and periodomestic breeding. A variety of specialized control measures is applied. NMEP provides materials and operational funds, as each town agrees to carry out the necessary work on that basis.

The situation in the Municipal Corporation of Greater Bombay indicates that effective vector and malaria control can be conducted in an extremely large and varied urban environment. The measures applied in Bombay are in keeping with widely recommended practices and have demonstrated effectiveness. The modified plan of operations

anticipates the development of similar programs wherever the town conditions require. Towns are selected on priority with respect to locations in the most malarious areas. The plans are reasonably developed but progress is slow. The urban centers add another feature to the malaria problem requiring some years to solve.

### Training

The requirements of malaria training are immense, involving refresher as well as basic instruction. The total staffing pattern and collaborating agencies include many thousand of individuals who will require both instruction and motivation. The Government has some specialized malaria training resources in the NICD and the NMEP and their 12 Field Stations and Regional Coordinating Offices. These require considerable additions in funds, personnel and facilities to provide for professional courses, reaching through National, Regional, State, Zonal and District levels to the Primary Health Centers. The paramedical staff and cooperative workers will have a wide range of training requirements. The multi-purpose Basic Health Workers are being trained through the 7 Central and 60 Regional Training Centers for such staff. The intention is to add malaria appropriately to the other facets of their instruction.

Most of the actual planning and implementation would appear to be still in the discussion stage. WHO has assisted in preparing a special report and recommendations for malaria training which is now receiving GOI study. The BODA is considering assistance to the 106 medical colleges for professional training including specific malaria interest. Some assistance by this agency is also proposed for malaria training equipment for general use by the NMEP and NICD.

### Research

Studies with appropriate emphasis on operational problems and alternative control are being coordinated and developed. The ICMR convened its Malaria Expert Committee and 8 Task Forces for that purpose in February-March 1977. Some 22 projects are now budgeted, though only 3 are much beyond the initial stages. In addition to participating with the above projects, the NICD and the NMEP are conducting various malaria investigations as part of their normal functions.

The WHO Southeast Asia Regional Office has convened a Consultative Meeting on Malaria in April 1976 and a Workshop on South East Asia Regional Program for Applied Research in Malaria Control in March 1978. These meetings were hosted by the GOI and have proved valuable in developing the Indian malaria research program. WHO and SIDA are assisting with a large research and operational effort toward containment of the falciparum malaria problem in the worst affected Districts.

### 3. Insecticide Situation

#### a. Standards and Regulations

The NMEP uses three insecticides in residual house-spraying: DDT, BHC and Malathion, supplied to the operational areas in the form of water-dispersible powders and applied to interior walls in aqueous suspensions at standard dosages. These insecticides are manufactured and formulated in India, but not in sufficient amounts to meet the current demands of health (consisting almost entirely of malaria control) and agriculture. Production has been expanded with growing rapidity in recent years. In so far as the specific needs of the NMEP are concerned, a relatively few (3 to 5) years of development may serve to match the available supplies to the projected requirements.

The Government of India has provided legal codes, technical guidelines and regulatory processes covering pesticides, as well as other matters, which include the following:

#### Indian Standards Institution

The Central Government in 1948 established the Indian Standards Institution (ISI) as an autonomous advisory body under the Ministry of Commerce and Civil Supplies. The ISI functions through a series of specialized committees of high expertise, drawn from governmental, industrial and technical organizations and programs in India. The ISI is assisted by and coordinated with the appropriate international agencies. The committees and subcommittees (such as those concerned with pesticides) provide a resource for preparation, adoption and revision of standards and specifications. These are to be followed in producing, testing, packing, marking, handling, using of any and all products made and used in India.

Specifications have been prepared and published on DDT, BHC and Malathion in India, among many other materials. The "ISI mark" is available to manufacturers and formulators who meet the officially stated ISI requirements. Insecticides (and other materials) may be produced for sale legally without the ISI mark, or may be indicated in the marking as being of equal quality. The Government policy is to buy only those items which have the ISI seal of approval.

### Insecticides Act

Legislation on insecticides was enacted by the Government of India in 1968 (since amended to 1977) and came generally into application and enforcement by the Central and State Governments in 1971. The purposes are "to regulate the impact, manufacture, sale, transport, distribution and use of insecticides with a view to prevent risk to human beings or animals, and for matters connected therewith". As provided by this Act, the Government has constituted the Central Insecticides Board to advise the Central and State Governments on technical matters and to carry out other functions prescribed by the Act.

The Act was prepared by the Ministry of Health and Family Welfare in connection with the Drug Act. The Board is now under the Ministry of Food and Agriculture; however, the Director General of Health Services remains the Chairman of the Board. The membership represents a high level of governmental leadership and technical expertise covering such fields as public and industrial health, food and agriculture, community development and cooperation, transport and shipping, chemicals and fertilizers, plant protection, zoological survey, and medical, agricultural, scientific and industrial research.

The Act sets forth the procedures for the registration of insecticides for import or manufacture, granting and revoking of licences to dealers, establishment of the Central Insecticides Laboratory, insecticides analysis and inspection, and the governing rules and infringement penalties applicable to an extensive list of requirements for the regulation of insecticides as stated in the Act. DDT, BHC and malathion are specifically included.

b. Producers and Capacities

About 30 years ago, the pesticides industry in India began the expansion in capital investment and productive capacity which continues to the present time. The three insecticides used by the NMEP in residual house-spraying have been to the fore in this period of development leading to the impressive variety and quantity of pesticides manufactured in this country today. In 1947-48 the introduction of DDT and BHC formulations for agricultural purposes was followed by increasing importation and formulation of pest control chemicals. Manufacture of technical grade materials began with BHC in 1952 and DDT in 1955. The DDT plant was constructed with the assistance of UNICEF and WHO specifically in connection with the needs of the expanding national anti-malaria program. This facility provided the foundations for Hindustan Insecticides Ltd., a leading Public Sector company and a major manufacturer of DDT, BHC, Malathion and other pesticides.

The pesticides industry has achieved prominence in the national economic plans and projections, primarily due to its key role in the NMEP and agricultural projects. An estimate from the Ministry of Petroleum, Chemicals and Fertilizers in March 1978 places the installed capacity for pesticidal formulations in the order of 56,700 metric tons per annum. About 30% of the formulations are estimated as being produced in the "small-scale sector;" the most popular formulations are based on DDT, BHC and Malathion. In September 1977 the Indian Standards Institution listed 980 valid licences held by manufacturers (some hold licences for more than one pesticide), enabling them to use the ISI mark on their pesticide products. Nearly two-thirds of these licences (618) are for the production of DDT, BHC and Malathion, as technical grade materials or in various formulations.

While many licensees would appear to be available to formulate the insecticides, not all would be prepared to produce the specific type, quality and amount of formulations required for antimalaria operations. Not only the capacity for production, but also the time required is important; the insecticides must be delivered and applied in the operational areas at the proper time to afford the maximum protection during the transmission season. In addition to the time required for factory production, the necessary Government procedures of procurement and distribution should be taken into account.

Malathion has a relatively short shelf-life (about 2 years as technical grade, 1 year as water-dispersible powder), especially under tropical storage conditions. It is obvious that the technical grade material of this insecticide, whether produced in India or imported, must be delivered to the formulators in carefully scheduled quantities to avoid long delays in processing. Similarly the WDP formulations must be produced, packaged and delivered to the field, in conformance both to the period of maximum seasonal effectiveness and to the duration of the insecticidal potency.

A statement obtained from the Ministry of Petroleum, Chemicals and Fertilizers in March 1978 provides a view of the approved manufacturers of DDT, BHC and Malathion, 1978-82, as to the installed and projected capacities of production of technical grade materials (Table 6). To the facilities in operation are added those approved through licenses or letters of intent, together with the likely year in which manufacturing will begin. This tabulation indicates substantial development of plants and capacities during the period covered, amounting to increases in the production in metric tons of DDT/TG from 4,500 to 9,500; BHC/TG from 32,500 to 43,300 and Malathion/TG from 2,600 to 8,920 during 1978-82. DDT and BHC are being manufactured from indigenous materials. Malathion production will require some imported constituents until 1980 or later.

A stabilization or expansion of the above manufacturing capacities will be determined by the continuing demands of the projects and markets in India and the possible export opportunities. The pesticides industry has shown impressive indications of vitality, initiative and potential for growth. There is an active Pesticides Association of India, founded in 1964, which provides for interchange among the membership and participates in the work of Government committees in this field. The leadership and facilities of the pesticides industry, the linkage and response to the Government projects in health and agriculture, and the attention being given to national and international developments relevant to pesticides give an encouraging impression of the growing resources of technology, management and production.

#### c. Malaria Control Requirements

The antimalaria program in India, as in numerous countries, is basically dependent on residual insecticidal house-spraying to interrupt malaria transmission. In the rural areas especially, there is no other currently available attack on the malaria vector which could be applied with any comprehensive protective coverage of the population.

To be usable in the necessary mass campaign for malaria control, an insecticide must meet criteria of effectiveness against specific vectors, economy in procurement and equipment, safety to personnel and householders, freedom from undesirable environmental effects, and acceptability to the public.

DDT has been widely used by public health authorities in India and throughout the world under such criteria as given above. It is generally rated the best for application against malaria-carrying mosquitoes on all accounts. In India BHC is the first alternative when resistance to DDT occurs in the vector species; Malathion follows as the second alternative with vector resistance to both DDT and BHC. Prices vary but all three insecticides are well within practical cost considerations. In rural areas application is made with hand-spraying equipment manufactured in India. In a few urban areas DDT and Malathion may be dispensed by fogging or misting equipment.

As used with proper procedures under careful supervision for malaria control purposes, DDT, BHC and Malathion may be applied without personal hazard or environmental impact of identifiable significance.

Malathion is formulated in India and applied by the NMEP as 25% WDP. This compound has an unpleasant odor which causes some difficulty in public acceptance. The premium technical grade material and 50% WDP formulation, as produced in the United States, are "reodorized" to reduce the objectionable characteristic. Both the NMEP and the suppliers are aware of this problem, but it has not been regarded as a major deterrent to an extended use of Malathion thus far. Cyanamid India Ltd. proposes to begin manufacture of the premium technical grade by 1979, after installation of special factory equipment. Other producers might be interested if sufficient demand is indicated.

The amounts of DDT, BHC and Malathion required by the NMEP are based on extensive field data obtained in geographic reconnaissance of the operational areas. This information includes the area of sprayable interior surfaces, as well as the numbers of houses and occupants. With determination of the most effective insecticide to be used in each operational area, the requirements are computed in accordance with the standard dosages and the resulting consumption per capita.

The formula for the annual projection in India in metric tons per million population in areas to be sprayed is 100 for DDT 75%, 336 for BHC 50%, and 900 for Malathion 25%. The formulation percentages given are

those commonly but not exclusively used. The technical grade (or "100%") equivalents may be employed for comparison of requirements and availability of these insecticides (Table 7).

Both health (malaria) and agricultural projects are large consumers of DDT, BHC and Malathion. The Government of India is assured of at least 50% of the indigenous insecticides and more as may be justified in the public interest. At present the urgent need to reduce malaria is being accorded high priority, with most of the available insecticide production going to the NMEP. The Central Insecticides Board, the Ministry of Petroleum, Chemicals and Fertilizers, and related agencies are also concerned to respond to the demands of agriculture as effectively as possible.

The determinations of Government allocations are well coordinated and the necessary flexibility is being maintained in utilizing the insecticides for food production and malaria reduction. The needs of both malaria control and agriculture are characteristically seasonal and overlapping. The insecticide production requirements are correspondingly subject to cyclical pressures of variable degree.

The Government of India and the pesticides industry show encouraging evidence of planning and progress toward meeting insecticide production requirements with indigenous resources. The projected imported quantities of DDT and Malathion would seem fully justifiable and necessary, both to sustain the crucially needed antimalaria services and to bridge the period of industrial development to meet future requirements.

#### 4. Conclusions

The NMEP modified plan of operations can be described as a working approach toward dealing with an emergency situation. It was necessitated by a massive resurgence of malaria which persists into the present. The plan was initiated in April 1977 following development based on in-depth review of the malaria problems and expert consultation on the program options. It has not been prepared or projected as the final word on operations and requirements for any extended period. The business at hand is the containment and reduction of widespread malaria outbreaks in both urban and rural areas. The plan is fundamentally concerned not only to stem the tide of malaria infections but also to prevent catastrophic losses of the gains previously won, against malaria and thus for the national economy.

The unfavorable factors in the malaria situation are various and formidable. Morbidity rates have reached epidemic proportions in numerous

large areas; mortality rates, though still reported to be quite low, represent an advance from nil of a few years past. Technical, operational and administrative problems continue to impede the counter measures. The modified plan of operations itself can only be implemented with frank expediency in some respects. Under the present conditions, the GOI effort is to make the best possible use of all available resources in combating malaria, while intensifying research and training to develop the essential improvements of methods and manpower.

The favorable factors rest on the foundations of the GOI recognition of the gravity of the malaria resurgence and the necessity of effective control. The GOI has evidenced high priority in the financial support of the antimalaria campaign, in the development of the research and training plans, and in the emphasis given to strengthening the antimalaria activities and public cooperation at all levels. Assistance is being obtained from WHO, SIDA, and possibly UNICEF, BODA and other agencies, in planning, training, research and some features of implementation. Valuable resources are available to the National and State programs in the knowledge, experience and capability of the malaria personnel throughout the country.

The basic organization and operations of the NMEP have had demonstrated success when adequately provided with equipment, materials and manpower. The major reversals experienced by the program would seem to have been associated more with shortfalls in implementation than with failures in method. Decreased availability of staff, funds, vehicles, insecticides, drugs and other required support has been coincident with increased occurrence of malaria in many areas. Recognizably, there are also difficult problems of persistent malaria transmission, and new control techniques are urgently needed for reasons both technical and practical.

The impressive achievements of the NMEP in past years have been made with exemplary systems of total coverage by residual insecticidal spraying, case detection and treatment, and remedial measures. Modifications have been introduced, due to shortages of supplies and for reasons of economy. The continuing effectiveness of these vital protective and evaluative services will need careful follow-up examination. The new plan has considerable flexibility for adjustment on the basis of experience.

The modified plan of operations sets forth a number of new approaches which can only be realized through extensive developments in training, research and public cooperation. The NMEP has been strengthened by the more direct involvement of the general health services. In other particulars, the program may easily require several years (perhaps 3 to 5) of organizational and operational development. During this period the mainstay of the attack on malaria will continue to be domestic residual spraying with DDT, BHC or Malathion in rural areas. In the most malarious towns, specialized urban and anti-mosquito and antimalaria measures are being introduced gradually with NMEP assistance.

The insecticidal supplies and equipment, both imported and indigenous, are decisively important in implementing the modified plan of operations and affording protection and relief from malaria in large areas. The amounts of insecticides indicated for importation are required to spray the dwellings of some 90 million people in 1979, or approximately one-third of the total spraying program. The remaining two-thirds of the insecticides requirement will be available from indigenous sources. Since the areas to be sprayed are selected on the basis of high malaria incidence and the dangers of increasing transmission, the significance of a shortfall in the essential insecticides is accordingly multiplied.

The production of insecticides in India has reached the point of self-sufficiency with BHC. DDT and Malathion are also produced in India, but will need several years to reach sufficient production levels to meet the demands of health (practically all malaria control) and agricultural projects. The pesticides industry of India appears to be vigorous and capable, and the GOI standards and regulations are generally in keeping with international codes. The prospects are encouraging for the GOI to have indigenous resources available to supply the necessary insecticides within 3 to 5 years.

The specific reduction of malaria incidence cannot be forecast with certainty for insecticidal vector control, whether with imported or indigenous materials. It can be predicted with confidence that epidemic and endemic malaria should be much reduced in the operational areas. In past experience in India, where the residual insecticides have been provided in adequate quantities and properly applied, malaria transmission has been generally interrupted. The reverse of this excellent possibility becomes a disastrous probability, if the population in areas which require spraying is left without such protection.

Under the present conditions of widely prevailing high malaria incidence throughout many areas of India, the people living and travelling in unsprayed areas could be exposed to extreme hazards of malaria infection. The risk would be locally variable, but the average in any extensive area would be a near certain increase in malaria cases. Especially in areas affected by falciparum malaria, an increase in fatalities could also be expected.

The current modified plan of operations for malaria control in India has some features, as has been indicated, which require testing and development. This is well recognized by the Government of India and the modifications remain reasonably flexible in their present early stages. It cannot be overly emphasized that a shortfall in insecticide supplies at this time can only worsen the malaria situation. With adequate insecticides, the National Malaria Eradication Program will have the means to interrupt malaria transmission in large areas, to protect numerous communities exposed to malaria risk, and to proceed with priority attention to the planned extension and intensification of malaria control.

## B. Financial Analysis

### 1. Alternative Sources of Financing

Other donors besides AID which are assisting the India Malaria Control Program are the WHO, Swedish International Development Agency and UNICEF. The British ODA has begun initial discussions with the Government on providing grant assistance for Malaria Control training. Details on the type and amounts of assistance are not known. It is important to note that the GOI provides the vast majority of financial resources required for the program, and reliance on direct external financing of commodities and technical assistance is minimal, for example in 1979 about 82% of the costs of the program that year are met with GOI funds.

Following is a summary of other donor assistance:

World Health Organization - WHO has programmed about \$67,000 a year from 1978 through 1982. The assistance is in the form of fellowships, shortterm consultants and a subsidy for holding seminars and workshops, WHO also supplies test kits for the study of susceptibility of vectors. At the WHO Regional Office in New Delhi, WHO has a malariologist responsible for monitoring the program for WHO. WHO also provides consultants who participate in the Annual Independent Appraisals of the program.

Swedish International Development Agency - SIDA is providing a five year grant to cover several communicable diseases. The portion of that grant attributed to Malaria is about \$27.0 million. The grant, to be administered by WHO, will finance local and foreign exchange costs for (1) a P. Falciparum containment program in 55 districts and (2) field operational research. The grant is expected to be signed shortly.

United Nations Children's Fund - In the past UNICEF has provided grants for equipment and for emergency imports of anti-malarial drugs; however, UNICEF plans to discontinue assistance to malaria control after 1978. The final UNICEF planned contribution to the program will be about \$100,000 for microscopes and some replacement parts for microscopes now in use.

Other Assistance - The GOI has been getting some of its insecticides from Poland and the USSR. The team does not know the terms under which these insecticides were provided, but apparently, they were obtained through Rupee payment. It is probably safe to state that the GOI may choose

to continue this line of supply if requirements of insecticides indicate a need that is not being met domestically or through other imports.

## 2. Project Costs

The total costs of the program are difficult to estimate because of the scope and complexity of the variables involved, e. g., continued vector susceptibility to various insecticides. It is, however, safe to say that over the next five years the costs of the program could reach \$700.0 million. Because of the difficulty of projecting beyond a couple of years, AID proposes limiting the initial development loan commitment to two years -- 1979 and 1980. Program costs in these two years are estimated to be \$133.0 million and \$144.0 million respectively.

The major commodity components to these costs are insecticides and anti-malarial drugs. In 1979 these two commodity groupings account for an estimated 69% of program costs or about \$92.0 million of a total \$133.0 million. Quantity and cost estimates for insecticides and anti-malarial drugs for 1979 and 1980 presented below are followed by the detailed budget projections for the first two years of the program. Budget estimates for 1981-1983 are based on conservative assumption of incidence (API) reduction applied against overall commodity and operational costs.

## 3. AID Loan Budget

The AID loan will finance about 23.0% of the insecticide requirement for 1979-80 and about 14.0% of the overall program costs. The proposed budget for the AID loan is presented below. It is important to note that these requirements may change somewhat as the program develops.

