I.D EVALUATION SUMMARY PART

PD-AAV-888

(BEFORE FILLING OUT THIS FORM, READ THE ATTACHED INSTRUCTIONS)

A. REPORTING A I.D UNIT (Mission or AID/W Office)

(ES # 87-2

B. WAS EVALUATION SCHEDULED IN CURRENT FY ANNUAL EVALUATION PLAN? yes [X] slipped [ ] ad hoc [ ]

C. EVALUATION TIMING interim [ ] final [X] ex post [ ] other [ ]

D. ACTIVITY OR ACTIVITIES EVALUATED (List the following information for project(s) or program (s) evaluated; if not applicable, list title and date of the evaluation report)

Project #	Project/Program Title (or title & date of evaluation report)	First PROG or equivalent (FY)	Most recent PACD (mo/yr)	Planned LOP Cost ('000)	Amount Obligated to Date ('000)
391-0472	Malaria Control II Project April 30, 1987	1982	Sep.30 1987	$ 41,000	$ 41,00

E. ACTION DECISIONS APPROVED BY MISSION OR AID/W OFFICE DIRECTOR

Action(s) Required	Name of officer responsible for Action	Date Action to be Completed
To implement recommendations and incorporate recommendations in the follow up amendment to current project for extension of project activities to Sept.30, 1993.	1. GOP Dr. Imtiaz Hussain Shah, Director Directorate of Malaria Control Program and 2. provincial Malaria Control Program USAID Dr. Rifaq A. Ismail, project Officer, Malaria Control Project.	Continued implementation to the current PACD and through the extended project.

(Attachments, if necessary)

F. DATE OF MISSION OR AID/W OFFICE REVIEW OF EVALUATION mo 4 day 30 year 87

G. APPROVALS OF EVALUATION SUMMARY AND ACTION DECISIONS:

	Project/Program Officer	Representative of Borrower/Grantee	Evaluation Officer	Mission or AID/W Office Director
Signature				
Typed Name	Dr. Rifaq A. Ismail	Dr. Imtiaz H. Shah	J. Addleton	Eugene S. Staples
Date	07 JUL 1987		27 JUNE 1987	

a

H. EVALUATION ABSTRACT (do not exceed the space provided.

The purposes of this terminal joint USAID/WHO Evaluations held from April 4-30, 1987 are to evaluate the progress of the Project from authorization todate, and to assess to what extent it has contributed in attaining project objectives as outlined in the Project Paper. The evaluation will assist Mission management in identifying continuing or new problems which could be addressed in the design of a possible extension to the Project. This terminal evaluation may also assist in making appropriate modifications in objectives and implementation techniques and provide guidelines for future malaria control strategies in Pakistan.

The team visited the four provinces and a number of municipalities for discussions at federal, provincial, district, local and municipal levels. Field visits were made to observe various MCP and local health services activities down to the village level.

The increase in the number of reported malaria cases over the period 1982-1986 from 56360 to 90393 reflects both an absolute increase in the malaria incidence and an improvement in the reporting of malaria cases. The former is of some concern as it indicates that the current mix of antimalaria measures just falls short of maintaining the status quo. The latter is of course a positive development which must be ascribed to a substantial strengthening of PCD, helped by the decentralization of malaria microscopy services, particularly in the last two or three years, as a result of which PCD's contribution to the detection of cases has increased from 26.9% in 1982 to 42.5% in 1986.

The MCP's reliance on indoor spraying with residual insecticides as a major method of malaria control is now and then questioned, but the team is inclined to support at this stage the MCP on this point. It should be noted that the use of insecticides is currently selectively restricted to about 25% of the population, who are selected with the help of the best available epidemiological criteria. Alternative methods of control presently on hand have either a very limited applicability or low effectiveness, and would not substantially reduce the proportion of the population to be covered by indoor spraying, if one wishes to preserve the presently attained level of control. Among alternative measures only surveillance i.e. the development of an effective PCD network has recently enjoyed some increased interest. Other alternative and/or supplementary measures have till now received insufficient attention.

I. EVALUATION COSTS

1. Evaluation Team

Name	Affiliation	Contract Number OR TDY Person Days	Contract Cost OR TDY Cost (US$)	Source of Funds
Mr. Ed Smith	Retd.AID/W	PSC - 30 days	Not yet finalized	ESF & Mondale
Mr. Ray Beach	CDC/Guetamala	Invitational travel-30 days	100,000 + $400	ESF & Mondale
Dr. William J.O.M. Van Dijk	WHO	NA - 30 days	WHO Sponsored	WHO Sponsored
Mr. A.A. Mujahid,	GOP	NA - 30 days	GOP Sponsored	GOP Sponsored

2. Mission/Office Professional Staff Person Days (estimate) 50

3. Borrower/Grantee Professional Staff Person-Days (estimate) 60

(PLEASE SEE ATTACHED SHEET)

Mr. Ray Martin, Chief/HPN	12	Director, Directorate of Malaria Control	30
Dr. Rifaq A. Ismail, Project Officer	30	Other officers -do-	30
Dr. William Chin, Long-Term Advisor	30		
Mr. Babar Hussain, Prog. Assistant	30	GOP provincial personnel	30

A.I.D. EVALUATION SUMMARY PART II

J. SUMMARY OF EVALUATION FINDINGS, CONCLUSIONS AND RECOMMENDATIONS (Try not to exceed the 3 pages provided)
Address the following items:

- o Name of mission or office
- o Purpose of activity (ies) evaluated
- ⊠ Purpose of the Evaluation and Methodology Used
- ⊠ Findings and Conclusions
- o Recommendations
- o Lessons learned

Purpose of the Evaluation and Methodology used:

- to assess the current status of the Pakistan Malaria Control Program (MCP) in terms of progress made from 1982 todate in meeting program objectives;
- to formulate recommendations on the program's future strategy and for improving the program's operations;
- to identify areas of unmet needs by the current project and indicate areas where further external assistance would be most useful and effective; and,
- to make on the basis of an analysis of findings concrete recommendations regarding the future scope and direction of AID's involvement in malaria control in Pakistan.