	(in \$1000's)		
	<u>1979</u>	<u>1980</u>	<u>Total</u>
DDT 75% WDP (7246 MT/yr)	8,912	9,355	18,267
Malathion Technical (4200 MT and 4100 MT respectively)	7,770	7,962	15,732
Abate (Larvicides)	225	225	450
Truck Mounted Sprayers (12 ULV)	53	-	53
Hand Operated Sprayers (100 ULV)	15	-	15
Contingency (approx. 10%)	1,525	1,958	3,483
	<u>18,500</u>	<u>19,500</u>	<u>\$38,000</u>
Total	<u>18,500</u>	<u>19,500</u>	<u>\$38,000</u>

**Insecticides for Malaria Control (\$1000's)**  
(excluding duties/taxes)

	<u>Quantity</u>	<u>Cost/unit</u>	<u>Cost</u>
<u>1979</u>			
1. DDT 75% WDP Import (C & F)	9,807	1230	12,063
2. DDT 50% WDP Domestic	8,800	888	7,814
3. BHC 13% WDP Domestic	32,617	500	16,308
4. Malathion Technical Import (C & F)	4,200	1850	7,770
5. Malathion Technical Domestic	1,600	3375	5,400
6. Malathion 25% WDP Formulation	21,340	1192	25,437
7. Diazinon 40%	12	916	11
8. Abate	16,270(Lt)	4	65
9. Other Larvicides			2,727
			<u>\$77,595</u>
<u>1980</u>			
1. DDT 75% WDP Import (C & F)	9,807	1291	13,660
2. DDT 50% WDP Domestic	8,800	932	8,205
3. BHC 13% WDP Domestic	32,617	525	17,124
4. Malathion Technical Import (C & F)	4,100	1942	7,962
5. Malathion Technical Domestic	1,800	3544	6,378
6. Malathion 25% WDP Formulation	21,712	1252	27,183
7. Diazinon 40%	12	962	12
8. Abate	16,270(Lt)	4	65
9. Other Larvicides			2,863
			<u>\$82,452</u>

Anti-Malarial Drugs (\$1000's)  
Estimates

	<u>Quantity</u> <u>(MT)</u>	<u>Unit</u> <u>cost</u>	<u>Cost</u>
<u>1979</u>			
1. Chloroquine (Powder)	380	32,500	12,350
Primaquine (Powder)	2	145,000	295
Tabletizing			1,895
Total			<u>\$14,540</u>
<u>1980</u>			
1. Chloroquine (Powder)	380	34,125	12,967
Primaquine (Powder)	2	152,250	304
Tabletizing			1,979
Total			<u>\$15,250</u>

Malaria Program Budget (\$1000's) 1/  
(Estimates)

<u>Commodities Costs</u>	<u>1979</u>	<u>1980</u>	<u>1981*</u>	<u>1982*</u>	<u>1983*</u>
Insecticides	77,595	82,452			
Drugs <sup>2/</sup>	14,540	15,250			
Vehicles <sup>3/</sup>	212	244			
Microscopes/Slides <sup>3/</sup>	350	287			
Sprayers <sup>4/</sup>	424	410			
Subtotal <sup>5/</sup>	(92,121)	(98,633)	(109,000)	(102,500)	(79,500)
 <u>Operating Costs</u>					
Overhead <sup>6/</sup>	531	610			
State Programs <sup>7/</sup>	35,076	40,337			
Publicity <sup>8/</sup>	1,250	1,437			
Research <sup>8/</sup>	3,137	3,277			
WHO Specialists/Training	66	66			
Subtotal	40,060	(45,727)	(50,400)	(47,800)	(45,500)
Total <sup>9/</sup>	<u>\$133,181</u>	<u>\$144,360</u>	<u>159,400</u>	<u>150,300</u>	<u>125,000</u>

Foot Notes:

\* Costs from 1981-1983 are rough estimates based on probable reductions in malaria incidence; cost escalations and change in program emphasis from active spraying to surveillance.

- 1/ developed by AID, not official GOI projections.
- 2/ \$212,000 represents vehicles for urban malaria, rural malaria vehicles are funded through General Health Services and state operating program costs.
- 3/ includes \$100,000 in 1979 from UNICEF
- 4/ includes \$68,000 from AID loan for truck and handoperated ULV sprayers.
- 5/ does not include customs duties on imports
- 6/ includes overhead of NMEP central operations and operations of six regional offices, e.g., salaries, training, POL.
- 7/ includes operations from state level down to actual spray, entomological field operations
- 8/ includes SIDA \$5.4 million per year of five year \$27.0 million grant.
- 9/ British ODM grant not included.

#### 4. Financing Plan

##### a. Source of Funds

The plan presented below assumes an AID input into the program for a five year period 1979-1983. The loan proposed in this paper is for the program years 1979 and 1980 with major loan disbursement in 1978 and 1979 -- at the time of import procurement. A three year AID loan disbursement period is proposed.

	<u>Finance Plan (\$1000's)</u> <sup>1/</sup>					
	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>Total</u>
National Program <sup>2/</sup>	102,481	112,801	121,472	113,046	88,305	538,105
State Contributions <sup>3/</sup>	6,630	6,690	7,310	7,670	8,050	36,350
SIDA Grant	5,400	5,400	5,400	5,400	5,400	27,000
WHO Grant	70	70	70	70	70	350
UNICEF Grant	100					100
AID Loan	18,500	19,500	25,120	24,100	23,150	110,370
Total <sup>4/</sup>	133,181	144,461	159,372	150,286	124,975	712,275

<sup>1/</sup> Developed by AID, not official GOI projections

<sup>2/</sup> From NMEP budget excluding budget allocations needed to cover donor assistance

<sup>3/</sup> from state malaria control budgets

<sup>4/</sup> does not include proposed British ODM grant

The NMEP budget for FY 79 is Rs. 750.0 million or \$93.75 million excluding an allocation for SIDA and AID support. If supplemental budgets are submitted for these, the NMEP budget level will increase to \$117.65 million. Given the NMEP plan for 1979 a budget deficit of about \$15.5 million appears to still exist. Part of this can and will be covered by existing stock of insecticide and drugs. Even given inventories, either program operation will have to be reduced to match available funds or supplemental budget funds beyond those to cover the SIDA and AID support for 1979 must be secured. We understand the latter course will be followed to the extent possible.

##### b. GOI Release of Funds to States

The NMEP releases operating funds and materials to states on a quarterly basis based on program performance and use of previously released funds and materials. If states are not adhering to the Modified

**Plan of Operation, if districts within the states are not effectively executing operations, if annual evaluation suggested remedial actions are not implemented, the NMEP can and does restrict the flow of central support to state program.**

#### **5. Conclusion**

**The India Malaria Control Program is large and complex both in terms of the program scope and resource requirement. Budget projections into the future are understandably difficult to make. In the GOI context resources requirements and allocations will take place on an annual fiscal year basis. Official projections of future year requirements will be reviewed every year in accordance with the "Rolling Plan" concept recently adopted. For AID to have officially sanctioned cost projections for five years into the future seems unnecessary, especially, since such projections on other malaria control programs seldom bare any resemblance to reality after a year or two have passed. Given these factors, the AID loan is proposed for only two years. Follow-on assistance could be considered later, e. g. , FY 1980.**

**The financial information presented in this paper does not have official GOI approval. The figures were however developed in conjunction and consultation with both public and private sector Indians and are felt to be reasonably accurate.**

**The GOI has requested an AID loan of \$38.0 million with a three year disbursement period.**

### C. Social Soundness Analysis Summary

The social factors affecting malaria control in India can be linked to three basic issues: the numerical size of the population to be affected; the magnitude of cultural diversity present in the sub-continent; and the social acceptance of the techniques used in malaria control. The issue of the magnitude of the people is not necessarily a limiting factor if the scope and the extent of a malaria program is sufficient to incorporate the majority of the population. This problem of numbers is not a new one to India, even in the area of public health (i. e., the malaria program from 1953 to 1965, and the recent small pox eradication effort.).

With cultural diversity as an issue, the complexities of extending malaria control to all the people become much more profound. The various languages, social traditions and health belief systems present in India necessitate a program which is flexible enough to accommodate this diversity within a range of implementation policies adapted to the new local circumstance. The system in the current malaria control program encourages some degree of flexibility by allowing states a very autonomous role in exercising anti-malaria activities in their own areas. Furthermore, the structure of the new malaria control plan allows a local community variation within the general guidelines set by the national office. Health education policies also take into account the communication channels most used in different areas and makes a practice of translating all materials into local languages.

Perhaps the most significant of all issues is that of social acceptance. The two features of malaria-control techniques on which social acceptance looms heavily are the use of drugs and insecticide spraying. Fortunately for the malaria control program, the use of western medicines appears to be generally accepted and even often preferred over other medicines. The basic practice of pursuing a variety of complementary curative procedures easily accommodates the presence of western medicine along with the others. Being practical and perceptive, the people examine cures on the basis of their success in overcoming any ailment's symptoms. Such examination has helped the rise of a social acceptance for western drugs.

Spraying with insecticides, however, has met with some social acceptance problems. In the early days of malaria control, the acceptance of household spraying was fairly high. This was due largely to the ability of the spray to destroy household pests, especially bed-bugs. The link between malaria and spraying was frequently not understood by the populace. When insect resistance to DDT increased and pesky insects remained after spraying, people's acceptance of spraying dropped sharply. Other factors which contributed to a resistance to spraying included: the spray's bad smell; the interruption of vital observances; spraying was a time-consuming bother; the spray discolored the walls; spraying was believed dangerous and not understood; and the spraying process broke religious or caste restrictions.

Related to the social acceptance of household spraying is the place malaria holds in the health belief system. If people perceive malaria to be a serious threat, then they will be more apt to take steps to work with the malaria control program. In some areas, malaria is viewed as just such a threat; in others, it is not. Even when malaria represents a health concern of the population, not all people associate malaria with the presence of mosquito.

Certainly, household spraying represents one of the most serious obstacles to social acceptance. The malaria control staff has responded with a major part of their program devoted to community health education and an effort to obtain what they term "public cooperation". By large communication campaigns, NMEP hopes to inform people about the causes of malaria and how their program activities combat malaria. NMEP also hopes that by involving local communities in the selection and establishment of local level malaria centers, they can achieve a greater public involvement in the program. This policy represents a logical and a sound course to follow given the principles learned in community development and applied social science.

Nevertheless, a continuing monitoring of the social acceptance issue during the implementation of the new program is essential. Social acceptance problems are certain to arise during the life time of the program and no public cooperation effort is flawless. Along with this monitoring function, a research capability is necessary in order to examine problems as they arise. Such examination should investigate the reasons for resistance and probably courses of action which would lead to reduced resistance.

Present staffing levels at NMEP indicate that outside local assistance may be needed for at least the research function.

The identification of beneficiaries and the project's benefit incidence show that the major limiting factor will be the extent of the program's operation. The program itself does not restrict participation on the basis of education, income, caste, occupation, age, or sex. Rather any person with a fever or living in some physical structure has the ability to become direct beneficiaries.

Given the social setting and the current plan, the malaria control program appears as socially sound as it can be (considering the nature of the malaria control techniques presently available). The major problem area remains household spraying. Social resistance to spraying is there now and will continue to be present. If a malaria immunization inoculation were available, many of the social acceptance issues would be reduced since inoculations are generally well received. The only reasonable approach to the problem of social resistance is constant monitoring of the situation; research of resistance instances; and a program flexible enough to incorporate research findings.

D. Economic Analysis (Tables on Annex E)

1. Summary and Conclusions

The purpose of this economic analysis is to determine whether a malaria control program is in the best interest of India. The basis for this determination is very simple: if the benefits exceed those of the alternative course of action, the program merits endorsement. In this analysis the alternative is the absence of a program.

The program is assumed to be ten years. Total economic costs are estimated at U.S. \$1,052 million equivalent. Total economic benefits are estimated at U.S. \$2,791 million equivalent. <sup>a/</sup>

To determine the benefit-cost ratio and the net present worth, we have used a discount rate of 12%. The rationale for the selection of this rate is that "...12 percent seems to be a popular choice and almost all countries seem to think it lies somewhere between 8 percent and 15 percent." (World Bank Publication) Furthermore, the World Bank, with greater experience on the Indian economy, has used a 12% discount rate in the analysis of its projects.

The benefit-cost ratio is 1.9 This ratio indicates that for every \$1.00 spent on malaria control, the economy will derive \$1.90 in benefits.<sup>b/</sup> The net present worth is US \$584 million equivalent; that is, U.S.\$ 584 million equivalent will be generated over the life of the program, after all costs are covered, including the opportunity cost of capital.<sup>c/</sup> The internal economic rate of return (IERR) is 44%; well above current rates of return in India.<sup>d/</sup>

Since accurate projections in estimating costs and benefits is considerable difficult, and errors will affect the economic profitability of the program, we have subjected the program to three rigorous sensitivity analyses.

First, we have assumed that the price of the inputs (costs) were underestimated by 50% during the life of the program. Under this assumption, the IERR is 24%.<sup>e/</sup> Second, we have assumed that the expected benefits (i.e., losses and expenditures avoided) were overestimated by 50% over the life of the program. In this case, the internal economic rate of return decreases from 44% to 12%. <sup>f/</sup>

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<sup>a/</sup> See Table J

<sup>b/</sup> *ibid*

<sup>c/</sup> See Table J

<sup>d/</sup> *ibid*

<sup>e/</sup> See Table K

<sup>f/</sup> See Table L

Finally, we have tested the profitability of the program if it were to face a simultaneous 25 percent cost overrun and a 25 percent annual decrease in the expected benefits. The internal economic rate of return is 20 percent.<sup>a/</sup>

## 2. Methodology

The essence of this economic analysis is the comparison of what the economy's expenditures and losses would be without the program and what they would be with the program.

The values of costs and benefits have been divided by years and appropriately discounted over time (at 12% ) to yield present values.

Given the absence of significant subsidies and administrative price controls, the monetary expressions are at market prices.

Project costs have not been increased for general price inflation because the same increase would apply to the valuation of the benefits, leaving the ratio between them unchanged.

The official exchange rate appears to reflect the scarcity value of foreign exchange; thus, the exchange rate of U.S. \$1.00 = Rs. 8.45 has been used throughout the analysis.

## 3. Malaria Cases Projections <sup>b/</sup>

Available data indicates that over 90 percent of India's population live in zones affected by malaria.

Without the constraints imposed by a malaria control program, the annual parasite incidence (API) could reach over 208 cases per thousand population -- comparable to that which existed prior to 1953 (75 million cases in a total population of 361 million). Our highest API estimate, without a program, is less than one-half of 208.

The program will prevent approximately 329 million malaria cases<sup>c/</sup> and enable the economy to save U.S. \$1,739 million equivalent from 1979 to late 1988.<sup>d/</sup>

We have disaggregated the expected cases by the type of medical treatment required and by type of malaria. <sup>e/</sup>

a/ See Table M

b/ See Tables A thru D

c/ See Table A

d/ See Table K

e/ See Tables B and C

#### 4. Costs<sup>a/</sup>

Program costs consist of the monetary values of all the resources, both physical and human, that will go into the operation of this program.

The total, undiscounted value of the economic costs is estimated at U.S. \$2,791 million equivalent. The present worth at 12 percent is estimated at U.S. 584 million equivalent.

#### 5. Benefits

The program's benefits are the avoided expenditures and losses as a result of the malaria control endeavour.

The program will produce substantial direct and indirect benefits. This analysis has quantified only those benefits that can be valued in monetary terms. They are:

(a) The avoided expenditures in medical treatment. The Indian economy will save U.S. \$1,845 million equivalent from 1979 to 1988.<sup>b/</sup>

(b) The avoided expenditures in antimalaria drugs. The savings for this concept amount to U.S. \$386 million equivalent.<sup>c/</sup>

(c) The avoided loss of income of agricultural workers as a result of malaria. This benefit is estimated at U.S. \$551 million equivalent. It should be noted that we have only considered labor in the agricultural sector, while malaria affects labor in all sectors of the economy.<sup>d/</sup>

(d) The avoided value of additional food requirements. Individuals who suffer from any febrile disease have excess caloric needs. In malaria, the excess caloric intake required daily is 400 kilo calories or 100 grams of carbohydrates for an average of 5 days. Because the GOI is especially concerned with improving the nutritional standards of the people, and those most likely to suffer malaria are food producers, it is safe to assume that the excess caloric requirements will demand additional food imports and/or a more unequal allocation of foodstuffs. The value of the avoided excess foodstuffs requirements is estimated at U.S. \$11 million equivalent.<sup>e/</sup>

<sup>a/</sup> See Table J

<sup>b/</sup> For computations and explanations See Table E

<sup>c/</sup> For computations and explanations See Table F

<sup>d/</sup> For computations and explanations See Tables G&H

<sup>e/</sup> For computations and explanations See Table I

In addition to the direct benefits that lend themselves to quantification, we have encountered an equal or greater number of benefits whose impact is evident but cannot be assessed, directly in economic terms. The most significant ones being:

- strengthening of the general health delivery system;
- decrease of the incidence of other diseases (malaria reduces the general state of an individual's health); and
- an indirect contribution to food production and labor productivity

SUMMARY TABLE

Program Life	: 10 years (1979-1988)
Exchange Rate	: U.S. \$1.00 = 8.45
Undiscounted Value Total Costs	: U.S. \$1,052 million equivalent
Undiscounted Value Total Benefits	: U.S. \$2,791 million equivalent
Discounted Rate Used	: 12%
Present Value Total Costs	: U.S.\$ 656 million equivalent
Present Value Total Benefits	: U.S. \$1,240 million equivalent
Benefit-Cost Ratio at 12%	: 1.9
Net Present Worth at 12%	: U.S.\$ 584 million equivalent
International Economic Rate of Return (IERR)	: 44%
Malaria Cases Projections (1979-88)	
- without malaria control program	: 342 million cases
- with malaria control program	: 13 million cases
Expenditures Avoided (1979-88)	
- in medical treatment	: U.S. \$1,845 million equivalent
- in antimalaria drugs	: U.S. \$ 384 million equivalent
- in lost income	: U.S. \$ 551 million equivalent
- in value of foodstuffs	: U.S. \$ 11 million equivalent
Sensitivity Analyses	
- assuming a 50% cost overrun	: IERR is 24%
- assuming a 50% decrease in benefits	: IERR is 12%
- assuming a 25% cost overrrun and 25% decrease in benefits	: IERR is 20%

### E. Environmental

AID is issuing a decision that an Environmental Assessment will not be undertaken prior to approval of the project. This decision is in the form of a "negative declaration" based on Reg. 16, Sec. 216.3(a), which provides for a deferral of a decision to undertake an Environmental Assessment and on Sec. 216.1(c)(7) which provides that "... the Agency may defer an Environmental Impact Statement or an Environmental Assessment for an action which the Agency has identified as being normally covered by the provision of disaster relief, the fact that a substantial number of Environmental Assessments or Environmental Impact Statements relating to similar activities have been prepared in the past, or the fact that the Agency has previously decided to prepare a programmatic Statement or Assessment covering the activity in question". The negative declaration for this project is based on criteria number (i), above, because of the extreme seriousness of the malaria epidemic in India. The situation of the malaria epidemic in India has also led AID to determine that an emergency condition exists based on the fact that in outbreak or imminence of outbreak of malaria-carrying insects, that significant health problems would occur without the use of the proposed pesticides and insufficient time is available before the pesticides must be used to evaluate its use. This determination excuses AID from the procedures of Regulation 16 relating to pesticide use and procurement under Section 216.3(b).

Given the extreme seriousness of the malaria epidemic in India, AID plans to authorize the two year loan of \$38.0 million (\$28.0 million in FY 78) and permit the GOI to procure required AID financed insecticides without a completed environmental assessment. While AID and the GOI will proceed to do the EA in an orderly manner, the emergency nature of the program, at least during the first two years, prohibits completion of the EA before insecticides must be ordered -- in the Summer of 1978. If required insecticides are not ordered at this time, given the procurement, production, delivery and formulation lead times, they will not be available for use beginning 1979 spray season and the effect on the program could seriously retard the GOI plans for reducing the epidemic level of malaria. It is AID's judgment that after the 1980 program the epidemic will be reduced to a manageable level at which time AID and the GOI will consider AID's role in the longer term problems of control and possible eradication of the disease.

Despite the negative declaration AID considers an Environmental Assessment highly desirable and therefore is proceeding to schedule the assessment for completion by January 1, 1979. This will permit GOI and AID review/consideration of the assessment before the 1979 insecticide spraying season -- when the AID financed insecticides procured in the Summer of 1978 will be used.

## Part IV. Implementation Planning

### A. Administrative Arrangements

#### 1. Government Administrative Arrangements

The malaria control program in India is decentralized. The 21 state governments and 12 territories have responsibilities for planning and implementing programs. The central National Malaria Eradication Program organization, which provides the bulk of financial and commodity resources to the State programs, is superimposed over the state.

Organization charts in ANNEX A reflect state and central organizational frameworks for the national program.

#### a. National Malaria Eradication Program (NMEP)

The NMEP under the Ministry of Health and Family Welfare will be the implementing organization for the project and will be the GOI authorized representative for the AID loan. The primary functions of the central NMEP and its six regional offices are:

- Planning and programming central support to state programs.
- Coordinating malaria activities within India
- Providing resources to state programs based on compliance with national program standards of operation, performance and program demands
- Evaluating state program operations
- Providing technical (entomological, epidemiological, etc.) advice to state programs
- Carrying out national research programs and coordinating state programs
- Sponsoring and financing national and regional training program
- Carry out entomological studies in areas of high incidence
- Maintain data on program operations and effectiveness
- Represents the GOI malaria control efforts at national and international levels

The central NMEP is considered by AID to be a well staffed, competent organization qualified to carryout the functions listed above.

(A more detailed description of NMEP as well as state operations is included in the project description, Part II.B.).

b. State Programs

The states and territory governments as discussed in the project description have complete authority for the execution of programs under their jurisdictions. Within the state, district and zonal organization perform day to day operations under the supervision of the district chief medical officer of Health and the district malaria officer who is responsible for actual field operations. The states are the key to the India program and are therefore of critical importance to its overall success.

c. Public Cooperation

Local participants, as explained in the project description and social analysis, is critical to an effective malaria control program. Massive resource inputs by central and state governments are not sufficient. Accordingly, the GOI in its Modified Plan of Operation has developed a scheme for local participation which includes the following major components:

1. Cooperation of Panchayats (the local/village governing structure) and Tribal Welfare Departments in the program to educate the community, provide voluntary labor, distribute drugs and assist spray teams in gaining access to homes.
2. Involvement and training of Youth Organizations to educate the community, provide information to the public and in some cases assist with malaria operations, e.g., drug administration.
3. Involve Women's Organization to educate and motivate the public especially women.
4. Involvement of school teachers/students to educate the public, gain community cooperation, distribute drugs and generally assist with field operations.

5. Involvement of the General (Private) Medical practitioner to take blood films of fever cases, administer presumptive treatment, administer radical treatment, and educate the public.