The evaluation team consisted of USAID, WHO and national malaria specialists, and visited the Directorate of Malaria Control (DOMC) in Islamabad, the Health Directorates of the four provinces and of a number of municipalities for discussions and a review of availabl documentation at federal, provincial, district and municipal levels. Assisted by federal provincial and municipal officials field visits were paid to observe various MCP operations, down to the village level. This final report was presented by the team to the Government of Pakistan (GOP) on April 29, 1987.

SUMMARY

Date this summary prepared:

Summary of Evaluation Findings, Conclusions and Recommendations:

The current status of the Malaria Control Program in terms of progress made in meeting project objectives is discussed at considerable length in Section III of the Report.

Findings and Conclusions:

Major achievements include the progress made with the laboratory services, PCD, vigilance organizations in urban centers, the development of criteria for the introduction of indoor spraying, and the orientation and training on malaria provided to general health services personnel.

Two major technical problems are chloroquine resistance in P. falciparum and insecticide resistance in the vectors.

The resistance to chloroquine should be closely monitored, additional control measures institututed, as and when indicated, and treatment with alternative drug studied. It is of interest that the number of P. falciparum cases in Punjab province started declining in the last two years following indoor spraying in the affected areas.

The resistance of vectors to malathion is so far by and large tolerance only. There is no hard data showing a substantial reduction of effectiveness of the insecticide, but the matter should be watched carefully.

Training has been given great importance. The NMTC has been performing excellently, but a tremendous training task lies still ahead. Operational research has received some attention but considering the many questions which need an urgent answer, the project did not really come up to expectations in this respect. The establishment of the NIMRT and the recent merger of it with the NMTC are encouraging developments, but little progress has been made so far with the creation of a viable and functional applied field research unit.

Of great concern remains the fact that the MCP continued to fail to attract suitable candidates for the senior posts in the program, and prospects of succeeding look presently grim.

Another major problem to be resolved relates to repeated budgetary constraints the MCP is facing in some instances with the implementation of planned malaria control measures.

A number of administrative and operational matters deserving attention are listed in the report, including the need for a more active participation by the community, improvements in the evaluation and supervision of spraying operations, transport, etc.

Recommendations:

1. Since there is no cost-effective alternatives available to substitute for residual spraying of insecticides, future strategy should emphasize the most effective use of the available insecticides and should include applied field research on selective spraying and testing of alternative insecticides.

2. Applied field research should be conducted on all available mosquito and/or malaria control techniques to determine how they might be used as supplementary measures in an integrated program utilizing all available methods.

3. The shift in emphasis from ACD to PCD should be accelerated and when PCD is producing the majority of the positive slides, consideration should be given to phasing out ACD.

4. In view of the importance of basic and inservice training and the need to avoid any interruption in the conduct of courses already scheduled for the future, resolution of the problems of merging the NMTC with the NIMRT and of location and up-grading of the facilities is critical to future success. The team urges consideration and resolution of these problem without further delay.

5. Since the PP objectives for participant training were not met and in view of the critical technical manpower shortage it is recommended that a concerted effort be made to recruit, train and retrain professional personnel in the fields of epidemiology, entomology, administrative management, health education, training and research.

ATTACHMENTS (List attachments submitted with this Evaluation Summary; always attach copy of full evaluation report, even if one was submitted earlier)

Copy of the Evaluation Report.

COMMENTS BY MISSION, AID/W OFFICE AND BORROWER/GRANTEE

Mission was briefed and has discussed this evaluation with the team. Dr. Rifaq A.Ismail, Project Officer, MCP II and project staff including Dr. William Chin, long-term advisor will follow up with the Government of Pakistan for recommendation of the report. The design team for post 1987 extended project will review the recommendation and will facilitate incorporation of the relevant recommendations with design of the extended project.

MISSION COMMENTS ON FULL REPORT

REPORT OF THE

TERMINAL EVALUATION OF THE PAKISTAN MALARIA CONTROL PROJECT (391-0472)

April 4, 1987 - May 3, 1987

April 30, 1987

Islamabad, Pakistan

BASIC PROJECT IDENTIFICATION DATA
(Outline)

1. Country: Pakistan

2. Project Title: Malaria Control II Project

3. Project Number: 391-0472 (Grant)

4. Project Dates:

   a. First Project Agreement: May 19, 1982
   b. Final Obligation (Actual): April 28, 1986
   c. Project Assistance Completion Date (PACD): September 30, 1987

5. Project Funding:

   a. A.I.D. : Bilateral Funding (Grant) ESF Grant $41,000,000
   b. Other Major Donors: World Health Organization
   c. Host Country Counterpart Funds: Rs.414,070,000
      $39,700,000 - Rs.10.43 = $1
   TOTAL: $80,700,000.00

6. Mode of Implementation: 1. PSC - Dr. William Chin
   2. Invt. Trvl.

7. Project Design:
   1. Government of Pakistan, Islamabad
   2. USAID Mission to Pakistan, Islamabad
   3. AID/Washington
   4. IQC Consultants

8. Responsible Mission Officials:

   a. Mission Director Mr. Eugene S. Staples/Mr. Donor M. Lion
   b. Project Officer Dr. Rifaq A. Ismail

9. Previous Evaluation
   1. External Evaluation - October 1985
   2. External Evaluation - September 1983

10. Cost of Present Evaluation:

		Person Days	Dollar Costs	Rs.
a. Direct Hire:				
(1) AID/W TDY:				
(2) USAID Staff:				
b. Contract:	1. Mr. Ed Smith	30 days	$400.00	42,000.00
c. Other: Invitational:	1. Mr. Ray Beach	30 days	$400.00	100,000.00

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

The terminal external evaluation of the Malaria Control II Project was held from April 4-29, 1987. The objectives of the evaluation were:

- to assess the current status of the Pakistan Malaria Control Program (MCP) in terms of progress made from 1982 to date in meeting program objectives;
- to formulate recommendations on the program's future strategy and for improving the program's operations;
- to identify areas of unmet needs by the current project and indicate areas where further external assistance would be most useful and effective; and,
- to make on the basis of an analysis of findings concrete recommendations regarding the future scope and direction of AID's involvement in malaria control in Pakistan.

The evaluation team consisted of USAID, WHO and national malaria specialists, and visited the Directorate of Malaria Control (DOMC) in Islamabad, the Health Directorates of the four provinces and of a number of municipalities for discussions and a review of available documentation at federal, provincial, district and municipal levels. Assisted by federal, provincial and municipal officials, field visits were paid to observe various MCP operations, down to the village level. This final report was presented by the team to the Government of Pakistan (GOP) on April 29, 1987.

The increase in the number of reported malaria cases over the period 1982-1986 from 56360 to 90393 reflects both an absolute increase in the malaria incidence and an improvement in the reporting of malaria cases. The former is of some concern as it indicates that the current mix of antimalaria measures just falls short of maintaining the status quo. The latter is of course a positive development which must be ascribed to a substantial strengthening of PCD, helped by the decentralization of malaria microscopy services, particularly in the last two or three years, as a result of which PCD's contribution to the detection of cases has increased from 26.9% in 1982 to 42.5% in 1986.

The MCP's reliance on indoor spraying with residual insecticides as a major method of malaria control is now and then questioned, but the team believes that spraying will remain a major method for malaria control for some time. It should be noted that the use of insecticides is currently selectively restricted to about 25% of the population, who are selected with the help of the established epidemiological criteria. Alternative methods of control presently on hand have either a very limited applicability or low effectiveness, and would not substantially

reduce the proportion of the population to be covered by indoor spraying, if one wishes to preserve the presently attained level of control. Among alternative measures only surveillance i.e. the development of an effective PCD network has the potential for reducing reliance on spraying.

Two major technical problems are chloroquine resistance in P. falciparum and insecticide resistance in the vectors.

The resistance to chloroquine should be closely monitored, additional control measures instituted, as and when indicated, and treatment with alternative drug studied. It is of interest that the number of P. falciparum cases in Punjab province started declining in the last two years following indoor spraying in the affected areas. The resistance of vectors to malathion is so far by and large tolerance only. There is no hard data showing a substantial reduction of effectiveness of the insecticide, but the matter should be watched carefully.

Training has been given great importance. The NMTC has been performing excellently, but a tremendous training task lies still ahead. Operational research has received some attention, but considering the many questions which need urgent answers, the project did not really come up to expectations in this respect. The establishment of the NIMRT and the recent merger with the NMTC are encouraging developments, but little progress has been made so far with the creation of a viable and functional applied field research unit.

Of great concern remains the fact that the MCP continued to fail to attract suitable candidates for the senior posts in the program, and prospects of succeeding look presently grim.

Another major problem to be resolved relates to repeated budgetary constraints the MCP is facing in some instances with the implementation of planned malaria control measures.

A number of administrative and operational matters deserving attention are listed in the report, including the need for a more active participation by the community, improvements in the evaluation and supervision of spraying operations, transport, etc.

Major achievements include the progress made with the laboratory services, PCD, vigilance organizations in urban centers, the development of criteria for the introduction of indoor spraying, and the orientation and training on malaria provided to general health services personnel.

The team recommends a project extension along the lines spelled out in their report.

II. INTRODUCTION

2.1 Brief History of the Pakistan Malaria Program

Malaria has traditionally been a major public health problem in what is now Pakistan. Periodic epidemics were common occurrences such as the ones which struck the Punjab in 1908 and the Sind in 1929 causing an estimated 300,000 and 40,000 deaths respectively. In the years immediately prior to the eradication campaign in 1961, malaria infected an estimated 7 million people, causing some 100,000 deaths annually. The assistance provided by USAID to Pakistan for malaria eradication/control is of long standing beginning with the provision of more than $28 million in loans and grants to support the malaria program from 1963-70, and $24 million from 1975-80. In general the strategy of USAID assistance conformed to the guidelines of the WHO. Thus, the initial support, from 1963-70, was to assist the malaria program to undertake an eradication effort by the use of house spraying with DDT. During this period the malaria incidence in Pakistan dropped from the estimated 7.0 million cases in 1961 to only 9,500 reported cases in 1967. Although eradication was not achieved this was a remarkable control effort resulting in a 99% plus reduction of malaria.

USAID assistance discussed above terminated in 1970. By 1969 there were indications of an increase of malaria, particularly in Punjab. By 1972 this resurgence had reached epidemic proportions with 10 million cases estimated for 1974. The causes of the resurgence included a variety of administrative, operational and technical problems. In all probability complacency due to the success of the early program resulted in a loss of priority for malaria which in turn resulted in a loss of budget support which seriously interfered with the ability of the program to cope with the problem.