The organization for enlisting support of these organizations/individuals will generally be at the district/zonal level of operation.

## 2. AID Project Administration

Because of the sheer size of the India Malaria Program, comprised of essentially 30 separate state and union territory programs, coordinated by and receiving the majority of financial and commodity support from the central government National Malaria Eradication Program, detailed monitoring by AID of the program operations, as is done by AID in most other countries, would require a sizeable Mission staff. It would also implant an AID funded specialist at regional and possibly state level operations. Such involvement by AID at local levels is not considered practical. Accordingly AID will rely to a major extent upon the NMEP and WHO organizations for detailed program monitoring, reporting and evaluation.

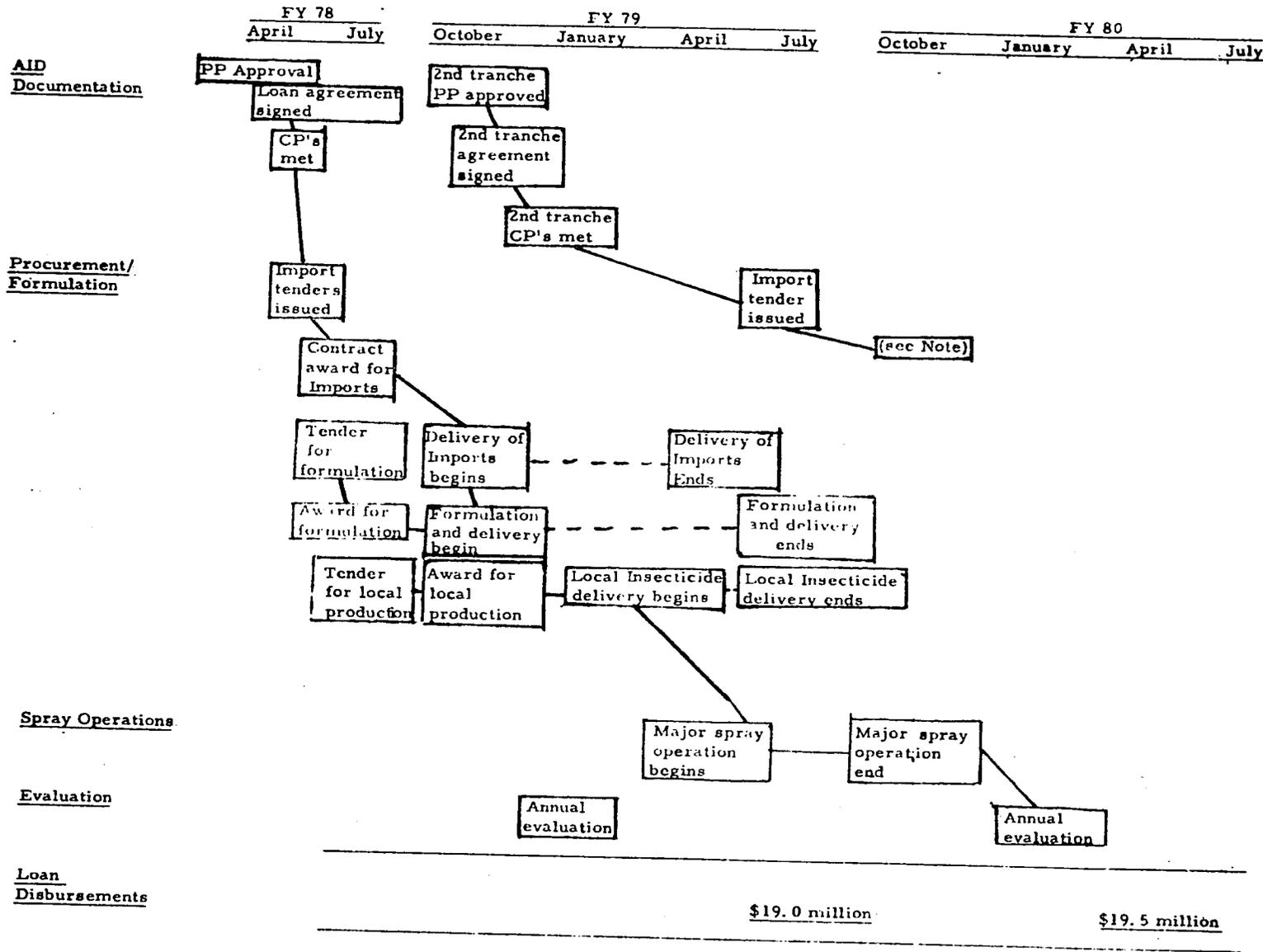
Responsibility within AID for general monitoring of the malaria control program and specifically AID's inputs to the program will fall on the Mission and the Regional Malaria Office (RMO) in Colombo. The Mission has a controller, capital development and health sector staff to monitor day-to-day activities, procurement, loan documentation, and general program progress. It will, however, be necessary for the RMO to visit India periodically throughout the project's implementation. The RMO should plan to spend at least 50 work days a year in New Delhi. This is considered a minimum and is based on the assumption that AID monitoring will not be as detailed or as far reaching as is recommended for most countries being assisted by AID with their programs.

If after experience with program operations, more specialized malaria monitoring services are considered necessary, AID will support the assignment of a full time malariologist to the Mission staff or other arrangements which would meet an increased monitoring function requirement.

The capital development staff is considered adequate to handle AID responsibilities concerned with insecticide procurement and loan documentation.

Schedule for Insecticide Availability (FY 78-80) \*

B. Implementation Arrangements  
1. Implementation Network



Note: Procedure will be repeated each year  
AID provide project insecticide import  
ing.

## 2. Pesticide Management and Health Safeguards

The proper management of insecticides used in the NMEP efforts is of major concern both to the GOI and to other agencies involved. Considerable effort was made by the Project Paper Team at the National, Regional, State and District levels to determine the adequacy and effectiveness of the GOI/NMEP in the safe use, storing and ordering of pesticides. Special stress was given to the procedures used in safely applying the insecticides, especially malathion, at the village level to insure that field personnel and villagers were not subjected to any health hazard in the application process.

In summary, AID has determined that due consideration is being given by the GOI to the importance of proper and safe pesticide management from the initial formulating process to its application in village houses and structures. The basis for this conclusion especially in regards to malathion is as follows:

1. The specifications for malathion, 25%, WDP are clearly written and approved by the Indian Standard Institute (ISI). This ISI has 20 laboratories which can carryout physical and chemical tests on the formulated materials.

2. At the time the insecticide is formulated representatives of the GOI Directorate of Supply and Disposal (DGS&D) take samples of each batch. Three identical samples taken from each batch goes to DGS&D, one to NMEP and one to the testing laboratory. It is only upon receipt of laboratory certification that the DGS&D issues a release certificate permitting the material to be shipped to its designated delivery point.

3. The field procedures for testing malathion are to take samples every three months after delivery up to a year. A portion of the contractor's (suppliers) payment is withheld until the final 12 month sample has been taken and certified as meeting standard. If any of the samples taken during the year are sub-standard, the manufacturer must replace or reformulate the stock. In the case of BHC, samples are collected after six months and twelve months.

4. There is a concerted effort on the part of the GOI to store insecticides properly. Field visits were made for the central insecticide storage facilities in Gujarat State, District Surat (March 16, 1978, at GOI Central Warehouse at Kim) and the warehousing was found satisfactory. The warehouse at Kim was secure, had cement floors and walls, provide protection from rain and sun, was well drained. Careful inspection was made of the insecticide containers

which were stored in this warehouse and there were only 5 or 6 of 400-450 drums which were found damaged. The drums contain 25 kg. of malathion, 25% WDP each, are made of metal and all clearly labeled. There is a detailed caution label on each can. The date of production, batch number, manufacturer's name and location, product name, chemical breakdown, expiration date are all a part of this label. It was reported that theft of malathion is not common and is not considered a problem in this program.

5. From the Central District Warehouse containers are moved just prior to spraying to village locations. Investigations were made at the Village of Derod, District Surat, on March 16 to check storage facilities. The material is kept in a closed mud and thatch house in the village which offers security and protection. There were no drums in the village house at the time of the visit which indicates that control of the malathion storage inventory was being properly done.

6. Field Teams using malathion in the Districts are given training on proper handling of malathion prior to the operational season. Training is based on directives provided by the NMEP. A chain of directives were reviewed starting at the NMEP Headquarters in Delhi and leading organizationally to the Regional Coordination Offices (RCO's), to State Malaria Offices, to the Districts and finally to the individual Public Health Centers. The basic NMEP, NHQ directive on malathion (No. 9-19-72-NMEP(11) was dated April 23, 1973. The latest state circular based on this directive on malathion usage and care was issued by the Gujarat State Malariologist on May 21, 1977 to all District Malaria Officers and District Panchayats. The District Officer at Surat issued a directive based on the State directives on this subject in June 1977 to all PHC Medical Officers. The contents of the directive at all levels was essentially the same -- caution, signs and symptoms of poisoning, treatment, hints for medical practitioners. On June 27, 1977 the NMEP/Delhi issued a revised circular on malathion giving instructions and precautions on its use. The Gujarat State Malaria Officer, Dr. M.N. Rajcor, and the Regional Coordination Officer, Dr. C.M. De, reported no serious intoxications due to malathion had occurred in Gujarat State to their knowledge during the past spraying cycle. The District of Surat has been using malathion since 1970 and in 1977 protected a population of 380,500 with selective malathion spraying. The District Officer also reported no serious intoxication in spray personnel from malathion application.

7. At the District Malaria Office in Surat a review of the protective equipment issued each sprayman was made. Each sprayman is given 2 sets of clothes which include long sleeve shirts and long pants, a set of gloves, plastic hat with wide brim, shoes, face mask. A unique stirring rod was in use for mixing the malathion slurry. The District Malaria Officer, Mr. A.S. Nair, was completely familiar with operational standards for malathion use. Soap is issued for washing the clothes. Spraymen are instructed to wash frequently during the day and prior to smoking or eating. A plastic sheet is issued each two man spray team to be used within the households to cover any food item.

8. Supervision of the Teams is done by the State and District Malaria Officers and the officials of the Public Health Center. Cholinesterase tests are reported to be made on each sprayman before each of the three yearly rounds of spraying. It was reported that depressed cholinesterase levels in spraymen or villagers was not a problem. Spraymen may work a six day week in the operational season. If signs of depressed cholinesterase appear, spraymen are assigned to MHC squads.

9. Precautionary Label on Malathion Drums at Kim, Surat District, Gujarat

"CAUTION, Malathion is harmful if swallowed. Avoid contamination of foodstuffs, empty food staff containers, animal feeds and inhalation of mists made from this insecticide. Do not use this container for any other purpose except for storage of pesticides. Keep out of the reach of children. If poisoning occurs call a physician. Atrophine and oxygen are useful in treatment.

Antidote -- In case of poisoning, call a physician immediately and remove patient from further exposure. Wash contaminated skin and irrigate eyes with normal saline solution. A gastric lavage with 5% sodium bicarbonate may be given. Atrophine and Oxygen are useful in treatment. Administer 1 to 2 grams 2-Pyridine - 2-Aloxino-N-methyl iodine (2-P.A.M) intravenously very slowly."

Based on the evidence which would be obtained during this period, it was felt that sufficient consideration has been given to the proper management of insecticides used in malaria control by the GOI and that personnel at all levels were thoroughly familiar with the problem. It should be noted that malathion usage for India in 1978 is only planned for the States of Gujarat, Maharashtra, Tamil Nadu and Karnataka (Mysore). The latter two states will only be protecting population of approximately 600,000 and 650,000 with malathion during 1978. A letter has been sent to Tamil Nadu by the RCO, Baroda on precautions to be observed in the application of malathion.

### 3. Transportation and Storage

#### a. Transportation

The Ministry of Health and Family Welfare has a fleet of over 11,000 vehicles (jeeps, trucks, pick-up vans, motor cycles, etc.,) nearly 40% of which are employed in the malaria program on a full time basis. In addition, vehicles assigned to other programs such as tuberculosis control, cholera, family planning, immunization programs, etc., are frequently used by the NMEP to transport insecticides, anti-malarial drugs and spray teams during peak spray seasons. Also, additional vehicles are hired locally by State Governments in case of emergency needs.

Virtually all vehicles used in the program are manufactured locally and adequate spare parts are available within the country. The Government has established a Central Health Transport Organization in New Delhi and State Health Transport Organizations in all major states for proper maintenance and repair of all health program vehicles, including malaria vehicles. In smaller states where there exist no such transport organization, local arrangements have been made for the maintenance and repair of vehicles. Also, a limited number of new vehicles are proposed to be bought every year to replace old vehicles.

Rail transport is used to move bulk shipments of malaria commodities from ports and production points to state central distribution points. No problem of timely availability of rail transport has been experienced in the past nor is any future problem expected.

Although the AID malaria team did not make a detailed study of the transport and vehicle situation in the States, it was assured by senior Ministry and NMEP officials that transport will not be a major problem in the effective implementation of the project.

#### b. Storage

The Ministry has established a Central Medical Stores Depot in Bombay and five regional depots at Madras, Calcutta, Hyderabad, Karnal (Haryana) and Gauhati (Assam). In addition, each state has one or more depots to store health and medical supplies, including malaria program items. The insecticides and anti-malarial drugs are released to the State Depots by the NMEP as required on the basis of evaluations made by its Regional Coordinating Offices. The states in turn distribute the commodities to the district level operations.

#### 4. Procurement Procedures

The Ministry of Health usually sanctions the Director General of Supplies and Disposal to procure required commodities and equipment for the Malaria Control Program both domestic and imported. In the case of AID financed commodities, the Ministry of Health has not determined whether it will use DGS&D or the India Supply Mission in Washington, D.C. In any event, in procurement of AID financed commodities, standard AID regulations for country contracting of materials and equipment, Handbook 11, will be followed. An AID approved IFB, including specifications, will be used by the Government and AID will approve awards. Procurement of insecticides will be limited to U.S. source and origin unless adequate quantities at reasonable prices are not available from the U.S.

Because there is only one malathion technical and one DDT 75% WDP manufacturer in the U.S., negotiated procurement may be required. In the event adequate quantities of quality material at reasonable prices can not be attained, AID will seek appropriate waiver to procure outside the U.S.

#### 5. Disbursement Procedure

Either standard Letter of Credit/Letter of Commitment or direct Letter of Commitment procedures will be utilized unless AID otherwise agrees in writing.

The loan disbursement period will be three years.

### C. Evaluation

AID will rely on NMEP and WHO procedures for detailed evaluation of the program.

Under this procedure, 80 of India's 368 districts receive appraisal evaluations each year and each year 80 different districts are selected on a sample basis for detailed evaluation.

The results of the evaluations are reviewed and collated at the state, region and national level.

There are three members of each district evaluation team:

1. The team leader is from one of the five regional offices not having responsibility for the district being evaluated.
2. A member of the Indian Army Health Service.
3. A representative of WHO.
4. A representative of NMEP.

The primary objective of the evaluation is to determine actions taken toward implementation of the Modified Plan of Operation; actions taken by states on administrative and technical recommendations made by the Ministry of Health and Family Welfare and the NMEP; utilization of insecticides and anti-malarial drugs; action taken on entomological studies; and timely and accurate reporting.

Ultimate success of program effectiveness will be through the measurement of the reduction of malaria incidence to a level below 2 API per 1,000.

The evaluation team reviews the following details of district programs in determining whether their operations are adequate and acceptable:

1. Staffing requires vis-a-vis the modified plan, that sanctioned by the states and staff in place;
2. Laboratories established, blood films collected, examined, number of microscopists, number of films examined per micro scopists, time lags between blood films collection and receipt at the lab and receipt at the lab and examination cross checking lab operations;
3. Drug distribution centers established and fewer treatment depots operations, i.e. blood films collected, fever cases treated, drugs supplied and follow-up checking of cases treated;

4. Vehicles, spray equipment and microscopes number required and number available;

5. Surveys of surveillance operations by month for active case detection, passive case detection, and epidemiological investigations;

6. Radical treatment of positive cases and cases radically treated by month in areas under spray operations and those not under spray operations;

7. Utilization of insecticides and anti-malarial drugs including annual estimated requirement, beginning stocks, new receipts, total available balance expected to be unused and end of transmission season;

8. Spray operations including per cent of coverage (efficiency), entomological studies and results, resistance problems;

9. Training for chief medical officers, district health officers, spray personnel etc;

10. Health education and community participation programs. The evaluation teams, in concluding their appraisal, will recommend remedial or disciplinary action as appropriate and report its findings to the state government.

While it is not presently anticipated that AID should participate in each district level evaluation appraisals, and AID malariologist will participate in the National level evaluation review and district evaluation reports should be available for AID review.

#### D. Conditions Precedent, Covenants and Exceptions

In addition to the standard conditions precedent and covenants the following program specific conditions and covenants will apply.

NOTE: The following are illustrative of the Conditions Precedent and Covenants that the AID Mission proposes to negotiate with the Government of India. The final text of the CPs and Covenants will evolve from loan agreement negotiation talks and will be consistent with and inclusive of the requirements for specific CPs and Covenants as contained in the loan authorization.

##### 1. Conditions Precedent to Disbursement for the First Year of the AID Loan Program

Prior to disbursement of the loan or to the issuance of Letters of Commitment for that portion of the Malaria Control Loan to be disbursed in the second year of the loan the Borrower shall, except as AID may otherwise agree in writing, furnish to AID in form and substance satisfactory to AID:

a. Evidence of arrangements for the procurement of AID financed commodities including lists and prices of such commodities, schedule for their purchase and delivery and a draft tender document including specifications for imported commodities.

##### 2. Conditions Precedent to Disbursement for the Second Year of the AID Loan

Prior to disbursement of the loan or to the issuance of Letters of Commitment for that portion of the malaria control loan to be disbursed in the second year of the loan, the Borrower shall, except as AID may otherwise agree in writing, furnish to AID in form and substance satisfactory to AID:

a. Evidence of arrangements for the procurement of AID financed commodities including lists and prices of such commodities, schedules for their purchase and delivery and a draft tender document including specifications for imported commodities.

b. Evidence that commodities procured for the previous year's program (financed by AID) have been effectively utilized for the program.

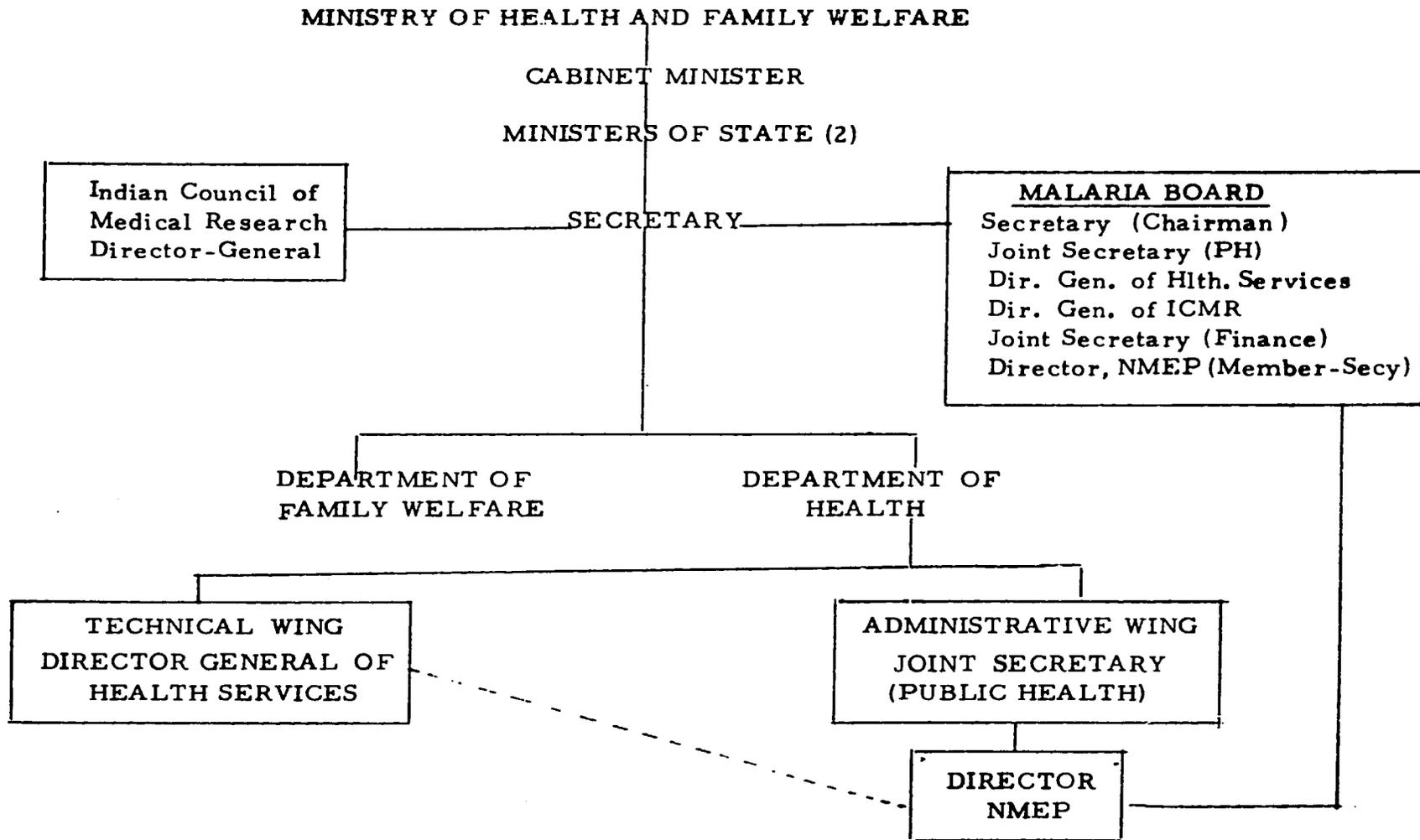
### 3. Special Covenants

a. Health Safeguards. The borrower will take appropriate safety measures including the provision of safety equipment to insecticide handlers and training of handlers and supervisory personnel in the dangers associated with the insecticide and proper procedures for safe handling. The borrower will also maintain rigid control over the quality of insecticide procured for the Malaria Control Program to insure that it meets WHO and AID technical requirements.

b. The borrower understands that an environmental assessment of the program will be required and agrees to assist, as appropriate, with the preparation of the assessment.

c. Environmental. The cooperating country will, in consultation with AID, undertake an Environmental Assessment on the use of insecticides in the program with AID assistance as may be appropriate. The cooperating country will also review the findings of the Environmental Assessment during the post authorization design and implementation stages of the program for appropriate application of such findings in the program.

NATIONAL MALARIA ERADICATION PROGRAM (NMEP) ORGANIZATIONAL CHART



N. M. E. P. ORGANIZATIONAL CHART - CENTRE

MINISTRY OF HEALTH AND FAMILY WELFARE GOVERNMENT OF INDIA

DIRECTORATE GENERAL OF HEALTH SERVICES

N. M. E. P. DIRECTORATE

DIRECTOR

DEPUTY DIRECTOR (Entomology)

DEPUTY DIRECTOR (Medical)

DEPUTY DIRECTOR (L. & Adm)

Asstt. Director (A)

Asstt. Director (M)

S. M. O. (C C C O)

Accounts Officer

D. A. D. (A)

D. A. D. (A)

S. M. O. (Planning)

Asstt. Director  
(Entomology)

Asstt. Director  
(Urban Malaria)

Asstt. Director  
(Chemistry)

Asstt. Malaria Engineer

D. A. D. (L)

D. A. D. (S)

Drawing Section

Workshop

Research Officer

Research Officer  
(Alwaye)

R. C. O. Bangalore

R. C. O. Baroda

R. C. O. Bhubaneshwar

R. C. O. Hyderabad

R. C. O. Lucknow

R. C. O. Shillong

Regional Director  
Sr. Medical Officer

Regional Director  
Sr. Medical Officer

Regional Director  
Dy. Asstt. Director  
(Training)

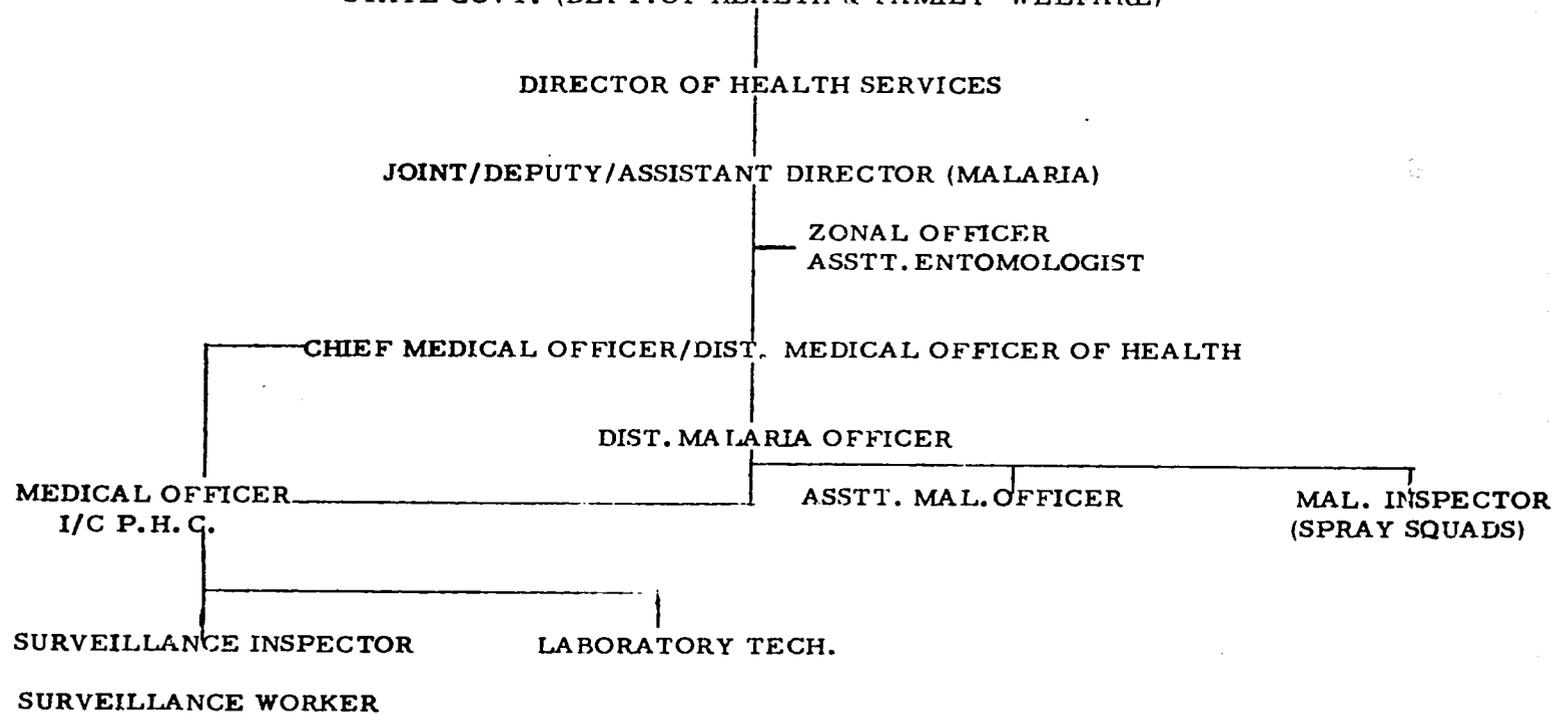
Regional Director  
Sr. Medical Officer

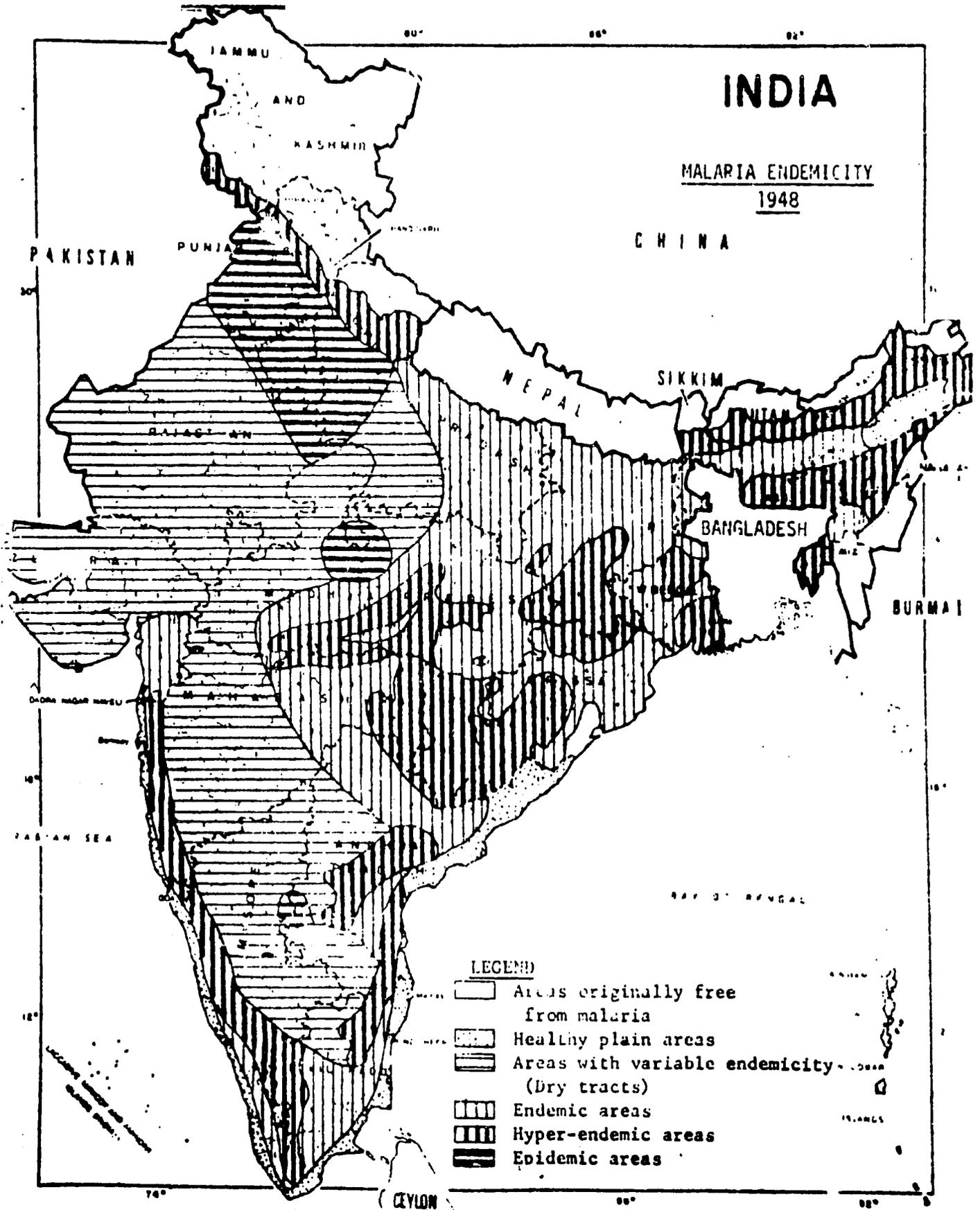
Regional Director  
Asstt. Director  
(Medical)

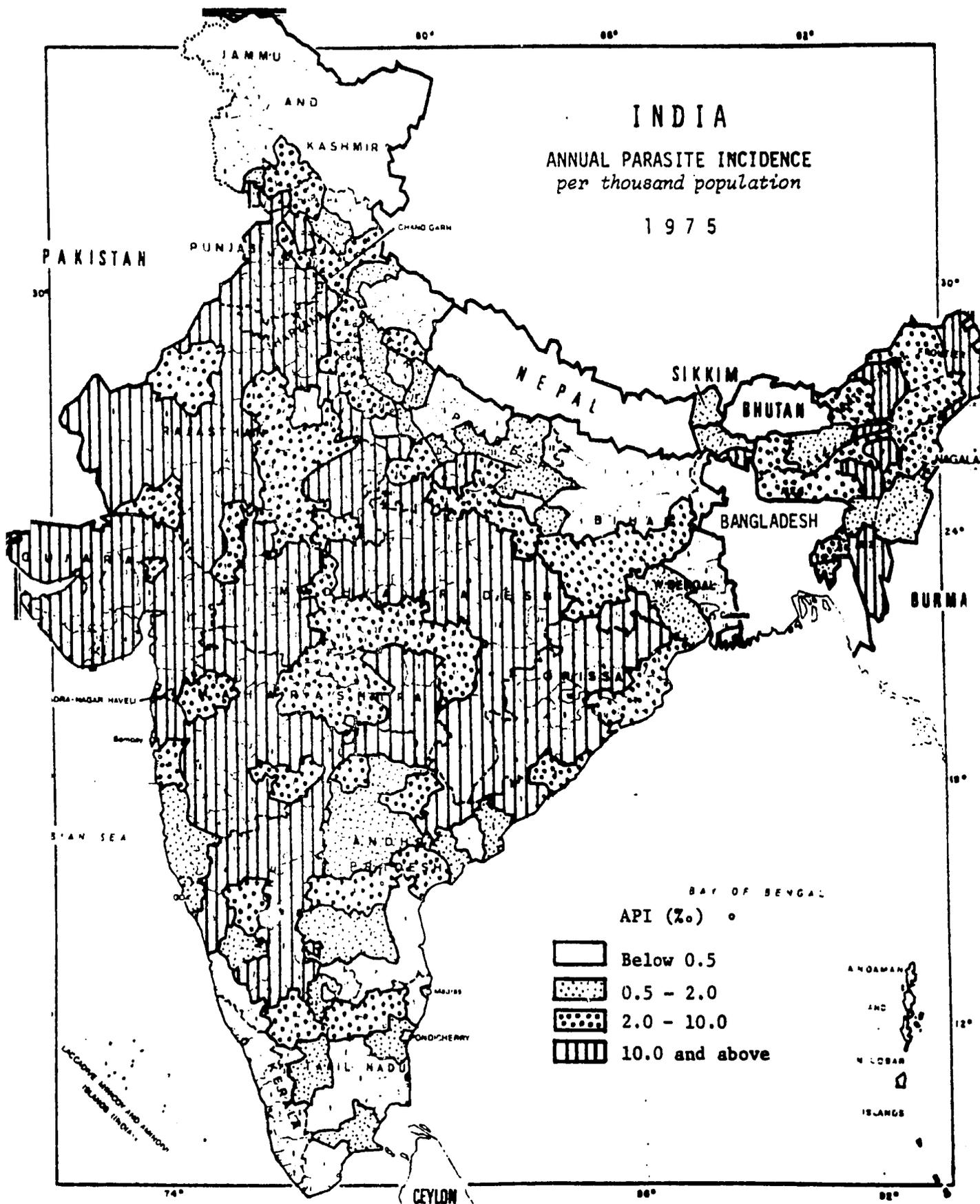
Regional Director  
Sr. Medical Officer

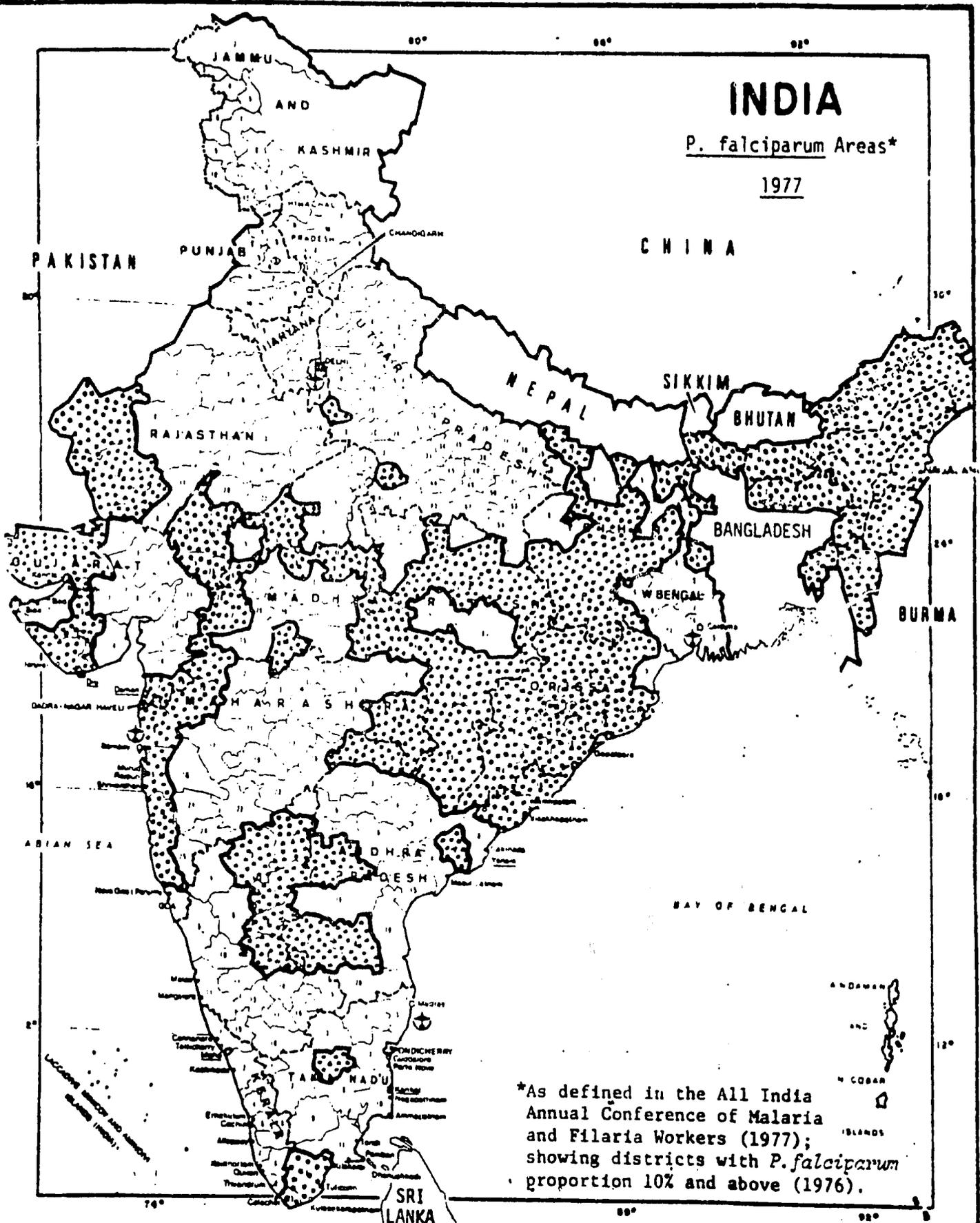
Asstt. Director  
(Entomology)

N. M. E. P. ORGANIZATION IN STATES  
STATE GOVT. (DEPT. OF HEALTH & FAMILY WELFARE)













## DDIA - Malaria Positive Blood Slides

Annex C  
TABLE 1

State	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Andhra Pradesh	8904	12133	13952	11248	9400	704	2978	7658	8765	13334	21652	50482	94400	134295	151103	216154	
Assam	2112	3203	10677	11243	10584	12744	17215	21610	27688	17219	17434	17246	37918	58478	126362	148608	
Bihar	3444	3505	4356	4647	5513	1824	3111	6007	8057	9876	12447	16701	39989	61903	94371	78048	
Gujarat	4044	3286	10571	21656	15327	17170	79652	56005	91744	269301	583310	524914	437292	573118	799180	1214028	
Haryana						153	2219	6610	8871	13897	24523	49126	109777	229869	507220	736566	
Himachal Pradesh	16	7	43	43	121	75	50	116	71	87	83	236	1092	8076	16481	32113	
Jammu & Kashmir	10	5	2	7	8	5	29	1	1	-	4	34	1036	3618	19403	37839	
Karnataka	3650	1335	646	789	1570	1182	858	1029	1408	2417	37725	41523	78443	173044	330963	534517	
Kerala	111	65	55	33	67	124	1-3	135	202	279	287	404	666	862	1651	5029	
Madhya Pradesh	1180	8609	8920	13781	20157	62357	84569	65440	57786	133108	191236	215264	276910	477058	836680	978693	
Madharaashtra	3641	4496	3570	4998	6095	12890	19410	26785	60350	91319	199096	223289	262780	428432	705472	702155	
Manipur	95	54	102	93	270	409	273	466	579	498	310	843	2147	1347	2162	1008	
Meghalaya												2751	2934	6393	4107	6763	7035
Nagaland	17	-	-	-	26	409	266	325	822	502	435	875	2823	3108	5344	1409	
Orissa	5052	11758	17376	31796	24992	9949	18561	31794	28962	11388	33260	51226	189767	297701	317669	329100	
Punjab	1478	966	570	552	334	332	1836	9503	11220	15886	51372	99082	166346	230252	288214	440465	
Rajasthan	8494	3210	3813	3164	2872	9680	23899	14399	15487	79788	109773	82517	118012	177597	354567	412776	
Tamil Nadu	2061	1412	3092	896	563	265	100	156	761	1300	1557	1518	5869	19657	74579	103921	
Tripura	41	140	559	808	831	1825	3861	7507	7369	4247	2772	6579	5171	3562	8002	7171	
Uttar Pradesh	3117	3525	5194	4126	3365	10222	12264	16449	3785	7779	9891	17676	52052	193715	381750	337728	
West Bengal	160	157	472	860	173	425	1996	2460	692	423	965	3638	12433	19387	39634	28917	
Andam & Nicobar	495	502	1308	461	442	120	927	1874	1874	2989	1753	3060	1519	1278	1106	1510	
Arunachal Pradesh	277	153	1438	1190	801	1008	3644	5816	10798	7461	11944	12269	10657	22271	24810	27930	
Chandigarh								5	1	-	-	17	917	2373	4269	10535	
Coal fields	709	333	117	335	25	53	188	390	414	236	464	864	3452	3228	3894	4266	
Delhi	40	276	61	19	7	45	114	37	243	1056	3852	3578	3452	12163	37379	49330	
DNK Projects															12493	15465	
Goa	-	-	115	175	25	3	11	9	6	12	32	104	124	165	634	2012	
Lakshadweep																103	
Mizoram										3796	3436	2573	8640	6912	13179	11941	
Pondicherry															174	325	
Sikkim	5	45	68	142	89	37	25	34	19	29	34	77	196	188	134	113	
Bhutan	-	-	-	-	518	144	407	247	672	630	720	1376	4212	5208			
INDIA	49151	59375	87306	112942	100185	148156	278621	274881	348647	694647	1323118	1430025	1936485	3172866	5166142	6467215	