During the early seventies, malaria was once again interfering with other development programs. This led to a resumption of USAID assistance in 1975 to the malaria program at the request of the Government of Pakistan. The project this time was designed to overcome the epidemic and bring the incidence of the disease to a manageable level. Unfortunately, the malaria vector had become resistant to DDT and a much more expensive insecticide, malathion had to be used.

Again, results were spectacular. From the estimated 10 million cases in 1974, malaria was reduced to 12,304 reported cases in 1979. Again a 99% plus reduction of malaria. Slide positivity rates tend to confirm the magnitude of the reduction going from 14.9% during the epidemic to 0.45% in 1976, a reduction of 96.98%.

The major achievement of the MCP from 1975-80, the reduction of API to 0.5 cases/1,000 population was shortlived. By 1981, there was already indication of increasing malaria transmission. This deterioration in the malaria situation may have been exacerbated by the sudden influx of Afghan refugees many of whom were infected with malaria, which by 1981 had reached an estimated 2 million.

In order to redirect the MCP to one based on epidemiologic concepts and assist the GOP in maintaining a malaria API of 0.5 case/1,000 or less, the Malaria Control II Project was conceived and approved on May 11, 1982. This 5-year project, which has a project Assistance Completion Date (PACD) of September 30, 1987, provides $41 million as a grant and an equivalent of another $2 million in Mondale rupees. The major objective of this project as stated in the Project Paper is to "build on the achievements of the previous project by assisting the GOP to contain or further reduce the incidence of malaria. This was to be accomplished by: (1) expanding the capacity and increasing the capabilities of the federal, provincial and municipal health services to effectively control malaria; and, (2) assist the MCP move from a vertically organized program emphasizing total coverage house spraying and active case detection surveillance methods to an integrated program utilizing a selective mix of vector control measures and a better balance between active and passive case detection and treatment methods".

2.2 Objectives of the Evaluation

Since the project will be completed in September 1987, this is considered a terminal evaluation with the objectives of evaluating the progress of the project from authorization to date, assessing the extent to which the project objectives as outlined in the Project Paper have been achieved, providing guideline for future malaria control strategies in Pakistan and identifying problems and unmet needs which might be addressed in the design of future assistance in support of malaria control in Pakistan.

A detailed scope of work for the evaluation team is given as Annex 8.1.

III. CURRENT STATUS OF THE MALARIA CONTROL PROGRAM IN TERMS OF PROGRESS MADE IN MEETING PRESENT OBJECTIVES

3.1 Epidemiology, Surveillance and Laboratory Services

The main objectives of epidemiological operations in a MCP are:

(1) The monitoring of the malaria situation throughout the country on the basis of which in the various localities and areas the most appropriate anti-malaria measures can be instituted;

(2) The evaluation of the malaria control measures instituted; and,

(3) The control of malaria which epidemiological operations per se may provide through the timely detection and subsequent radical treatment of cases of malaria. This is of particular importance for areas of low endemicity where these operations may be the only anti-malaria measures required for keeping malaria under control.

As a result of the current wide availability of anti-malarial drugs in the open market, the classical methods for measuring malaria prevalence through malariometric surveys, or malaria incidence through the case detection systems have lost some of their original sensitivity as the true prevalence or incidence is to an unknown extent masked by self medication. This may be an explanation of the quite dramatic increase in malaria incidence now and then observed in areas where P. falciparum developed resistance to commonly used anti-malarials.

A summary of epidemiological data collected during the period 1982-1986 in each province is given in Annex 8.6.

3.1.1 Active Case Detection (ACD)

The majority of blood smears continued to be collected through ACD, although this proportion declined from 77% in 1982 to 72% in 1986. ACD's share in the detection of malaria cases decreased from 51% in 1982 to 45% in 1986, but the slide positivity rate (SPR) of the smears collected through ACD showed an increase from 1.1% in 1982 to 1.9% in 1986. Although figures may not be fully comparable, they might point to a slight increase in the malaria incidence over the 1982-1986 period.

The ACD activity has been decreasing during the period, but it is still excessively high. It may be recalled that ACD was developed in the eradication era with the sole purpose of detecting any relapsing or imported cases which might still be around after the parasite reservoir in the community had (virtually) been depleted during the preceeding years of total coverage indoor spraying operations. ACD was of particular value for areas where and at a time when there were no other ways or means of confirming the absence of malaria.

Since such an objective does not exist in a MCP, there is very little justification for ACD in a MCP, and at the rate with which the general health infrastructure is presently being developed in rural areas of Pakistan, any need there might have been is rapidly disappearing.

It is noted that this has been realised earlier, and that the ACD worker has become malaria supervisor, in charge of all anti-malaria activities in his area, including the preparation and supervision of spray operations where applicable, activated PCD at health institutions where the PCD post's own personnel does not participate in this activity, at times involved in the administration of radical treatment, the collection of follow-up smears, the dispatch of blood smears from PCD posts to the laboratory, etc. Yet it is felt that too much time is devoted to ACD which always has been by far the least productive case detection mechanism.

It is further noted that some innovative approaches towards a more efficient ACD system have been taking place in recent years, without having been able to remove some of the major limitations of ACD:

Mobile teams composed of two or three malaria/CDC supervisors recruited from adjacent areas have been conducting quite productive special surveys on a monthly basis in some so-called silent areas of the NWF province, i.e. areas where these supervisors previously failed to function properly. The arrangement did not of course remove ACD's poor coverage in time, nor the fact that a substantial part of the community is repeatedly not met, because of absence from home during working hours or because of well-known biases of age or sex in the collection of blood smears by ACD.

One of the major limitations of the classical ACD pattern, namely the fact that ACD for malaria alone is a highly incomplete health service to the community particularly in less malarious areas seems in principle to have been overcome in Punjab by the creation of Health Outreach Teams composed of a malaria/CDC supervisor, an EPI worker, and a sanitarian. Once fully developed, this scheme may provide the best first line primary health care which a mobile service could provide.

3.1.2 Passive Case Detection (PCD)

There is a modest but definite shift towards PCD over the years, from 10% of all blood smears collected through PCD in 1982 to more than 16% in 1986. As a result, the proportion of malaria cases detected through PCD went up from 27% in 1982 to 42.5% in 1986. The increasing role played by PCD in the overall case detection may at least partly explain the general increase in the SPR.

Despite progress made in this respect, much of the PCD is still activated PCD, and the majority of potential PCD posts does not yet participate in this activity. Participation has till now, very much been the result of provincial support and strong backing by the district health officer. A proper orientation on the subject matter for all health staff directly or indirectly involved in malaria PCD is obviously a pre-requisite. Training of some categories of health personnel has meanwhile been started, or has been planned for the same and other categories of other health institutions to be started shortly.

It would appear that the interest in PCD among clinicians is, not unexpectedly, stimulated by the prospects of having an immediate microscopically confirmed diagnosis of a suspected case of malaria. The decentralization of malaria microscopists as well as the training in malaria microscopy of assistant laboratory technicians may thus be of importance for the further promotion of PCD.

The availability of malaria microscopy at a health institution does not guarantee that blood smears will be collected from all fever cases, and in a MCP one should perhaps no longer insist on this, as clinicians would not easily follow such instructions. At two hospitals where the team looked into this, the actual blood smear collection was even less than half the number of patients with fever of unknown origin.

3.1.3 Other Bloodsmear Collections

Under this heading a variety of parasite surveys, including mass blood surveys, epidemiological contact surveys, special surveys, etc. have been brought together, as a result of which the figures are difficult to analyse. It is noted that these surveys, which were largely of a malariometric nature produced over the period 1982-86 a rather constant SPR, which is two or three times higher than that of the ACD blood smears, but that their share in the total case detection has fallen sharply from 22% of all positives detected in 1982 to 13% in 1986, due to the increased share taken by PCD.

3.1.4 The P. falciparum - P. vivax ratio

After a shift towards P. falciparum from 18% in 1982 to 30% in 1983, the ratio remained of the same order during the following years. In the individual provinces it appears that the number of falciparum cases reached a peak in 1984 in Punjab and in 1985 in Baluchistan, but the figure is still increasing in Sind, where the proportion of falciparum cases reached 61% in 1986. It was noted with surprise in this connection that at the provincial MCP office there was no knowledge about the possible occurrence of chloroquine resistance in the province except for some unconfirmed reports from Larkana, no follow-up smear was being collected from P. falciparum cases, which had been given a radical treatment with chloroquine, and no alternative antimalarial drugs have been distributed. In some Punjab districts where chloroquine resistant P. falciparum had earlier assumed epidemic proportions, the situation was dramatically brought under control by malathion indoor spraying.

3.1.5 Malaria Microscopy

Considerable progress has been made with the decentralization of district malaria laboratories.

In Punjab all district malaria laboratories have been decentralized, and microscopists stationed at hospitals and rural health centers (RHCs). Training of assistant laboratory technicians in malaria microscopy was provided for in short courses at the NMTC in Lahore. As a result over 260 health institutions in the province are presently capable of carrying out malaria microscopy. ACD blood smears previously processed at the district, are now routed to the nearest RHC. The move appears to have been a very good one, which not only reduced the average time-lag between detection and treatment of cases but provides for a substantial proportion of patients immediate treatment upon microscopic confirmation of malaria.

In NWFP the malaria laboratory services have been decentralized so far in two districts only, but other district malaria laboratories are expected to follow in due course. Microscopists have been stationed at hospitals and RHCs, one exceptionally at a basic health unit (BHU).

In Sir the district malaria laboratories were similarly decentralized during 1986, involving the re-location of 54 out of the total 74 malaria microscopists of the province.

In Baluchistan, there are two microscopists at the provincial reference laboratory, and two divisional malaria laboratories with four and seven microscopists only i.e. there is not much to decentralize. With the purpose of providing malaria microscopy to the many remote areas, it is planned to train existing assistant laboratory technicians in malaria microscopy, if the necessary supplies and equipment (microscopes) can be obtained. It is anticipated that this would boost the PCD activities in the province which is currently restricted to APCD at seven health institutions, out of about 750 potential PCD posts which exist in the province.

The provincial reference laboratories have been retained every where, and some cross-checking is also carried out at district level. This function could here and there be strengthened by ensuring that genuinely unbiased samples are submitted to the reference laboratory for cross-checking.

Errors found at cross-checking relate mostly to missed positives, whereas false positives virtually do not exist. This is somewhat surprising in view of the very dirty blood smears which the microscopists have now and then to read, particularly in Baluchistan, presumably due to dust which gathered on the slides during their sometimes long journey to the laboratory.