Annex C  
TABLE 2

STATE	INDIA: <i>P. falciparum</i> Infections Proportion (%) of Positives																	
	Year	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Andhra Pradesh	2986 38.5	2656 31.2	1744 28.7	2583 33.0	3073 32.7	1486 31.2	940 31.0	2945 38.5	3519 40.8	3712 37.0	4090 38.8	4632 37.2	6204 30.0	13635 50.3	13993 31.3	19054 39.0		
Assam	1289 81.0	1675 48.1	3174 28.7	2191 24.7	1811 27.3	3327 28.1	4709 27.4	10536 49.2	10722 28.7	5226 20.4	5615 32.2	5876 34.1	18754 22.1	16126 46.7	58723 48.5	63177 43.0		
Bihar	824 23.9	1086 37.0	1844 40.9	1400 30.1	220 12.8	964 53.9	1887 80.7	4065 87.7	4621 87.4	5288 53.5	7296 58.0	8776 52.9	21279 53.2	22139 27.7	48416 51.3	40955 58.5		
Gujarat	1672 41.4	933 28.4	2430 23.0	6658 20.7	3746 24.4	2560 26.9	10295 28.2	8391 28.2	17751 29.4	26969 23.0	50133 34.4	22148 34.2	30846 31.1	52019 31.1	52189 31.1	73674 31.1		
Haryana						4 2.0	173 7.3	12 2.2	3 0.22	60 2.4	24 0.1	28 0.20	10 0.22	158 0.22	1823 0.22	3755 0.22		
Himachal Pradesh	-	2 28.0	15 36.3	8 28.0	7 5.8	6 9.0	1 3.0	4 3.2	-	-	-	-	3 0.3	1 0.08	3 0.08	3 0.02		
Jammu & Kashmir	-	2 40.0	-	-	-	-	-	-	-	-	-	-	3 9.0	-	7 0.08	9 0.02		
Karnataka	1011 27.7	537 40.2	315 48.2	251 21.9	670 42.7	707 59.9	345 40.0	340 33.0	308 25.0	383 25.0	936 2.2	3181 7.7	5481 7.0	19637 21.4	24658 20.5	49900 22.0		
Kerala	34 30.0	- 6.2	5 9.1	2 4.1	-	2 1.0	-	2 1.5	2 1.0	11 3.0	2 0.7	2 0.5	8 1.2	4 0.9	23 1.4	38 0.9		
Madhya Pradesh	575 48.7	1089 35.3	3787 42.5	6408 46.5	5691 29.2	15680 25.2	16752 29.2	24792 37.3	19560 33.9	22641 27.0	29483 25.4	34106 25.9	44267 26.1	104022 21.0	228192 20.7	355199 20.7		
Maharashtra	1932 33.1	1336 30.2	1771 49.7	2492 49.0	3285 37.5	5167 40.1	6148 21.7	7901 29.5	16702 27.7	18065 22.2	22108 22.1	21388 31.2	18122 21.2	38919 31.1	55972 21.2	39055 21.0		
Manipur	47 42.5	43 29.6	26 25.5	39 41.7	15 27.9	140 34.0	43 24.9	195 48.4	133 23.0	56 11.0	37 10.0	130 37.2	323 38.3	446 32.0	620 29.7	530 42.5		
Meghalaya										3059 57.1	1716 82.4	1836 80.0	4810 71.2	2412 58.7	2969 43.9	404 59.2		
Nagaland	4 23.5	-	-	-	-	165 40.0	28 10.5	19 24.3	315 38.5	173 28.7	86 28.0	268 30.0	184 21.1	2018 24.9	1623 24.2	361 28.7		
Orissa	676 13.4	2960 26.2	4006 22.1	6939 21.9	7466 27.5	7141 21.3	15449 23.2	24854 29.0	20379 27.2	5346 46.9	13562 40.0	23458 45.9	29379 41.2	154665 32.0	147760 46.5	210217 40.0		
Punjab	400 27.1	94 9.7	48 8.4	113 21.2	16 4.9	6 1.3	2 0.1	220 2.3	3 0.04	29 0.2	19 0.04	323 0.5	21 0.02	35 0.02	191 0.27	479 1.1		
Rajasthan	3266 38.5	508 15.0	1210 31.7	546 26.1	344 22.1	532 3.5	1221 3.1	321 6.2	1258 7.5	4985 6.3	8064 7.4	8470 10.3	16451 12.9	13663 7.7	21304 5.8	24263 5.5		
Tamil Nadu	1181 57.3	739 51.3	358 11.0	65 7.3	49 8.7	12 4.5	9 4.9	122 36.3	302 39.7	579 36.9	425 28.0	561 37.0	1868 31.9	6567 31.4	2573 5.5	2087 7.2		
Tripura	38 22.7	88 88.7	284 50.8	132 26.3	130 15.0	1148 82.9	2102 34.4	4689 82.5	3197 43.4	1732 40.8	1039 37.5	2907 44.2	2945 87.0	1993 56.0	5257 65.7	5123 21.4		
Uttar Pradesh	1033 51.1	974 27.0	1507 89.0	1129 27.4	455 13.5	392 3.8	651 5.3	146 3.2	164 4.7	362 7.0	755 4.2	846 4.0	1851 2.0	4072 2.1	3686 2.3	10798 3.4		
West Bengal	4 2.5	33 38.0	98 80.0	117 13.0	30 23.2	99 3.1	62 30.2	753 34.5	239 9.0	38 2.0	93 2.0	352 2.7	308 0.3	1757 2.1	5304 20.9	1855 8.4		
Andaman & Nicobar	9 1.3	-	6 0.5	5 1.1	15 3.4	14 12.7	167 18.0	251 13.4	302 16.1	222 7.4	50 0.9	357 12.7	40 0.9	70 5.0	109 3.5	61 9.1		
Arunachal Pradesh	9 3.2	-	23 1.8	35 2.9	64 8.0	63 6.3	961 28.4	1460 26.1	1821 26.9	1154 15.5	2739 23.1	1458 12.0	3479 12.7	7726 24.7	10328 12.0	10011 25.0		
Chandigarh															2 0.28	1 0.22	4 1.11	
Coal fields	143 30.8	66 29.8	39 50.4	66 29.7	10 40.0	10 18.0	35 18.0	33 3.5	19 3.1	17 7.0	42 9.1	99 12.5	1 1.0	262 3.1	237 6.1	466 10.3		
Delhi	7 17.5	1 0.4	12 19.7	5 26.3	1 34.3	1 2.2	1 0.9	1 2.7	1 -	6 0.5	13 0.3	103 2.9	1 0.07	5 1.04	102 1.27	59 1.1		
DNK Projects															5973 47.8	7748 50.1		
Goa	-	-	-	1 0.8	-	-	-	-	-	-	-	-	-	1 0.8	3 1.8	16 2.5	122 6.1	
Lakshadweep																		
Mizoram											416 12.1	567 22.0	5045 58.4	3833 55.6	7301 65.4	4781 40.7		
Pondicherry															4 2.3	3 1.5		
Sikkim	1 33.3	8 17.8	6 8.8	25 17.0	1 1.1	4 10.0	3 18.0	-	1 6.3	2 8.0	1 2.0	2 2.0	26 13.3	26 13.8	12 9.0	6 5.2		
Shutun																		
INDIA	17141 34.9	16674 28.0	21750 26.1	31490 27.0	26163 28.2	39618 38.7	61984 21.3	92714 33.7	103217 29.0	100115 14.4	148683 17.5	142177 9.9	265154 13.7	476922 26.0	729251 24.1	753713 21.7		

Indian Malaria Program Surveillance Data by Phases  
1961 - 1975

Annex C  
TABLE 3

Year	Total Pop. (mill.)	Attack Phase				Consolidation Phase				Maintenance Phase			
		Pop. (mill.)	Pos. Cases	API %	% Pf.	Pop. (mill.)	Pos. Cases	API %	% Pf.	Pop. (mill.)	Pos. Cases	API %	% Pf.
1961	439	374	49151	0.13	36.8	-	-	-	-	-	-	-	-
1962	448	249	54454	0.22	28.9	157	5121	0.03	23.8	-	-	-	-
1963	458	166	73003	0.44	26.9	260	14303	0.05	23.6	-	-	-	-
1964	468	120	83664	0.70	29.9	288	29232	0.10	22.1	47	46	0.0	0.0
1965	478	93	68132	0.73	50.9	203	31492	0.15	16.4	170	561	0.0	16.0
1966	489	66	59306	0.90	47.9	169	85223	0.50	5.5	241	3627	0.01	12.8
1967	499	83	121069	1.45	39.4	147	144719	0.98	9.08	259	12833	0.05	10.3
1968	511	141	235759	1.67	35.5	112	22388	0.20	35.1	249	16734	0.07	7.6
1969	522	136	299810	2.20	30.8	114	28829	0.25	29.8	264	20008	0.08	13.5
1970	534	136	599788	4.41	14.4	120	50172	0.42	18.8	271	44687	0.16	10.5
1971	547	138	1093259	8.41	11.9	93	88683	0.95	14.6	312	141176	0.45	4.0
1972	558	132	1084494	8.22	9.7	93	151093	1.62	15.4	322	194438	0.60	3.0
1973	570	135	1196724	8.86	7.4	93	343453	3.69	7.1	322	394308	1.22	3.8
1974	582	141	1778900	12.51	19.7	92	623803	6.94	13.2	335	770163	2.30	3.1
1975	594	141	2775586	19.7	19.9	92	939087	10.2	14.8	335	1451199	4.33	2.7

Annex C  
TABLE 4

India Malaria Incidence and *P. falciparum* cases  
1976

STATE	Population (in 000's)	No. of blood smears collected	No. of positive cases	API ‰	No. of PF cases	PF as % of Pos. cases
Andhra Pradesh	45,320	5,552,264	245,950	5.43	19,148	7.79
Assam	16,064	1,533,850	143,608	9.25	65,177	43.86
Bihar	61,989	2,227,680	78,048	1.26	40,955	52.50
Gujarat	30,811	5,433,512	1,214,028	39.40	73,674	6.10
Haryana	12,056	3,322,378	736,566	61.09	3,755	0.50
Himachal Pradesh	3,007	272,652	22,110	7.35	3	0.001
Jammu & Kashmir	2,562	233,895	37,839	14.76	9	0.003
Karnataka	28,409	3,691,080	634,517	22.34	69,900	11.02
Kerala	24,248	936,057	5,029	0.21	38	0.76
Madhya Pradesh	46,219	4,883,825	878,693	19.01	155,759	17.70
Maharashtra	56,295	7,860,174	702,155	12.26	39,055	5.56
Manipur	1,023	112,023	1,208	1.18	530	43.87
Meghalaya	1,217	108,869	7,035	5.78	4,804	68.29
Nagaland	708	30,195	1,609	2.27	961	59.73
Orissa	23,953	3,018,480	329,104	63.91	210,227	63.88
Punjab	14,532	2,692,960	440,465	30.31	479	0.11
Rajasthan	29,231	3,578,216	412,776	14.12	24,163	5.85
Sikkim	156	28,320	113	0.72	6	5.31
Tamil Nadu	45,905	3,457,968	103,921	2.26	4,087	3.93
Tripura	1,692	152,646	7,171	4.23	5,123	71.44
Uttar Pradesh	94,189	5,529,990	337,728	3.59	10,798	3.20
West Bengal	45,230	2,362,910	28,917	0.64	1,855	6.41
Mizoram	354	55,824	11,941	33.77	4,781	40.04
Andaman & Nicobar	150	47,932	1,510	10.06	62	4.11
Arunachal Pradesh	481	121,487	27,995	58.03	10,024	35.88
Chandigarh	285	72,315	10,335	37.02	4	0.04
Delhi	5,053	721,257	49,330	9.76	3	0.006
Goa	866	99,005	2,012	2.32	122	6.06
Pondicherry	483	50,990	325	0.67	5	1.54
Coal Fields	1,810	92,614	4,266	2.36	466	10.92
DNK Projects	308	106,779	15,465	50.21	7,748	50.10
Lakshadweep	37	2,149	103	2.78	-	-
ALL-INDIA	594,643	58,390,296	6,496,870	10.93	753,711	11.60

Annex C  
TABLE 5

Malaria Research Projects in India, March 1978  
Sanctioned by Malaria Executive Board and  
Indian Council of Malaria Research.

<u>Area of Research</u>	<u>No. Proj.</u>	<u>Participating Organizations*</u>	<u>Sanctioned Budget</u>
1. Operational Aspects of Malaria Control	6	NICD, NMEP	Rs. 1,890,500
2. Ecology and Control of Malaria Vectors	1	Bangalore U.	22,000
3. Chemotherapy of Malaria	2	CDRI, NICD	574,000
4. Drug Resistance in Malaria Parasite	1	NMEP	1,072,500
5. Serology of Malaria	4	PGI, JIPMER, NICD, St. John's Med. College	564,000
6. Cultivation of Malaria Parasites	3	NICD, VRC, STM	713,500
7. Immunological Aspects of Malaria	5	PGI, AIIMS, NICD, PGI Lady Hardinge M. C.	328,500
Total	22		Rs. 5,165,000

\*Participating Organizations:

NICD, National Institute of Communicable Diseases, Delhi  
 NMEP, National Malaria Eradication Program, Delhi  
 Bangalore University, Bangalore  
 CDRI, Central Drug Research Institute, Lucknow  
 PGI, Post-graduate Institute of Medical Education and Research, Chandigarh  
 JIPMER, Jawaharlal Institute of Post -graduate Medical Education and Res.,  
 Pondicherry  
 St. John's Medical College, Bangalore  
 VRC, Vector Control Research Center, Delhi  
 STM, School of Tropical Medicine, Calcutta  
 AIIMS, All India Institute of Medical Sciences, New Delhi  
 Lady Hardinge Medical College, New Delhi.

Annex C  
TABLE 6

Estimated Insecticide Production Capacity in India 1978-82  
(In Metric Tons of Technical Grade)

No. of Manufacturers	1978	1979	1980	1981	1982
<b>DDT</b>					
Current 1	4,500	4,500	4,500	4,500	4,500
Letter of Intent *			(5,000) 3,000	4,000	5,000
<b>Total 1</b>	<b>4,500</b>	<b>4,500</b>	<b>7,500</b>	<b>8,500</b>	<b>9,500</b>
<b>Malathion</b>					
Current 4	(2,500) 2,000 (1,000)	2,500	2,500	2,500	2,500
License 1	600	800	1,000	1,000	1,000
" 1		(900) 540	720	900	900
" 2			(2,400) 1,400	1,920	2,400
Letter of Intent 3			(1,400) 840	1,120	1,400
" 2				(900) 540	720
<b>Total 13</b>	<b>2,600</b>	<b>3,840</b>	<b>6,500</b>	<b>7,980</b>	<b>8,920</b>
<b>BHC</b>					
Current 7	28,900 (6,000)	28,900	28,900	28,900	28,900
License 1	3,600	4,800	6,000	6,000	6,000
Letter of Intent 1			(6,000) 3,600	4,800	6,000
" 1				(3,000) 1,800	2,400
<b>Total 10</b>	<b>32,500</b>	<b>33,700</b>	<b>38,500</b>	<b>41,500</b>	<b>43,300</b>

\* Same manufacturer.  
( ) Installed capacity.

NMEP INSECTICIDE REQUIREMENTS 1978-82

DDT, BHC, Malathion

	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>
Pop. in areas to be sprayed (millions)	263.31	269.48	279.73	275.41	280.61
Pop. in areas with DDT Spray	132.46	132.46	124.73	116.20	117.00
x 100 MT 75%	13,246	13,246	12,473	11,620	11,700
= 75 MT 100%	9,935	9,935	9,355	8,715	8,775
In India "	4,500	4,500	7,500	8,500	9,500
For NMEP "	4,500	4,500	4,580	4,940	5,275
Import MT "	5,435	5,435	4,775	3,775	3,500
= MT 75%	7,247	7,247	6,367	5,033	4,667
Pop. in areas with Malathion	25.30	26.20	38.70	37.10	35.50
x 900 MT 25%	22,770	23,580	34,830	33,390	31,950
= 225 MT 100%	5,693	5,895	8,708	8,348	7,988
In India "	2,600	3,840	6,500	7,980	8,920
For NMEP "	1,493	1,795	1,788	1,779	1,788
Import MT "	4,200	4,100	6,920	6,569	6,200
= MT 50%	8,400	8,200	13,840	13,138	12,400
Pop. in areas with BHC spray	105.55	110.82	116.30	122.11	128.11
x 336 MT 50%	35,465	37,236	39,077	41,029	43,045
= 168 MT 100%	17,732	18,618	19,538	20,514	21,522
In India "	32,500	33,700	38,500	41,500	43,300
For NMEP "	17,732	18,618	19,538	20,514	21,522

Project Paper Social Analysis:  
Social and Behavioral Factors Influencing Malaria Control  
in India

Introduction

The new malaria control program in India utilizes long established anti-malaria techniques. As such, the program encounters social and behavioral factors which are commonly associated with these techniques. What differentiates these factors from those found in other countries or settings is the unique nature of the Indian social milieu.

In the following discussion, several issues will be considered. Among these are: the social characteristics of India which have relevance to the nation-wide malaria control program; some of the existing approaches to health generally in the Indian population; how malaria as a disease and malaria-control as a public health program relates to these approaches and prevailing behavior patterns; and, lastly, given this relationship, what are the patterns of popular participation and benefit incidence likely to be as a result of the program.

I. Socio-Cultural Feasibility

A. The Social Setting

Perhaps the most striking social features affecting any nation-wide program in India is the country's very size and its complexity. According to 1971 census data, the total population in India was over 548 million. Since 1971, the population has continued to increase and current estimates from health sources place the figure at around 630 million or even greater. Those 630 (or more) million people are far from homogeneous, socially or linguistically.

There are 22 different states and 9 distinct union territories. Each, represents social differences and contains a variety of separate social groups. For example, there is a large number of tribal people (representing different cultural traditions) living

in a variety of states and numbering over 27 million. In addition, many of the states roughly correspond to language areas in which a common language is spoken but which is linguistically distinct from other language areas. India exhibits at least 15 different languages spoken by a significant proportions of the population (see Table 1) while also possessing several other languages spoken by smaller numbers of its residents. The number of languages present requires any nation-wide program to be fluent in each of the languages in their area of operation -- particularly when public involvement or public relations are required.

Table 1  
Major Languages in India

1. Assamese	6. Kashmiri	11. Sanskrit
2. Bengali	7. Malayalam	12. Sindhi
3. Gujarati	8. Marathi	13. Tamil
4. Hindi	9. Oriya	14. Telugu
5. Kannada	10. Punjabi	15. Urdu

Another element in the complex social setting of India is religion. Partially due to India's long and varied history, there are many different religions which claim the support of the Indian people (see Table 2). The religion with the largest following is Hinduism which represents about 83% of the total population. Muslims, the second most popular religious group, make up about 11% of the population. Christianity is practiced by about 3% of the people. The remaining religions are quite diverse and tend to be localized in specific areas across the country. Traditional tribal religions are basically characterized by animistic practices but some tribal people have converted to other religious persuasions one of which is Christianity.

Table 2  
Major Religions and Their Prevalence in India

<u>Religion</u>	<u>No. of Adherents</u>	<u>Percentage to total population</u>
Hindus	453,436,630	82.72
Muslims	61,418,269	11.20
Christians	14,225,045	2.60
Sikhs <sup>2</sup>	10,378,891	1.89
Buddhists	3,874,942	.71
Jains <sup>3</sup>	2,604,837	.48
Others	2,221,038	.40

1. According to 1971 Census data. 2. Combines elements of Hinduism and

An integral part of the Indian social setting is, of course, the vast caste system. Caste has had a strong traditional role in structuring community life in India. Although some of that strength is beginning to wane today (particularly in urban areas) caste remains an important feature of social interchange for some specific functions such as in the selection of marriage partners. Caste, in the rural areas however, tends to be more generally recognized in day-to-day social activities and retains much of its original strength.

Hinduism and the caste system are closely related and function jointly, particularly in regards to concepts of ritual purity. There are four main caste divisions and castes are ranked in a hierarchy (see Table 3). Generally speaking members of the higher castes risk ritual contamination from any contact with individuals of lower castes. Eating and drinking activities are believed to be especially susceptible to the threat of ritual contamination; therefore, caste restrictions in these activities are especially strict.

Table 3  
The Main Castes

<u>Relative Ranking</u>	<u>Caste Group</u>
1	Brahmins
2	Kshatriyas
3	Vaisyas
4	Sudras
5	Menials (outcastes)

Membership in a caste is determined by birth. However, an individual is born into more than just a major caste group. Each group is divided into several component castes and each component caste is further subdivided into separate subcastes. Generally, the caste or caste group is recognized by the society at large and the sub-caste is the reference point for the individual and for any other specific sub-caste. The locality of certain castes is sometimes even restricted to areas within a village or towns. In this manner, older towns frequently have neighborhoods whose inhabitants all come from the same caste.

Traditionally, castes also represented a close correlation to its members' business or occupation (see Table 4). Acting somewhat in the way of the early European trade guilds, the caste offered its members not only a kinship bond but also a bond of economic similarity.