3.1.6 Criteria for the Introduction of Indoor Spraying Operations

It is not possible to develop a refined plan of indoor spraying operations which makes optimal use of insecticides, without a precise division of the country into areas with a high, medium and low malariogenic potential respectively, and for a detailed division of the country into areas of different malariogenic potentials, neither the necessary information is always available, nor the surveillance system which could provide this information. The establishment of a surveillance organization capable of doing so, remains therefore of primary importance.

During the period under review, criteria have been developed for deciding on an annual basis whether a locality should be included in the indoor spraying program of the following year, utilizing all pertinent data on hand, and the expertise available within the country. After minor modifications these criteria are presently given as:

a) the occurrence of more than one case of *P. falciparum*;

b) an annual parasite incidence (API) of more than two per thousand;

c) being surrounded by localities scheduled to be sprayed;

d) other factors suggesting a high malariogenic potential, e.g. malaria history of the locality, population movements, etc;

e) large localities will be partly sprayed, up to 25% of houses, usually outskirts only.

It is stressed that these criteria are necessarily no more than general guidelines on the basis of which the final decision to spray or not to spray is taken for each locality at the Provincial Directorate of Health Services in consultation with federal authorities and USAID and WHO representatives.

Since the criteria did not include any reference to a possible second spray round and in view of doubts about the exact start and duration of the transmission season which is known to vary in different areas of the country as well as doubts about the efficacy vis-a-vis the resistance/tolerance of vectors to malathion, during the 1985 ERT visit, it was proposed to obtain answers to these questions through serial parasite surveys to be conducted in selected localities side-by- side the collection of some relevant entomological data.

It appears that the proposed serial parasite surveys were cumbersome to carry out as prescribed, requiring manpower and material at a moment that the MCP was fully occupied, and less informative than expected in areas of lower endemicity. From the incomplete and other comparable data meanwhile collected in the North-West Frontier and Punjab provinces, it seems to be justified to conclude that:

a) the resistance/tolerance of vectors to malathion did not interfere with spraying objectives so far;

b) the effect of the indoor spraying operations lasts longer than anticipated on the basis of vector densities only;

c) even in the Punjab, provided the spray round is kept restricted to July, i.e. neither starts much earlier nor ends much later, one spray round might also in areas of high malariogenic potential, be generally sufficient. This finding is of additional significance, as the second spray round tends to sharply increase the rate of refusals.

The methodology currently in use for determining localities to be brought under indoor spraying coverage has shown in recent years to be most valuable. As indicated, only a fully developed surveillance system would be capable of providing data on which a more judicious use of insecticides could be based. Yet, it is suggested that substantial areas currently under spray cover in northern Baluchistan, presumably on the basis of a high API including several falciparum cases, may deserve a reappraisal as cases may be imported, and the areas concerned non-malarious, or virtually so.

3.1.7 Evaluation of Indoor Spraying Operations

Among the main objectives of epidemiological operations is the evaluation of antimalaria measures instituted. Indoor spraying with a residual insecticide, presently malathion, is a major one among these measures.

Various spraying schedules have been in force in different provinces during the past couple of years. One seems now to have generally settled on a single spray round starting in July and ending before August in Punjab, around August/September in Baluchistan, before September in NWFP and before October in Sind. Most of the additional rounds carried out in the past appear to have been abandoned. Considering the uncertainty about the duration of the transmission season in various parts of the country, the relatively short residual life of malathion, and the possible emergence of resistance of vectors to this insecticide, it is surprising how little information is being collected for evaluating the effect of the indoor spraying operations on the malaria transmission.

During the visit of the ERT in 1985, the positive cases found in recent years in some NWFP districts were divided into those found in sprayed and those found in unsprayed areas respectively. In the final analysis cases occurring during the first half of the year were assumed to belong to the transmission and the spray status of the locality in the previous year. It was then found that in the district concerned, virtually all cases originated in unsprayed localities, indicating that the indoor spraying had been highly effective.

The serial pre-spray and post-spray parasite surveys carried out in NWFP during 1986 support this conclusion, despite the fact that information is somewhat patchy and endemicity in general rather low. The Mardan district was unfortunately not included in these surveys, as there is some evidence from the outcome of the special surveys conducted by mobile teams during the second half of 1986, that spray operations in this district were not fully effective, possibly for operational reasons.

Some surveys conducted in selected areas of the Punjab around November suggest that spray cycles carried out had been effective but the single survey could, of course, not show whether two spraying rounds in the localities concerned had actually been required.

From the other provinces no data are available which would permit assessing the impact of indoor spray operations on the malaria incidence.

3.2 Antimalaria Drug Treatment and Parasite Resistance

Although not stated in the Project Paper, the objective of antimalaria drug treatment in the current project, as in all malaria control programs, is to reduce the infective reservoir. When a program is implemented through the integrated approach as is the case in Pakistan, an additional objective is the prompt clinical cure of a malaria patient. When these objectives are met enabling the efficient treatment of malaria patients, the combined case detection and treatment activities may serve as a useful malaria control method particularly in areas where the malariogenic potential is not high. Viewed from the perspectives of the 2 objectives, the chemotherapeutic method must meet the following requirements if it is to be effective:

1) Both the screening procedures to identify potential cases and the examination of blood smears taken from the suspected cases must be done with efficiency and promptness.

2) The treatment regimens to be used must be efficacious and modified as required to meet the changes in the susceptibility of parasites to drugs.

The screening procedures through various surveillance mechanisms and the laboratory aspects of malaria microscopy are covered in Section 3.1 of this report. This section will deal with the findings and conclusions on chemotherapeutic aspects as practiced by the MCP of Pakistan.

The chemotherapy of malaria in the MCP has been standardized to regimens recommended by the DOMC through the issuance of the Malaria/ CDC Supervisors' Manual and the plastic laminated treatment cards. The suggested regimens for various treatments are as follows:

MALARIA TREATMENT

I. Presumptive Treatment:

Age Group	Number of Chloroquine tablets (150 mg each)
1-11 months	1/4 tab.
12-24 months	1/2 tab.
3-4 years	1 tab.
5-6 years	2 tabs.
7-14 years	3 tabs.
15+ years	4 tabs.

II. Falciparum Malaria:

C = Chloroquine, 150 mg
*P = Primaquine, 7.5 mg

Age Groups	Day of Treatment 1	2	3
1-11 months	C=1/4	C=1/8	C=1/8
12-24 months	C=1/2	C=1/4	C=1/4
3-4 years	C=1 P=1/4	C=3/4 P=1/4	C=3/4 P=1/4
5-6 years	C=2 P=1/2	C=1-1/2 P=1/2	C=1-1/2 P=1/2
7-14 years	C=3 P=1	C=2-1/4 P=1	C=2-1/4 P=1
15+ years	C=4 P=2	C=3 P=2	C=3 P=2

III. Vivax Malaria:

Age Groups	Day of Treatment 1	2	3	4	5
1-11 months	C=1/4	C=1/8	C=1/8		
12-24 months	C=1/2	C=1/4	C=1/4		
3-4 years	C=1 P=1/4	C=3/4 P=1/4	C=3/4 P=1/4	P=1/4	P=1/4
5-6 years	C=2 P=1/2	C=1-1/2 P=1/2	C=1-1/2 P=1/2	P=1/2	P=1/2
7-14 years	C=3 P=1	C=2-1/4 P=1	C=2-1/4 P=1	P=1	P=1
15+ years	C=4 P=2	C=3 P=2	C=3 P=2	P=2	P=2

*(Primaquine must not be given to pregnant women nor to children below age 2 years.)

Because of the threat posed by the increasing transmission of falciparum malaria, including the rapidly spreading strains which are resistant to chloroquine, the radical treatment of this parasite has been accorded the highest of operational priorities; in districts where the number of smear confirmed cases is high, the DOMC recommendation is to concentrate the effort on radical treatment of falciparum cases first. Radical treatment for vivax infections is suggested only if the local malaria field workers have sufficient time for its administration.

Operationally, the presumptive treatment is administered after the taking of a blood smear and only if that smear can not be examined immediately on the spot. After the blood smear is reported as positive, the radical treatment is dispensed by the microscopist from either the office of the DHO or a primary health care facility where a microscopist may be assigned. The total treatment is generally wrapped

in a single scrap of paper with the smear reporting form attached. The treatment packet is then sent to the Malaria/CDC Supervisor by a porter or given to him at his fixed base of operation in a RHC or a BHU. The treatment is taken by the supervisor to the patient and according to instructions, at least the first dose must be administered in the presence of the supervisor followed by instructions given to the patient on how to take the remaining medication. If the patient is not available, the supervisor is supposed to return at a later time when the patient is home. Practically speaking, if the patient is available, the treatment may be administered according to the requirements described but the instructions regarding subsequent dosing often times may be unclear or not fully understood; rather than make an effort to return when the patient is home, the usual practice is to leave the packet with the person who comes to the door.

For the treatment of falciparum malaria, a recommendation was made by the DOMC more than 2 years ago to require a followup blood smear one month after administering the radical treatment. If the followup smear is positive for falciparum asexual and or sexual forms, an alternative treatment is to be administered.

Chloroquine Resistant Falciparum Malaria

The NMTC began its program to monitor the emergence of chloroquine resistant falciparum malaria in 1976. During the present project, monitoring for such strains was intensified by the NMTC. In addition, personnel from the NMTC as well as from all the provinces were trained in the monitoring methods emphasizing the in-vivo test particularly for district entomologists.

The NMTC was granted $50,000 by the WHO to conduct regional and incountry training on the in-vivo and micro in-vitro methods for 1986-87. To date, one regional and 2 incountry courses have been conducted.

The results of the monitoring studies are summarized in Annex 8.7.

Of interest is the generally higher resistance rates reported by the district entomologists than by the NMTC personnel. A likely explanation for the difference is the relative inexperience of the district personnel in performing in-vivo chemotherapy trials.

In general, the results show that since 1981-82, wherever monitoring involving sufficient number of cases has been carried out, resistant strains have been detected.

As would be expected when the emergence of chloroquine resistant falciparum strains is of relatively recent origin, the majority of the resistant strains is of the RI type. The response of falciparum strains to amodiaquine appears to be marginally more efficacious than against chloroquine. The susceptibility of local falciparum strains to

Fansidar is reassuring in 3 of the 4 in-vivo studies but rather disquieting in the evaluation performed by the NMTC in Sialkot during December 1985 to January 1986 which showed that 53% of the 17 infections tested were resistant to Fansidar. The MCP must view this finding with considerable concern as an omen of future developments and take appropriate actions to intensify the monitoring of such resistant strains.

The Treatment of Chloroquine Resistant Falciparum Malaria

The MCP strategy for the treatment of chloroquine resistant falciparum parasites depends on:

1. Initial treatment of smear confirmed falciparum cases with chloroquine plus primaquine (radical treatment regimen) plus a followup smear examination one month after drug administration.

2. If the one month followup smear is positive for falciparum malaria (presumptive evidence of drug resistance), a second treatment with amodiaquine and primaquine is suggested together with another followup smear one month later.

3. If the smear one month after the amodiaquine treatment is still positive, the third treatment recommended is Fansidar plus primaquine.