Table 4  
Examples of Castes Based Upon Traditional  
Occupational Pursuits

<u>Caste</u>	<u>Occupation</u>	<u>Caste</u>	<u>Occupation</u>
Soni	Goldsmiths	Kahar	Water-carriers
Lohar	Metalworkers	Sutar	Carpenters
Bunkar	Weavers	Chamars	Leather-workers
Kumar	Potters	Tamboli	Betel-dealers
Lunia	Salt-workers	Kakar	Rope-makers

Under impact of economic forces in more recent times, however, the correlation between caste and occupation has considerably diminished.

To give the reader an idea of the magnitude and the extent of the magnitude and the extent of the caste system, one must remember that there are over 3,000 different castes in India. Approximately 90% of the Hindu population belong to the lowest ranking of the main caste groups, the Sudras and the Menials. A hierarchy, or ranking, also exists within these lower castes however. In addition, the Government for purposes of social policy has grouped various elements into a so-called "Backward Class" which is made up of individuals who have not enjoyed much economic or educational opportunity. This "backward Class" is further officially divided into: Scheduled Tribes (tribal people), Scheduled Castes and Other Backward Castes. About 30% of the total population fall into the "Backward Class" category.

In summary, the Indian social setting is characterized by a wide range of heterogeneity and cultural diversity in the classic sense of a complex society. Any nation-wide program will have to be very flexible in its implementation and its day-to-day dealings with people in order to be sensitive to this diversity. But, such an implementation issue is an old and familiar one to the Government of India.

B. Elements of the Existing System of Health Beliefs and Curative Behavior

The health belief system in India, as in Sri Lanka, is varied and is a product of a long history of differing traditions moving across the land. The present manifestation of this system, for the nation as a whole, allows a place for each of the different traditions. Not only are different health and curative traditions tolerated, differing traditions are often respected or even consulted by individuals during a health crises (see Table 5). In fact, it is common for an individual to consult more than one tradition in the event of an illness.

Table 5  
Some of the Sources of Medical Assistance  
Available to the Average Person

<u>Practitioner</u>	<u>Approximate Practitioner Population</u>
Western Medical Practitioners	138,000 doctors**
Ayurvedic Practitioners	156,000
Homeopaths	141,785
Unani Practitioners (of Muslim origin)	25,000
Siddha Practitioners	15,000
Western Medicine Dispensers (No formal training)	N. D. *
Indigenous (Traditional) Medical Practitioners	N. D. *
Specialists in Magic	N. D. *
Religious Interventionists (varied)	N. D. *
Naturopaths	N. D. *
Astrologer - practitioner	N. D. *

\*N. D. = No data available. \*\* Estimates at the total number of non-Western practitioners have surpassed 300,000.

From locality to locality, the strengths or popularity of any specific tradition may vary widely. This is due to cultural differences and variations in the beliefs about what causes illness (see Table 6). Beliefs in the cause of illness, like the faith in the means to cure an illness, commonly include more than one source of illness

Table  
A Sample of Perceived Causes of Illness

1. A disruption of the bodily forces of "heat" and "cold" through:
  - a) Climatic factors (wind, rain, sun, mist, etc.)
  - b) Ingestion (consuming the wrong foods or drink)
  - c) Bodily Occurrences (an accident, a fall, etc.)
2. The presence of "germs"
3. An astrological imbalance
4. The improper order (ritual, mental, or moral) of ones life
5. The anger of a diety
6. The invasion of a spirit
7. Magical intluence from another party.

The allowance of a more than one possible cure for an illness and the recognition of a variety of possible causes indicates the complimentary nature of the Indian health belief system. Such a complimentarity also helps to explain the variety of curative behaviour patterns present.

As one might expect, reliance upon indigenous healers or specialists in magic are more strong in rural and tribal areas than in urban centers. Nevertheless, when one examines the types of health care available and the types of health care sought, a recognizable pattern emerges. This pattern is seen when one divides the nation into very rough zones which exhibits some cultural and behaviarol similarities in regards to health (see Table 7). After one notes the sources of curative assistance sought in the event of ailments which are considered serious, a prevailing pattern of curative behavior becomes apparent.

As the reader can see there are three sources for assistance most commonly consulted by individuals with the occurrence of major ailments. These are Western medicine, religious sources and ayurvedic medicine. Seeking religious or supernatural assistance at the recognition of a major ailment can be taken basically as a given. However, this assistance is done in a complementary fashion and along with the consultation of a medical specialist.

Of the two most popular medical assistance sources, Western medicine is turned to most frequently in major illness. One study (Dhillon and Srivastava 1972:25) discovered that from their sample

Table 7  
Zones of Behavioral Similarity for General Health Purposes \*\*

<u>Zone</u>	<u>Major Component States or Areas Includes</u>	<u>Order of Medical Treatment Sought for Major Ailments</u>	<u>Behavior common to any incidence of disease</u>
A. Eastern zone	Eastern Bihar West Bengal Assam Complex Orissa	1. Western Medicine 2. Homeopathic Medicine 3. Ayurvedic Medicine	Seeking* Religious Intervention
B. Northern zone	West Bihar Uttar Pradesh Himachal Pradesh Jammu & Kashmir	1. Western Medicine 2. Ayurvedic Medicine 3. Homeopathic Medicine	Seeking* Religious Intervention
C. Western zone	Punjab Haryana Rajasthan Delhi Gujarat	1. Western Medicine 2. Ayurvedic or Unani Medicine 3. Homeopathic Medicine	Seeking* Religious Intervention
D. Central zone	Madhya Pradesh Maharashtra Andhra Pradesh	1. Western Medicine 2. Ayurvedic Medicine 3. Homeopathic Medicine	Seeking* Religious Intervention
E. Southern zone	Tamil Nadu Karnataka Kerala	1. Western Medicine 2. Homeopathic or Ayurvedic Medicine	Seeking* Religious Intervention
F. Tribal Areas	Madhya Pradesh Orissa Bihar Gujarat Tamil Nadu West Bengal	1. Western Medicine 2. Ayurvedic or Indigenous medicine 3. Magical Intervention	Seeking* Religious Intervention

\* Concurrent behavior with and complimentary to any other treatment sought.

\*\*Information provided largely by Dr. Burdwan of the National Institute of Health and Family Welfare.

of patients, 84% turned to Western medicine exclusively or in combination with other sources; only 37% of the patients turned to Ayurvedic medicine exclusively or in combination with other sources consulted both Ayurvedic and Western medicine. The same study also found that until an illness becomes relatively serious or if an ailment is considered relatively minor, home remedies and indigenous folk medicine characterize most of the curative behavior (Dhillon and Srivastava 1972:20). Furthermore, another study (Banerjee, n. d. 22) found that if an ailment is considered serious, non-Western sources of medical assistance are frequently used: along with Western medicine; after Western medicine is considered to have failed in providing relief; when Western medical services are unavailable; and, as in the previous study, when the illness is considered of a minor nature.

The one similar characteristic in the health behavior for the vast majority of the Indian population is the prevalence of a curative rather than a preventive approach to illness. This prevalence of the curative philosophy is constant even as the belief about causes of illness or the preferred medical practitioners may vary.

C. Malaria and its Placement in the System of Health Beliefs and Behavior

Following the example set by the diversity of the Indian social setting generally, the people's perception and treatment of malaria does not display a simple constant pattern. People certainly do consider malaria to be a disease or at least an illness which can debilitate an individual for periods of time. As an example, one study (Dhillon and Srivastava 1972:11) in Old Delhi found that people believe illness to exist in an individual when: there is fever or pain; a person is confined to bed; a person cannot care for himself; a person cannot do his work; or when "home" remedies do not help and "professional" assistance is required. The same research also found that the occurrence of fever and the existence of a state of illness are frequently considered synonymous (Dhillon and Srivastava 1972:10).

It is readily apparent that the symptoms of malaria closely coincide with many of the criteria for illness commonly applied by the respondents of the Dhillon and Srivastava study. From this and other information available, malaria certainly meets the socially defined characteristics of illness across the country

generally. This constancy of the popular perception about malaria begins to weaken (or vary) after one examines other issues besides malaria's classification as an illness. One of these issues is the perceived causes of malaria.

Public health education has been active for many years and efforts in this field seemed to have produced results. A recent study of villages around New Delhi found that 72% of the respondents (the largest percentage of which were illiterate) were aware the mosquito was a carrier of disease (Singh, Patterson, Yasuno, and Jolly: 1972:269). Similarly, a sample population from a sub-sector of Punjab responded about 90% positively to the question, "Is malaria caused by the bite of the mosquito?" (Mitra and Gupta 1964:19). In another area within Haryana State, only 51% of a sampled population attributed malaria to mosquitos (Rebello and Verma 1977:49).

Presumably in these studies, 28%, 10% and 49% of the sample, respectively, attributed the cause of malaria (or malarial symptoms) to something other than mosquitos -- or simply did not know a cause. An investigation of the Kutch area of Gujarat state found that most of the people attributed malaria not to mosquitos but felt it was caused by "Rut-Pher", the exposure to sudden changes in temperature (Dhillon, Sharma and Parthasarathy 1969:106). Tribal people in the State of Orissa also attributed malaria (or any fever) to causes other than the mosquito. There, a sample of individuals viewed malaria usually a result of climatic changes or factors (Dhillon and Kar 1965:32 - 33). Other possible causes of malarial symptoms may be identified by individuals across India, according to the doctrines of the specialty disciplines followed by the practitioners listed above in Table 5. These causes could range from magical and religious sources to an imbalance of bodily "forces".

At any rate, the perceived cause of malaria varies from area to area. In some of the most populous areas, the mosquito is blamed by anywhere from 51 - 90% of the people. People in other areas, however, do not feel that the mosquito is the source of malaria.

The relative seriousness people credit to malaria as a general health problem is also worth noting in addition to perceived causes. Again, one can expect the relative ranking of malaria as a health problem to vary from place to place within the country. A fairly commonly expressed belief about malaria is that it

debilitates an individual and keeps him from work, but it usually does not produce death among adults. In the study in Haryana State mentioned above, the perceived threat of malaria was examined. The respondents credited malaria with a very high frequency rate in the category of commonly occurring diseases; however, they also ranked malaria low among those diseases considered "most dangerous" (Rebello and Verma 1977:49-50). Similarly, the same respondents ranked malaria as one of the "more dangerous" of the diseases they considered "least dangerous" (Rebello and Verma 1977:49-50). Among some of the tribal peoples of Orissa, fever (including malaria) is generally regarded as a mild disease which dissipates in a few days, even though it may recur after some time (Dhillon and Kar 1965:33).

One factor which influences the responses given by the sample populations in the surveys cited above is the earlier operation of the malaria program itself. In some areas, the experience of a reduction in the incidence of malaria may increase the complacency of the people toward malaria as a health problem and decrease the perceived threat of malaria. It is noteworthy, however, that the work of Rebello and Verma noted that the people felt the frequency or "commonness" of malaria to be fairly high. Additional cases describe several historical instances in which a very high malaria incidence rate was perceived as a serious enough problem by the populace affected to prevent or limit their operations in the area of high incidence. Certainly, the recognized threat which malaria represents to the people is influenced by the prevalence of the disease.

#### D. Malaria Control and Social Acceptance

The nature and likelihood of popular participation is crucial to a public health program such as malaria control. According to the current practices of anti-malaria technology, the acceptance or participation of the public is necessary in two major areas. First, the public must be willing to cooperate in case reporting, blood tests and curative drug treatment. Secondly, the action of household spraying with insecticides must be acceptable.

The experience of the program to date illustrate that the popular acceptance of drug treatment and the willingness to provide fever information when asked are both quite high. Part of the reason for this is due to the relatively high popularity of and even

preference for western medical care (see Table 7). The western medical treatment with the most public acceptance is injections. Oral medicines are somewhat less well regarded by most people, but are generally acceptable nonetheless. Furthermore, the people basically adhere to a strong curative philosophy which, as we have seen above, allows a profliery of possible curative assistance in the event of illness. Such opinions combine to strengthen the probability that the population at large will use the drug distribution centers and fever treatment depots provided for in the new malaria control program if they are readily accessible.

One difficulty which does arise from the popular use of anti-malaria drugs is a practice of discontinuing the taking of the drug before the end of the treatment period. NMEP has found in the past that patients sometimes stop taking the malaria pills immediately after their fever goes down. Following the common curative approach to illnesses, these people do not recognize the need to take the pills after the symptoms are gone (even though the protozoa may still be present in the blood stream and could reinfect the patient).

In response, NMEP has adopted the policy that, where such problems exist, the malaria program staff see to it that the drugs are taken in their presence. This is done by having people in urban areas take the drugs at the malaria clinics. In the rural areas, it is also accomplished by having the house-to-house worker observe the fever patients consuming the pills.

With the practice of household spraying, the issue of popular acceptance becomes much more complicated. Even during peak years of malaria control work, the popular acceptance of spraying varied from area to area. One area can register a high level of acceptance over a long period of time; another, may accept generally for a while and then begin to build a rising resistance. Still a third area may register a high degree of resistance for a relatively long period of time. According to NMEP estimates, resistance to household spraying has ranged anywhere from 5% to 60% of the population in different areas.

Part of the explanation for such diversity in acceptance lies in the cultural variations evident within the country. Another source of diversity is the fact that there seems to be a host of

feelings or beliefs which both support the practice of household spraying and detract from it. Among those factors which reinforce popular acceptance of household spraying (see Table 9), the most commonly occurring and the most widespread is the feeling that spraying helps to rid the house of troublesome insects. Among some villages around Delhi, 93% of a sample population expressed appreciation of insecticide control of mosquitos and other insects (Singh, Patterson, Yasuno and Jolly 1972:272). The early experience of NMEP dramatically pointed out that when the effectiveness of the insecticide (DDT) upon houseflies, roaches, mosquitos and especially bed-bugs was high, the program actually experienced a popular demand for household spraying. This response indicates that people were not accepting spraying simply as an element in the fight against malaria; rather, people viewed spraying as a welcome relief to the annoying bites of bed-bugs and the onslaught of other insects. Many people equated spraying with the destruction of household pests and did not link the spraying activity with malaria eradication or control. In this instance, NMEP was spraying for one reason and some of the people were accepting spraying for another.

In areas where the public-health rationale for household spraying was not generally understood, a fear of prosecution (whether imagined or real) if one rejected spraying apparently helped to promote popular acceptance (Dhillon and Kar 1965:34). In other areas, when the connection between the mosquito and malaria was recognized by the people, this understanding helped promote acceptance. The involvement of community leaders and neighborhood spokesmen in Kutch, Gujarat for example, has also assisted the goal of popular acceptance.

Along with factors reinforcing social acceptance are very popular and active forces which engender resistance to household spraying (see Table 10). One of the most crucial is related to a common factor which promoted social acceptance. As insects become resistant to DDT, people found that the household pests which they wished to control were apparently unaffected and remained about the house. Some people began to feel that the insecticide being sprayed was weak or even a useless substitute that no longer killed insects. Worse yet, there is a common

Table 8Some of the Factors Reinforcing Popular Participation in household Spraying

1. The desire to be rid of household pests
2. Fear of prosecution if one rejects spraying
3. An association of mosquitos with malaria transmission
4. The example of one's neighbors (peer group pressure)
5. The example and advice of recognized leaders (both formal and informal)
6. Willingness to cooperate with government authorities.

Table 9Some Expressed Reasons for Resisting Household Spraying

1. Spraying (with DDT) aggravates the problem of bed-bugs
2. Spraying discolors or "spots" the walls of the house
3. Spraying causes a "bad" smell in the rooms of the house
4. The spray (insecticide) itself is weak (or even a useless substitute for an insecticide) and will not kill common household pests.
5. Spraying requires the movement of household goods and is a bother
6. Spraying is harmful to new-born infants, to household members who are ill; and to pregnant women
7. "Ahimsa" (especially among Jains) as an element of faith prohibits the killing of life.
8. The practice of "Purdah" (among Muslims) requires the seclusion of women from male outsiders (spraymen)
9. Spraymen of lower castes are a source of ritual impurity, particularly in areas used for food preparation.
10. A festival or ritual observance is in progress
11. A complacency or apathy about the threat of malaria.

belief that spraying (DDT) actually increases the activities of bed-bugs and makes sleep nearly impossible. If the primary reason for the acceptance of household spraying had been the reduction of household pests, then the survival, or even a perceived increase in activity, of these pests after spraying effectively negates that rationale. The history of NMEP operations demonstrates this fact by reporting an increase in spraying resistance following the appearance of insect resistance to DDT.

Another prominent factor contributing to the resistance of spraying is the characteristic of the spray leaving a "spotting" or a visual residue on the walls. In many areas throughout the country, it is a common practice for people to frequently plaster their walls with colorful mud clays. Some of the reasons behind the plating of walls are: a concept of cleanliness; an association of household cleanliness with ritual purity; and, just an esthetic pleasure in having smooth and freshly plastered walls. Spraying which leaves a residue mars the wall's finish and detracts from the wall's appearance. There is even reported incidences of people allowing their house to be sprayed, only to replaster the walls once the spray teams have left the area. Mud-plastering of walls is often considered a necessary part of yearly festivals such as: "Diwali" in northern India; "Pongal" in the south; and "Durgapuja" or "Dusseera" in Bengal. During these times, people are very reluctant to have their houses sprayed which is considered a disruption of the necessary preparation for the festival. NMEP has responded by allowing spray teams to schedule their arrival in communities around these traditional festivals -- which represents an effort to avoid the problem.

The spraying operation itself is considered something of a bother and a nuisance. The inhabitants of the house must shuffle about; furniture must be moved; edibles and non-movable items must be covered to protect them from the spray; and then there is usually an unpleasant smell which lingers on after the spraying is completed. Some families report the after-smell so strong they become "dizzy" and must vacate the sprayed rooms until the smell dissipates. The proposed use of malathion with its very pungent odor will certainly aggravate the resistance encountered from the odiferous after effects of spraying.

The impression and experience that spraying one's house represents something of an inconvenient ordeal heightens the importance of the popular perception of the threat of malaria. If the people of an area tend to be relatively complacent about malaria or do not consider it a very serious threat, then the likelihood of their accepting the bothersome spraying procedure decreases significantly. The current malaria program has already encountered some public apathy (which may also be related to the public's preference for a curative approach to disease rather than a preventive one) and resistance to the spraying of malathion.

In urban areas and among the homes of those more economically well-off in rural towns, household spraying encounters strong resistance (as a result, ULV fogging is being experimented with for urban areas). This is due largely to the fact that the homes are more substantial and people show a reluctance to have their painted walls and household belongings subjected to spraying. Furthermore, the spraying of kitchen areas by low cast spraymen is resisted by many (urban or rural) for fear of ritual contamination and because of the food restrictions associated with caste observances (as mentioned earlier). In rural areas, the risk of contaminating the kitchen area is compounded by the fact that many homes have but one room of which the kitchen is a part -- thus making any entry into the house an entry into the kitchen. Cases have been reported in which the residents of a house allow all rooms except the kitchen to be sprayed.

The history of social acceptance to household spraying in India indicates that in the early 1950's acceptance ran very high, reaching levels of 80 - 90% acceptance in areas of major spraying activity. However, a rising resistance was evident in 1963. This coincides with the period in which some of the lowest incidence rates of malaria were recorded. The decrease of malaria incidence and the increase of a popular complacency concerning malaria are probably closely related. If such is indeed the case, as the incidence of malaria increases the apathy of the populace should decrease and a desire for some form of public health intervention. The popularity of drug treatment of cases will most likely remain high during periods of both high and low incidence. Some resistance to spraying may continue even with a relatively high incidence of malaria and may well increase again as the incidence rate goes down.

### E. The New Malaria Program and Social Acceptance

The NMEP and the health ministry are aware of the factors which have influenced the social acceptance of malaria control efforts. They have even instigated or lent support to some of the studies which have investigated the reasons behind people's behavior and resistance to household spraying. Other studies are beginning or are still on-going with findings yet to come. As a partial result of this interest in the public response to malaria control, the new modified plan of operations for the malaria program includes, as one of the three major components, a goal of promoting "public cooperation".

The inclusion of such a component in their operational plan represents a significant departure from the earlier implementation procedures of NMEP. Before, the only participation on the part of the public which was expected was for them to accept and submit to the ministrations of the malaria program. At first, this policy appeared sufficient; but rising resistance to household spraying and growing public apathy about malaria worried NMEP and Ministry of Health officials. This concern prompted the studies mentioned above which elucidated a series of operational and public relations short-comings. Several of these studies (see Dhillon, Sharma and Parthasarathy 1969, Dhillon and Kar 1965, Rebello and Verma 1977 and Bhattacharjee n. d.) called for the education of the people about the characteristics of malaria as a disease; the explanation of the basic steps taken by the government against malaria; and, the involvement of the community and its leaders in the malaria program implementation. These suggestions made an impact upon policy-makers and found their way into the "public cooperation" component of the modified plan.

There are six major pacts to the public cooperation component of the plan (see Table 10). Of these, two of the most important in regards to the program's implementation are the involvement of the Panchayat (local elected officials) and the establishment of fever treatment depots and drug distribution centers. Panchayats today act as community councils involved in the day-to-day administration of a locality. The elected members (although caste still plays a strong role in their selection) represent at least part of the recognized community leadership. The malaria

program hopes to acquire the support of Panchayats across the country, first by educating them about the importance of the malaria control effort and then in asking them to appoint or suggest individuals in popular public establishments who can act as drug distribution and fever treatment points for the community.

Table 10

Methods Defined in the Modified Malaria Plan  
Component for Public Cooperation

1. Secure the cooperation of Panchayats (local government)
2. Establish fever treatment depots and drug distribution centers
3. Involve youth organizations
4. Involve women's organizations (Bhagani Samaj, and Mahila Mandal)
5. Involve school children and teachers
6. Involve general medical practitioners.

Those people selected could be teachers, barbers or bicycle repairmen -- anyone who the Panchayat feels would provide the public with the easiest access to malaria treatment. The one person NMEP does not encourage for selection by the Panchayat is an indigenous health practitioner out of fear of a conflict of interest. Those who are recommended or appointed by the Panchayat are members of the community and become contact points for the malaria program staff. These individuals will receive training in malaria; drug dosages for treatment of malaria; record keeping; and in some cases the taking of blood slides. They will also be given a supply of drugs which will be replenished by malaria program staff. As members of the community, these workers should provide laudable dimension of accessibility. 300,000 outlets such as these are expected to be operational by the end of 1978 and a total goal of 400,000 is planned.

One possible social danger to which these individuals or centers may be exposed is a "professional" rivalry or jealousy coming from the already-established health practitioners in the community. Western and indigenous practitioners could exert some pressure on the populace not to partake of the depot's or

center's service. People also may not credit an appointed bicycle repairman to have the traditional credentials of a health practitioner either and prefer to continue using the conventional and socially approved sources of medical assistance.

Nonetheless, the practice of combining a series of sources for medical assistance should support the existence of the fewer depots and the drug distribution centers. The high value frequently placed upon Western medicines (drugs) should also lend a social value to the centers. Through popular education, malaria may acquire a special status within the health belief system, becoming bureaucratized in the public's mind as a "public-health-program" disease.

For most of the other entities presented in Table 10, involvement, according to the modified plan, basically means being exposed to malaria education material. A variety of educational tools (see table 11) are planned and available for educating people about malaria.

Table 11

Some of the Methods Used to Educate  
People about Malaria

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1. Slogans (imprinted on metal plates)
2. Posters
3. Handbills
4. Stencils (for painting slogans)
5. Pamphlets and Folders
6. Slides for use in Cinemas
7. Films
8. Radio Time
9. Malaria News Bulletin (a periodical)
10. Public Talks (by medical officer).

Such tools are planned to be used for the public generally and specifically introduced to: the membership of youth organizations (sports and special interest groups); women's groups; and through the schools. Private practitioners, on the other hand will be encouraged to take blood slides of all fever cases and administer

anti-malaria drugs. It is also hoped that private practitioners can also be encouraged to take up some of the health education role and thereby lend the program some of their prestige within the community as a health expert.

To accomplish this goal of public cooperation, some of the NMEP staff is supposed to be able to devote time (25% in some cases) for the purpose of community relations and community education. The staff will remain generalists or malaria and public health technicians while extending their work to cover issues of public cooperation. How much time these field people will actually have to devote to community relations along with their other duties remains to be seen. Interestingly, the current training curriculum for the malaria program staff contains at most only a single afternoon (2-4 hours) on the subject of health education. It would appear that the paucity of training in this field and an apparent lack of specialists in community relations and health education on the staff may well cause some difficulties in the future.

These and other potential difficulties already discussed indicate the need for program research and monitoring in the area of social acceptance and health education. Such research is essential if the program is to keep current with the reaction and involvement of the populace. The NMEP has, in the past, displayed a concern that this sort of research be carried out in certain geographic areas. The same concern, perhaps even on an increased level, must continue in the current malaria control program and timely social and educational research be pursued.

## II. Benefit Incidence

### A. The Scope of the Program

In its plan and operations, the NMEP covers the entire nation. All the states and territories fall under the implementation area of the malaria control effort (see Table 12). The program strives to reach both urban and rural populations in each of the states and territories.

The strategy to reach urban populations is a bit different from that applied to rural populations, but both strategies employ

the principles of: a control of the mosquito; malaria case detection; and drug treatment.

Table 12  
Major Areas in which the Malaria Program  
is Operative

<u>State</u>	<u>Population in Millions</u>	<u>1976 reported malaria cases</u>
Andhra Pradesh	43.5	245,950
Assam	14.6	148,608
Bihar	56.3	78,048
Gujarat	26.6	1,214,028
Haryana	10.0	736,566
Himachal Pradesh	3.5	22,110
Jammu & Kashmir	4.6	37,839
Karnataka	29.3	639,517
Kerala	21.3	5,029
Madhya Pradesh	41.6	878,693
Maharashtra	50.4	702,155
Manipur	1.1	1,208
Meghalaya	1.0	7,035
Nagaland	.5	1,609
Orissa	21.9	329,106
Punjab	13.5	440,465
Rajasthan	25.7	412,776
Sikkim	.2	113
Tamil Nadu	41.2	103,921
Tripura	1.5	7,171
Uttar Pradesh	88.3	337,728
West Bengal	44.3	28,917
<u>Territory</u>		
Andaman & Nicobar Is.	1.2	1,510
Arunachal Pradesh	.5	18,895
Chandigarh	.2	10,535
Dadra & Nagar Haveli	.07	15,465
Delhi	4.0	49,330
Goa	.8	2,012
Lakshadweep	.03	103
Mizoram	.3	11,941
Pondicherry	.5	325

Current estimates made by NMEP place the total population of India at approximately 630 million. Using this estimate as a basis, NMEP personnel plan that the malaria control program will provide health services (either directly or indirectly) to about 600 million people. Direct services would include fever detection, drug distribution and mosquito control activities which actually reach individual households. Indirect service comes in the form of a reduced malaria incidence rate and a lessening of the general health threat malaria represents.

The 30 million people who will not be provided service are those who live above 5,000 feet where malaria is not a problem. For the areas where the API is greater than or equal to 2, the new plan calls for a policy of "blanket" household spraying; surveillance activities; and drug distribution. About 264 million people live in these areas. For the remaining 336 million people who live in areas where the API is less than 2, the current policy is to use "focal" spraying for malaria outbreaks; maintain a stringent case surveillance; and distribute drugs to positive cases.

#### B. Participator Profile

Those people who will be directly reached need to meet very few criteria to become a beneficiary. Technically, the only requirements needed to be beneficiary is that the individual dwells within some sort of physical structure or that a person experiences a fever. There are no requirements (formal or informal) for an individual to achieve a certain income level; pursue a specific occupation; be born into one caste or another; be literate; attain a certain age; speak a specific language; or be born a man or woman.

In fact, the NMEP has adopted, especially, policies which strive to reach all segments of the population. In rural areas and urban low income groups, workers go from house-to-house because it is often difficult for these people to travel to health centers or malaria clinics. A variety of clinics and health stations are established in urban areas where the population is more mobile. Also in urban areas and among people of middle

and upper income levels where household spraying is difficult for a variety of reasons, NMEP has stressed anti-larval activities, case detection and drug distribution.

One of the problems in public health generally in India is public access to health services. This problem has troubled the malaria program in the past. As a result, the new malaria control program has begun to establish the aforementioned fever treatment depots and drug distribution centers in an effort to place services at a local level and to provide a wider range of outlets and people can take advantage of. Similarly, malaria control activities are being integrated into the existing system of primary health centers. In more remote areas where the extension of health services is made more difficult by the terrain and the dispersion of the population, the malaria program has, in the past, brought in supplies by air while the malaria team hiked several days to the populated area.

In reality however, access to direct health services still remains a problem. As an example, recent estimates place the undetected cases of malaria at anywhere from 60% to 80% of the total actual incidence rate. If one looks at the past services extended by the primary health center system alone, it is apparent that only about 15-20% of the people under the jurisdiction of the system are actually covered. The experience of the earlier malaria programs have been admittedly much more successful in reaching broad sections of the population than the primary health centers. Furthermore, the policy of the malaria program has always stressed the extension of their operations to the rural areas -- a policy which has not always been true of other public health efforts in India (see Banerji n. d.) In some instances rural villagers who were questioned said they did not commonly see government health officers; but when asked about the malaria worker, they responded that he came by frequently to ask about fever cases. The new malaria program is trying to further expand the avenues to malaria services available to the people.

### C. Participation of Women

As mentioned above, women benefit equally from the program both directly and indirectly. Direct beneficiaries of the malaria program can be considered to be fever cases and acceptants of dwellings. They are not categorized on the basis of sex. At the community involvement level, NMEP policy is that women's

organizations be the recipient of health education energies and their support sought in the malaria control efforts. Members of the Panchayat's can also be women and they, as elected leaders of the community, are asked to lend support. Similarly, the staff of the malaria program, as well as that of the other government institutions, includes women. Nearly all of the spray-teams and of those involved in case detection process are men. In the urban areas, the "inspection squad" to check water logging (and prevent mosquito breeding) inside houses is generally headed by a woman.

### III. Summary and Conclusion

Finally, all the social factors affecting malaria control in India can be linked to three basic issues: the numerical size of the population to be affected; the magnitude of cultural diversity present in the sub-continent; and the social acceptance of the techniques used in malaria control. The issue of the magnitude of the people is not necessarily a limiting factor if the scope and the extent of a malaria program is sufficient to incorporate the majority of the population. This problem of numbers is not a new one to India, even in the area of public health (i. e., the malaria program from 1953 to 1965 and the recent smallpox eradication effort.).

With cultural diversity as an issue, the complexities of extending malaria control to all the people become much more profound. The various languages, social traditions and health belief systems present in India necessitate a program which is flexible enough to accommodate this diversity within a range of implementation policies adapted to the new local circumstance. The system in the current malaria control program encourages some degree of flexibility by allowing states a very autonomous role in exercising anti-malaria activities in their own areas. Furthermore, the structure of the new malaria-control plan allows a local community variation within the general guidelines set by the national office. Health education policies also take into account the communication channels most used in different areas and makes a practice of translating all materials into local languages.

Perhaps the most significant of all issues is that of social acceptance. The two features of malaria-control techniques on which social acceptance looms heavily are the use of drugs and insecticide spraying. Fortunately for the malaria control program, the use of western medicines appears to be generally accepted and even often preferred over other medicines. The basic practice of pursuing a variety of complementary curative procedures easily accommodates the presence of western medicine along with the others. Being practical and perceptive, the people examine cures on the basis of their success in overcoming any ailment's symptoms. Such examination has helped the rise of a social acceptance for western drugs.

Spraying with insecticides, however, has met with some social acceptance problems. In the early days of malaria control, the acceptance of household spraying was fairly high. This was due largely to the ability of the spray to destroy household pests, especially bed-bugs. The link between malaria and spraying was frequently not understood by the populace. When insect resistance to DDT increased and pesky insects remained after spraying, people's acceptance of spraying dropped sharply. Other factors which contributed to a resistance to spraying included: the spray's bad smell; the interruption of vital observances; spraying was a time-consuming bother; the spray discolored the walls; spraying was believed dangerous and not understood; and the spraying process broke religious or caste restrictions.

Related to the social acceptance of household spraying is the place malaria holds in the health belief system. If people perceive malaria to be a serious threat, then they will be more apt to take steps to work with the malaria control program. In some areas, malaria is viewed as just such a threat; in others, it is not. Even when malaria represents a health concern of the population, not all people associate malaria with the presence of mosquito.

Certainly, household spraying represents one of the most serious obstacles to social acceptance. The malaria control staff has responded with a major part of their program devoted to

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community health education and an effort to obtain what they term "public cooperation". By large communication campaigns, NMEP hopes to inform people about the causes of malaria and how their program activities combat malaria. NMEP also hopes that by involving local communities in the selection and establishment of local level malaria centers, they can achieve a greater public involvement in the program. This policy represents a logical and a sound course to follow given the principles learned in community development and applied social science.

Nevertheless, a continuing monitoring of the social acceptance issue during the implementation of the new program is essential. Social acceptance problems are certain to arise during the life time of the program and no public cooperation effort is flawless. Along with this monitoring function, a research capability is necessary in order to examine problems as they arise. Such examination should investigate the reasons for resistance and probably courses of action which would lead to reduced resistance. Present staffing levels at NMEP indicate that outside local assistance may be needed for at least the research function.

The identification of beneficiaries and the project's benefit incidence show that the major limiting factor will be the extent of the program's operation. The program itself does not restrict participation on the basis of education, income, caste, occupation, age, or sex. Rather any person with a fever or living in some physical structure has the ability to become direct beneficiaries.

Given the social setting and the current plan, the malaria control program appears as socially sound as it can be (considering the nature of the malaria control techniques presently available). The major problem area remains household spraying. Social resistance to spraying is there now and will continue to be present. If a malaria immunization inoculation were available, many of the social acceptance issues would be reduced since inoculations are generally well received. The only reasonable approach to the problem of social resistance is constant monitoring of the situation; research of resistance instances; and a program flexible enough to incorporate research findings.

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ANNEX E

NOTES ON ECONOMIC ANALYSIS

Table A

## Basic Data

Year	India's Population Projections <sup>a/</sup> (000's)	Population in Malaria Zone <sup>b/</sup> (000's)	Without Program		With Program		Expected Cases Avoided <sup>e/</sup> (000's)
			Weighted Average <sup>c/</sup> API	Expected Cases <sup>d/</sup> (000's)	Weighted Average <sup>c/</sup> API	Expected Cases <sup>d/</sup> (000's)	
1979	642,000	581,000	13.30	7,727	6.70	3,893	3,834
1980	655,000	593,000	17.70	10,496	4.50	2,669	7,827
1981	668,000	605,000	23.50	14,218	3.00	1,815	12,403
1982	681,000	617,000	31.30	19,312	2.00	1,234	18,078
1983	695,000	629,000	41.60	26,166	1.60	1,006	25,160
1984	709,000	642,000	50.80	32,614	1.25	803	31,811
1985	723,000	655,000	61.90	40,545	1.00	655	39,890
1986	737,000	668,000	75.50	50,434	.80	534	49,900
1987	752,000	681,000	92.00	62,652	.60	409	62,243
1988	767,000	695,000	101.00	77,840	.50	348	77,492
				342,004		13,366	328,638

<sup>a/</sup> Population rate of growth from 1970 - 1975: 2.1% (Source: World Bank Atlas). We have assumed a 2% annual growth rate.

<sup>b/</sup> Source: Table 12 on Project Paper.

<sup>c/</sup> Highest API without the program is less than one-half of that in 1951 in which there were 75 million cases out of a total population of 361 million (i.e. 1951 API = 208)  
Lowest API with the program is greater than the API considered acceptable (.20).

<sup>d/</sup> Expected Cases = (API x Population in malaria zone) / 1,000

<sup>e/</sup> Expected Cases Avoided = Expected Cases Without Program minus Expected Cases With Program.

Table B

## Expected Cases Without Program

(000's)

Year	Total Cases <sup>a/</sup>	Out-Patients <sup>b/</sup>	Malaria Cases Requiring Hospital Treatment		
			Due to P. falciparum <sup>c/</sup>	Due to P. vivax and P. malariae	Total Cases Requiring Hospitalization <sup>d/</sup>
1979	7,727	6,182	1,468	77	1,545
1980	10,496	8,397	1,994	105	2,099
1981	14,218	11,374	2,702	142	2,844
1982	19,312	15,450	3,669	193	3,862
1983	26,166	20,933	4,971	262	5,233
1984	32,614	26,091	6,197	326	6,523
1985	40,545	32,436	7,704	405	8,109
1986	50,434	40,347	9,583	504	10,087
1987	62,652	50,122	11,904	626	12,530
1988	77,840	62,272	14,790	778	15,568
	<u>342,004</u>	<u>261,240</u>	<u>64,982</u>	<u>3,418</u>	<u>68,400</u>

a/ From Table A.

b/ Eighty percent of malaria cases do not require hospitalization.

c/ Ninety-five percent of the cases requiring hospitalization are due to cerebral malaria (i.e., P. falciparum).

d/ P. falciparum cases plus P. vivax and P. malariae cases requiring hospital treatment.

Table C

## Expected Cases With Program

(000's)

Year	Total Cases <sup>a/</sup>	Out-Patients	Malaria Cases Requiring Hospital Treatment		
			Due to P. Falciparum	Due to P. vivax and P. malariae	Total Cases Requiring Hospitalization
1979	3,893	3,114	740	39	779
1980	2,669	2,135	507	27	534
1981	1,815	1,452	345	18	363
1982	1,234	987	235	12	247
1983	1,006	805	191	10	201
1984	803	642	153	8	161
1985	655	524	124	7	131
1986	534	427	102	5	107
1987	409	327	78	4	82
1988	348	278	67	3	70
	<u>13,366</u>	<u>10,691</u>	<u>2,542</u>	<u>133</u>	<u>2,675</u>

<sup>a/</sup> From Table A.

Table D

## Expected Cases Avoided

(000's)

Year	<u>Total Cases<sup>a/</sup></u>	<u>Out-Patients</u>	<u>Malaria Cases Requiring Hospital Treatment</u>		
			<u>Due to P. Falciparum</u>	<u>Due to P. vivax and P. malariae</u>	<u>Total Cases Requiring Hospitalization</u>
1979	3,834	3,068	728	38	766
1980	7,827	6,262	1,487	78	1,565
1981	12,403	9,922	2,357	124	2,481
1982	18,078	14,463	3,434	181	3,615
1983	25,160	20,128	4,780	252	5,032
1984	31,811	25,449	6,044	318	6,362
1985	39,890	31,912	7,579	399	7,978
1986	49,900	39,920	9,481	499	9,980
1987	62,243	49,794	11,827	622	12,449
1988	77,492	61,994	14,723	775	15,498
	<u>328,638</u>	<u>250,549</u>	<u>62,440</u>	<u>3,285</u>	<u>65,725</u>

a/ From Table A.

Table E

## Costs Saved: Medical Treatment

(000's)

Year	Out-Patients		P. Falciparum		P. Vivax & P. Malariae		Total Cost Saved Medical Treatment
	Cases Avoided <u>a/</u>	Cost <u>b/</u> Savings	Cases Avoided <u>a/</u>	Cost <u>c/</u> Savings	Cases Avoided <u>a/</u>	Cost <u>d/</u> Savings	
1979	3,068	\$ 614	728	\$ 20,748	38	\$ 143	\$ 21,505
1980	6,262	1,252	1,487	42,379	78	555	44,186
1981	9,922	1,984	2,357	67,175	124	465	69,624
1982	14,463	2,893	3,434	97,869	181	678	101,440
1983	20,128	4,026	4,780	136,230	252	945	141,201
1984	25,449	5,090	6,044	172,254	318	1,193	178,537
1985	31,912	6,382	7,579	216,002	399	1,496	223,880
1986	39,920	7,984	9,481	270,209	499	1,871	280,064
1987	49,794	9,959	11,827	337,070	622	2,333	349,362
1988	61,994	12,399	14,723	419,606	775	2,906	434,999
	250,549	\$52,583	62,440	1,779,542	3,285	\$12,585	\$ 1,844,710

a/ From Table D.

b/ Excluding the cost of drugs. In 1977, the cost of out-patient treatment at hospital was US \$ .20. We have taken this estimated cost to determine costs saved. Assuming only 1 visit to hospital.

c/ Including the cost of drugs. In 1977, the cost of medical treatment of a cerebral malaria patient was US \$ 1.80 per day. The average days in the hospital is 15 (total hospital cost then is \$27). The cost of drugs, per patient, is US \$ 1.50. Total cost is US \$ 28.50 per patient.

d/ Excluding the cost of drugs. In 1977, the cost of medical treatment was US \$ .75 per patient, per day. The average number of days in the hospital is 5. The total cost of treatment, per patient, is then \$ 3.75.

Table F

## Costs Saved: Antimalaria Drugs

(000's)			
<u>Year</u>	<u>Cases Avoided<sup>a/</sup></u>	<u>Cost per Patient<sup>b/</sup></u>	<u>Total Cost Saved<sup>c/</sup></u>
1979	3,106	\$ 1.45	\$ 4,504
1980	6,340	1.45	9,193
1981	10,046	1.45	14,567
1982	14,644	1.45	21,234
1983	20,380	1.45	29,551
1984	25,767	1.45	37,362
1985	32,311	1.45	46,851
1986	40,419	1.45	56,608
1987	50,316	1.45	72,958
1988	62,769	1.45	91,015
	266,198		\$ 383,843

a/ Estimated by subtracting from Total Cases Avoided the Total of P. Falciparum Cases Avoided. P. falciparum cases are excluded because the cost of drugs was included in our estimate on Table E.

b/ In 1977, world market price of 1,000 Primaquin tablets was US \$ 145.00. Price per tablet is US \$ .145. Since the average malaria patient takes 10 tablets, the cost per patient is \$1.45

c/ Arrived at by multiplying the number of cases avoided by cost per patient.

Table G

## Data on Agricultural Labor Force

(000's)

Year	Total <sup>a/</sup> Population	Total Labor <sup>b/</sup> Force	Total <sup>c/</sup> agri- cultural Labor Force	Agri- cultural Labor in Malaria <sup>d/</sup> Zone	Agricultural <sup>e/</sup> Labor Affected Without Program	Agricultural <sup>f/</sup> Labor Affected With Program	Total Cases <sup>g/</sup> Avoided
1979	642,000	212,000	153,000	138,000	1,835	925	910
1980	655,000	216,000	156,000	140,000	2,478	630	1,848
1981	668,000	220,000	158,000	142,000	3,337	426	2,911
1982	681,000	225,000	162,000	146,000	4,570	292	4,278
1983	695,000	230,000	166,000	150,000	6,240	240	6,000
1984	709,000	234,000	168,000	151,000	7,671	189	7,482
1985	723,000	239,000	172,000	155,000	9,595	155	9,440
1986	737,000	243,000	175,000	158,000	11,929	126	11,803
1987	752,000	248,000	179,000	161,000	14,812	97	14,715
1988	767,000	253,000	182,000	164,000	18,368	82	18,286

<sup>a/</sup> From Table A.

<sup>b/</sup> 33% of total population (Source: Basic Statistics Relating to the Indian Economy: Bombay).

<sup>c/</sup> 72% of total labor force (Source: Economic Survey: Government of India).

<sup>d/</sup> Source: Basic Statistics Relating to the Indian Economy: Commerce Research Bureau, Bombay.

<sup>e/</sup> Determined by multiplying Weighted Average API without program times labor in malaria zone.

<sup>f/</sup> Determined by multiplying Weighted Average API with program times labor in malaria zone.

<sup>g/</sup> The difference between the number of agricultural labor affected without the program and with the program.

Table H

## Loss Avoided: Income of Agricultural Labor

<u>Year</u>	<u>Cases Avoided Agricultural Labor<sup>a/</sup> (000's)</u>	<u>Weighted Average Income Loss<sup>b/</sup> per Worker</u>	<u>Total Income Loss Avoided (000's)</u>
1979	910	\$ 7.10	\$ 6,461
1980	1,848	7.10	13,121
1981	2,911	7.10	20,668
1982	4,278	7.10	30,374
1983	6,000	7.10	42,600
1984	7,482	7.10	53,122
1985	9,440	7.10	67,024
1986	11,803	7.10	83,801
1987	14,715	7.10	104,477
1988	18,286	7.10	129,831
	<u>77,673</u>		<u>\$ 551,479</u>

a/ From Table G.

b/ Average income per day is US \$ 1.42 or Rs. 12 (Source: Agricultural Wages in India: Delhi). Average man-days lost due to malaria is 5. Average income loss per worker is equal to the average income per day times the number of days lost.

c/ Computed by multiplying the number of cases avoided times income loss per worker.

Table I

## Costs Saved: Food Requirements to Satisfy Excess Caloric Intake

Year	Adults Affected Without Program <sup>a/</sup> (000's)	Adults Affected With Program <sup>b/</sup> (000's)	Adult Cases Avoided <sup>c/</sup> (000's)	Food Value Per Case <sup>d/</sup>	Total Food Cost <sup>e/</sup> Avoided (000's)
1979	4,482	2,258	2,224	\$ .06	\$ 133
1980	6,088	1,548	4,540	.06	272
1981	8,246	1,053	7,193	.06	432
1982	11,201	716	10,485	.06	629
1983	15,176	583	14,593	.06	876
1984	18,916	466	18,450	.06	1,107
1985	23,516	380	23,136	.06	1,388
1986	29,252	310	28,942	.06	1,737
1987	36,338	237	36,101	.06	2,166
1988	45,147	202	44,945	.06	2,697
	<u>198,362</u>	<u>7,753</u>	<u>190,609</u>		<u>\$ 11,437</u>

<sup>a/</sup> Any person over 15 years of age is considered an adult. 58% of the population is over 15 years old (Source: Statistics at a Glance: Government of India, Delhi). Cases without program x .58.

<sup>b/</sup> Determined by multiplying number of adults affected with program times .58.

<sup>c/</sup> Determined: adults affected without program minus adults affected with program.

<sup>d/</sup> World market price (1977) of 1 kilogram of rice was US \$ .12.

<sup>e/</sup> Determined: food value per case times number of adult cases avoided.

Table J

## Benefit-Cost Ratio, Net Present Worth, Internal Economic Rate of Return

(US \$ 000's)							
Year	Total Costs	Total Benefits	Cash Flow	P. W. Cash Flow at 30%	P. W. Cash Flow at 50%	P. W. Total Costs at 12%	P. W. Total Benefits at 12%
1979	\$ 133,181	\$ 32,603	\$- 100,578	\$ - 77,344	\$ - 67,086	\$ 118,931	\$ 29,114
1980	144,360	66,762	- 77,588	- 46,398	- 34,449	115,055	53,209
1981	159,400	105,291	- 54,109	- 24,647	- 16,016	113,493	74,967
1982	150,300	153,677	+ 3,377	+ 1,182	+ 669	95,591	97,739
1983	125,000	214,228	+ 89,228	+ 24,002	+ 11,778	70,875	121,467
1984	90,000	270,128	+ 180,128	+ 37,286	+ 15,851	45,630	136,955
1985	70,000	339,143	+ 269,143	+ 42,793	+ 15,830	31,640	153,293
1986	60,000	422,210	+ 362,210	+ 44,552	+ 14,126	24,240	170,573
1987	60,000	528,963	+ 468,963	+ 44,083	+ 12,193	21,660	190,956
1988	60,000	658,454	+ 598,454	+ 43,687	+ 10,174	19,320	212,022
	<u>\$ 1,052,241</u>	<u>\$ 2,791,459</u>	<u>+\$1,739,228</u>	<u>\$ + 89,196</u>	<u>\$ - 36,880</u>	<u>\$ 656,435</u>	<u>\$1,240,295</u>

Benefit-Cost Ratio at 12% is 1.9

Net Present Worth at 12% is \$+583,860

Internal Economic Rate of Return is 44%

Table K

## Sensitivity Analysis: Assuming a 50% Cost Overrun

(US \$000's)

<u>Year</u>	<u>Total Costs</u>	<u>Total Benefits</u>	<u>Cash Flow</u>	<u>P. W. Cash Flow at 15%</u>	<u>P. W. Cash Flow at 30%</u>
1979	\$ 199,772	\$ 32,603	\$ - 167,169	\$ - 146,607	\$ - 128,552
1980	216,540	66,762	- 149,768	- 115,172	- 89,561
1981	239,100	105,291	- 133,809	- 90,321	- 60,883
1982	225,450	153,677	- 71,773	- 42,490	- 25,121
1983	187,500	214,228	+ 26,728	+ 13,872	+ 7,190
1984	135,000	270,128	+ 135,128	+ 61,618	+ 27,971
1985	105,000	339,143	+ 234,143	+ 93,657	+ 37,229
1986	90,000	422,210	+ 332,210	+ 116,606	+ 40,862
1987	90,000	528,963	+ 438,963	+ 135,201	+ 41,263
1988	90,000	658,454	+ 568,454	+ 153,483	+ 41,497
	<u>\$1,578,362</u>	<u>\$ 2,791,459</u>	<u>\$ + 1,213,107</u>	<u>\$ + 179,847</u>	<u>\$ - 108,105</u>

Internal Economic Rate of Return: 24%

Table L

## Sensitivity Analysis: Assuming a 50% Decrease of Benefits

(US \$000's)

<u>Year</u>	<u>Total Costs</u>	<u>Total Benefits</u>	<u>Cash Flow</u>	<u>P. W. Cash Flow at 15%</u>	<u>P. W. Cash Flow at 5%</u>
1979	\$ 133,181	\$ 16,302	\$ - 116,879	\$ - 102,503	\$ - 111,269
1980	144,360	33,386	- 110,974	- 85,339	- 100,653
1981	159,400	52,646	- 106,754	- 72,059	- 92,235
1982	150,300	76,839	- 73,461	- 43,489	- 60,458
1983	125,000	107,114	- 17,886	- 9,283	- 14,023
1984	90,000	135,064	+ 45,064	+ 20,549	+ 33,618
1985	70,000	169,572	+ 99,572	+ 39,829	+ 70,796
1986	60,000	211,105	+ 151,105	+ 53,038	+ 102,298
1987	60,000	264,482	+ 204,482	+ 62,980	+ 131,891
1988	60,000	329,227	+ 269,227	+ 72,691	+ 165,305
	<u>\$1,052,241</u>	<u>\$ 1,389,737</u>	<u>\$ + 343,496</u>	<u>\$ - 63,586</u>	<u>\$ + 125,270</u>

Internal Economic Rate of Return is 12%

Table M

Sensitivity Analysis: Assuming 25% Cost Overrun and 25% Decrease of Benefits

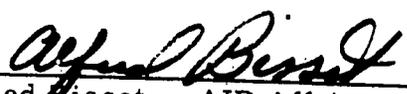
(US \$000's)

<u>Year</u>	<u>Total Costs</u>	<u>Total Benefits</u>	<u>Cash Flow</u>	<u>P. W. Cash Flow at 15%</u>	<u>P. W. Cash Flow at 30%</u>
1979	\$ 166,476	\$ 24,452	\$ - 142,024	\$ - 124,555	\$ - 109,216
1980	180,450	50,079	- 130,371	- 100,255	- 77,962
1981	199,250	78,968	- 120,282	- 81,190	- 54,728
1982	187,875	115,258	- 72,617	- 42,989	- 25,416
1983	156,250	160,671	+ 4,421	+ 2,294	+ 1,189
1984	112,500	202,596	+ 90,096	+ 41,084	+ 18,650
1985	85,700	254,357	+ 166,857	+ 66,742	+ 26,530
1986	75,000	316,658	+ 241,658	+ 84,822	+ 29,724
1987	75,000	396,722	+ 321,722	+ 99,090	+ 30,242
1988	75,000	493,841	+ 418,841	+ 113,087	+ 30,575
	<u>\$ 1,315,301</u>	<u>\$ 2,093,602</u>	<u>\$ + 778,301</u>	<u>\$ + 58,130</u>	<u>\$ - 130,412</u>

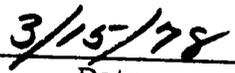
Internal Economic Rate of Return is 20%

INDIA - MALARIA CONTROL  
CERTIFICATION PURSUANT TO SECTION 611 (e) OF  
THE FOREIGN ASSISTANCE ACT OF 1961, AS AMENDED

I, Alfred Bisset, principal officer of the Agency for International Development in India, having taken into account among other things the maintenance and utilization of projects in India previously financed or assisted by the U. S. and the commitment of the Government of India to carry out an effective malaria control program, do hereby certify that in my judgment India has the financial and human resources capability to implement, maintain and utilize effectively the subject capital assistance project for malaria control.

  
\_\_\_\_\_  
Alfred Bisset, AID Affairs Officer

India

  
\_\_\_\_\_  
Date

## STATUTORY CHECKLIST

I. Country Checklist

A country checklist for FY 1978 was presented in the Project Paper for project for Gujarat Medium Irrigation project. No changes or modifications are required in regard to this project.

II. Project ChecklistA. GENERAL CRITERIA FOR PROJECT1. App. Unnumbered; FAA Sec. 653(b)

(a) Describe how Committees on Appropriations of Senate and House have been or will be notified concerning the project;  
 (b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than \$1 million over that figure plus 10%)?

(a) Congressional Notifications will be sent in April 1978

(b) No, see (a), above

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

(a) Yes

(b) Yes

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

(a) No legislative action required.

4. FAA Sec. 611(b); App. Sec. 101. If for water or water-related land resource construction, has project met the standards and criteria as per Memorandum of the President dated Sept. 5, 1973 (replaces Memorandum of May 15, 1962; See Fed. Register, Vol. 38, No. 174, Part III, Sept. 10, 1973)?

Not applicable

- 2 -

5. FAA Sec. 611 (e). If project is capital assistance for it will exceed \$1 million, has Mission Director certified the country's capability effectively to maintain and utilize the project? **Yes**
6. FAA Sec. 209, 619. Is project susceptible of execution as part of regional or multi-lateral project? If so why is project not so executed? Information and conclusion whether assistance will encourage regional development programs. If assistance is for newly independent country, is it furnished through multilateral organizations or plans to the maximum extent appropriate. **Project is multi-lateral in nature, WHO, UNICEF, SIDA are other donors.**
7. FAA Sec. 601(a); and (Sec. 201(f) for development loans). Information and conclusions whether project will encourage efforts of the country to
- (a) increase the flow of international trade;
  - (b) foster private initiative and competition
  - (c) encourage development and use of cooperatives, credit unions, and savings and loan associations;
  - (d) discourage monopolistic practices;
  - (e) improve technical efficiency of industry, agriculture and commerce; and
  - (f) strengthen free labor unions.
- (a) Only as regards imports for project.
  - (b) Local private enterprise and private organizations will participate in project, e. g. local insecticide production
  - (c) No effect expected.
  - (d) No effect expected.
  - (e) Reduction of malaria incidence will foster improved economic efficiency especially as regards agriculture.
  - (f) No effect expected.

8. FAA Sec. 601 (b). Information and conclusion on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).
- AID loan funds are expected to be used to purchase insecticides from U.S.
9. FAA Sec. 612(b); Sec. 636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized to meet the cost of contractual and other services.
- India is contributing over 70% of the costs of the program. No U.S. owned rupees are being used in this project.
10. FAA Sec. 612(d). Does the U.S. own excess foreign currency and, if so, what arrangements have been made for its release.
- Yes, the U.S. is using these rupees for other projects and have plans for their eventual liquidation.

## B. FUNDING CRITERIA FOR PROJECT

### 1. Development Assistance Project Criteria

- a. FAA Sec. 102(c); Sec. 111; Sec. 281a.  
Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production, spreading investment out from cities to small towns and rural areas; and
- (a) Reduction of malaria will directly benefit the rural poor and enable more productive use of rural labor. Also local participation is a key element to effective program execution.
- (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions?
- (b) The project will not have a direct effect on local institutions.

- 4 -

b. FAA Sec.103,103A, 104, 105, 106, 107.

Is assistance being made available:

[include only applicable paragraph -- e.g., a, b, etc. -- which corresponds to source of funds used. If more than one fund source is used for project, include relevant paragraph for each fund source.]

(2)(104) for population planning or health; if so, extent to which activities low cost, integrated delivery systems to provide health and family planning services, especially to the rural areas and poor.

c. FAA Sec.110(a); Sec.208(e). Is the recipient country willing to contribute funds to the project, and in what manner has or will it provide assurances that it will provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or has the latter cost-sharing requirement been waived for a "relatively least-developed" country)?

d. FAA Sec.110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to Congress been made, and efforts for other financing?

e. FAA Sec. 207; Sec.113. Extent to which assistance reflects appropriate emphasis on: (1) encouraging development of democratic, economic, political, and social institutions; (2) self-help in meeting the country's food needs; (3) improving availability of trained worker power in the country; (4) programs designed to meet the country's health needs; (5) other important areas of economic, political, and social development, including industry; free labor unions, cooperatives, and Voluntary Agencies; transportation and communication; planning and public administration; urban development, and modernization of existing laws; or (6) integrating women into

The project to control malaria will directly benefit rural India and the poor who suffer the most from the disease. Indian community health service scheme will participate fully in the project, and in rural areas the program will eventually be absorbed by the integrated health family planning and maternal-child health delivery system.

Yes. Annual budget and expenditure are considered in making this determination.

Only loan assistance is being prepared.

The project being proposed will reduce the incidence of malaria, one of India's major health problems.

f. FAA Sec. 281 (b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civic education and training in skills required for effective participation in governmental and political processes essential to self-government.

The project has as one of its main thrusts the participation of the local people. This is described in detail in the PP Social Analysis. India's intellectual and institutional sources are being used extensively in the project. Civic and community education participation through education training are key to a successful project and one fully integrated into this project design at the National, State and district governmental levels of implementation.

g. FAA Sec. 201(b)(2) - 4 and -(8); Sec. 201(e); Sec. 211(a)(1)-3 and -8). Does the activity give reasonable promise of contributing to the development; of economic resources, or to the increase of productive capacities and self-sustaining economic growth; or of educational or other institutions directed toward social progress? Is it related to and consistent with other development activities, and will it contribute to realizable long-range objectives? And does project paper provide information and conclusion on an activity's economic and technical soundness?

The project, in reducing malaria, will significantly contribute to economic growth and social and humanitarian progress. The project is related to other development activities and will contribute to their long range objectives. Conclusions on the economic and technical soundness of the project are presented in the project paper.

h. FAA Sec. 201(b)(6); Sec. 211(a)(5), (6). Information and conclusion on possible effects of the assistance on U.S. economy, with special reference to areas of substantial labor surplus, and extent to which U.S. commodities and assistance are furnished in a manner consistent with improving or safeguarding the U.S. balance-of-payments position.

All commodities financed under the AID loan are expected to be of U.S. source and origin.

III. Standard Item Checklist

C. OTHER RESTRICTIONS.

3. FAA Section 620(h)

In the past the GOI has used insecticide supplied by the U.S.S.R. in the Malaria Control Program and the GOI may procure from them in the future. The amount procured from block countries is relatively very small. The project is not considered by the GOI or other donors as a "communist block project".

DEPARTMENT OF STATE  
AGENCY FOR INTERNATIONAL DEVELOPMENT  
WASHINGTON

THE ADMINISTRATOR

PROJECT AUTHORIZATION AND REQUEST FOR ALLOTMENT OF FUNDS

PART II

INDIA

Malaria Control  
A.I.D. Project No.  
A.I.D. Loan No.

Pursuant to the authority vested in the Administrator of the Agency for International Development by the Foreign Assistance Act of 1961, as amended (the "Act"), and the Delegations of Authority issued thereunder, I hereby authorize the establishment of a Loan pursuant to Part I, Chapter 1, Section 104 of the Act to the Government of India (the "Cooperating Country") of not to exceed Twenty-Eight Million United States Dollars (\$28,000,000) (the "Authorized Amount") to help in financing certain foreign exchange costs of goods and services required for the Malaria Control Program as described in the following sentences. The Program is a large scale multi-donor, multi-year public health effort to meet an imminent, widespread outbreak of malaria and to reduce the incidence of malaria in India. The funds provided under the Loan will primarily finance the import of pesticides and sprayers to be used in urban malaria control operations.

I approve the total level of A.I.D. appropriated funding planned for this project of not to exceed Thirty-Eight Million United States Dollars (\$38,000,000) (the "Loan") which will be loan funded, including the funding authorized above, during the period FY 1978 through FY 1979. I approve further increments during that period of loan funding up to Ten Million United States Dollars (\$10,000,000), subject to the availability of funds, which will be processed in accordance with A.I.D. allotment procedures.

I hereby authorize the initiation of negotiation and execution of the Project Agreement by the officer to whom such authority has been delegated in accordance with A.I.D. regulations and Delegations of Authority subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate:

- 2 -

A. Interest Rate and Terms of Repayment

The Cooperating Country shall repay the Loan to A.I.D. in United States Dollars within forty (40) years from the date of first disbursement of the Loan, including a grace period of not to exceed ten (10) years. The Cooperating Country shall pay to A.I.D., in United States Dollars, interest from the date of first disbursement of the Loan at the rate of (a) two percent (2%) per annum during the first ten (10) years and (b) three percent (3%) per annum thereafter on the outstanding disbursed balance of the Loan and on any due and unpaid interest accrued thereon.

B. Source and Origin of Goods and Services

Insecticide financed by A.I.D. under the Program shall have their source and origin in the United States (A.I.D. Geographic Code 000), except as A.I.D. may otherwise agree in writing. Other goods and services financed by A.I.D. under the Program shall have their source and origin in countries included in A.I.D. Geographic Code 941, except as A.I.D. may otherwise agree in writing.

C. Conditions Precedent, Covenants and Exceptions

1. Conditions Precedent to Disbursement of the A.I.D. Loan for the First Year. Prior to disbursement of the Loan or to the issuance of Letters of Commitment for that portion of the Loan to be disbursed in the first year, the Cooperating Country shall, except as A.I.D. may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D. evidence of arrangements for the procurement of A.I.D. financed commodities including lists and prices of such commodities, schedules for their purchase and delivery and a draft tender document including specifications for imported commodities.

2. Conditions Precedent to Disbursement of the A.I.D. Loan for the Second Year. Prior to disbursement of the Loan or to the issuance of Letters of Commitment for that portion of the Loan to be disbursed in the second year, the Cooperating Country shall, except as A.I.D. may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D.:

(a) Evidence of arrangements for the procurement of A.I.D. financed commodities including lists and prices of such commodities, schedules for their purchase and delivery and a draft tender document including specifications for imported commodities; and

- 3 -

(b) Evidence that commodities procured for the Program in the first year, which have been financed by A.I.D., have been effectively utilized.

3. Special Covenants

(a) Health Safeguards. The Cooperating Country will take appropriate safety measures in implementing the Program, including the provision of safety equipment to insecticide handlers, establishing proper procedures for safe handling of the insecticide, and the training of handlers and supervisory personnel in the dangers associated with the insecticide. The Cooperating Country will also maintain rigid control over the quality of insecticide procured for the Program to insure that it meets World Health Organization and A.I.D. technical requirements.

(b) Environment. The Cooperating Country will, in consultation with A.I.D., undertake an Environmental Assessment of the use of insecticides in the Program, with A.I.D. assistance as may be appropriate. The Cooperating Country will also review the findings of the Environmental Assessment during the post-authorization design and implementation stages of the Program for appropriate application of such findings in the Program.

(c) Reporting. The Cooperating Country will provide to A.I.D. such reports on procurement, shipping and Program operation as A.I.D. may require.

Signature \_\_\_\_\_

John J. Gilligan

\_\_\_\_\_  
Date