The team found that compliance with the DOMC recommendations on the treatment of falciparum malaria in the different provinces is variable. Generally speaking, while directions have already been issued by the provincial directorate of health services to make followup smears one month after treatment of falciparum cases, these directives are seldom followed.

The Use of Amodiaquine

In the Punjab, the MCP is relying more heavily on the use of amodiaquine to counter the problem of chloroquine resistant strains than any other province. In those districts where chloroquine resistant falciparum strains have been identified, amodiaquine has replaced chloroquine in the presumptive treatment. In addition, 30 mg of primaquine (adult equivalent dose) is also added as part of the presumptive treatment. Amodiaquine has also replaced chloroquine in the radical treatment in these "problem" districts.

In the Sind, 2.1 million tablets of amodiaquine were procured by the provincial Directorate of Health Services in 1985 but to date, not a single tablet has been issued to the districts.

In the NWFP and Baluchistan, amodiaquine is not available.

The Availability of Fansidar

The DOMC received 1.5 million tablets of Fansidar from the WHO in 1986. To date, 0.4 million tablets have been provided to the

Punjab which has yet to be issued to the districts. The other provinces have no supply of Fansidar.

3.3 Spray Operations

Systematic spraying operations in Pakistan began in 1960 when the malaria eradication program was launched. Country-wide coverage was achieved in 1968.

During the current MCP (1982-87) spraying operations were observed and reviewed by an ERT in 1983. The ERT which visited in 1985 also commented on spraying operations. However, like the current team, direct observation of spraying activities was not possible because the team visits did not coincide with the annual spraying cycle.

The residual spraying operation for 1986 was a single spray cycle using malathion, 50% wdp. The spraying operation occurred between July and September with some variation in the termination date. In addition a limited second round of focal spraying occurred in each province.

The timing of the first cycle generally coincided with the P. vivax malaria transmission season. However, it predated the P. falciparum peak (September-December). The timing of the wall spraying cycle may be important in terms of malaria control objectives. If P. falciparum malaria is prevalent in a locality then stratification should include delaying the start of spraying so that the cycle conincides more closely with the P. falciparum peak which usually occurs in Sep.-Dec. Such theoretical considerations aside, the current spraying operation did reduce malaria incidence and was, therefore, effective.

To plan for spraying operations, locations were stratified and ranked according to a number of criteria which included : (1) API for P. vivax of 2/1,000 or more; (2) presence of one or more P. falciparum cases; (3) presence of migrants and refugees; and, (4) historical data primarily maps showing sprayed localities for previous cycles. Geographical reconnaissance data was then used to determine how many localities would be sprayed.

Malaria control activities in the Lahore and Karachi Municipal Corporations used external space treatments (thermal fogging and cold aerosols using malathion) and larviciding with insecticides (temephos and fenthion in a granular formulation dispersed by hand) on an occasional basis. In one instance motor oil is spread over a suspected breeding site. These control efforts could not be expanded due to lack of financial support, man-power, and insecticides. Source reduction through improvements in drainage was considered extremely difficult because different part of the city were under the jurisdictional authority of different organizations eg. Municipal Corporation, railroads, por. authority etc.

Tables 1, 2, and 3 compare MCP spraying objectives with the actual spraying achievements based on data provided to the ERT by the DOMC, provincial and district level offices.

TABLE 1 - MCP INSECTICIDE[1] UTILIZATION (1982-1986)

Year	Ordered[2]	Used[3]
1982	650[4]	128
1983	2,450	2,010
1984	1,650	2,138
1985	3,700	2,813
1986	3,000	3,431

1. Malathion only, all figures in metric tons.
2. Data from USAID reports.
3. Data from consolidated reports of MCP.
4. 450 MT (USAID), 200 MT (WHO).

TABLE 2 - ACTUAL SPRAY OPERATIONS COVERAGE VERSUS MCP OBJECTIVES

Year	% of Existing Houses		% of Planned Houses	
	Expected[1]	achieved[2]	expected	achieved
1983	25	26	80	82
1984	25	21	83	92
1985	25	26	85	92
1986	25	27[3]	90	88[3]

1. Out put indication from project document p.26.
2. Data from GOP annual report of Malaria Control. 1986
3. Data for 1st round of spraying.

TABLE 3 - CONSOLIDATED HOUSE SPRAY COVERAGE REPORT - 1982-86

Year	Houses Nos. planned (% total existing)*	Houses sprayed as % of planned houses	Partial spray %	Total spray %	Insecticide Used Type	Amt. in MT
1982	1,906,028 (17%)	77%	6%	94%	DDT (75%)	7.6
					Malathion (50%)	128.2
					Sumithion (40%)	682.3
1983	3,782,760 (32%)	82%	5%	95%	Malathion (50%)	2,010.1
					Sumithion (40%)	474.9
1984	2,797,889 (23%)	91%	12%	88%	Malathion (50%)	2,138.4
					Sumithion (40%)	28.0
1985	3,563,310 (29%)	92%	9%	91%	Malathion (50%)	2,813.6
					Sumithion (40%)	30.9
1986 1st round	3,542,233 (31%)	88%	**		Malathion (50%)	2,769.9
2nd round	833,595 (7%)	87%			Malathion (50%)	601.8

* - Total No. existing houses based on G.R. update and does not include houses in urban centers.

** - Summary of 1st and second round:

Punjab	8%
Sind	19%
NWFP	4%
Baluchistan	35%

Interviews with malaria superintendents and their assistants during the ERT-87 visit produced the following comments about spraying operations: (1) There were increased proolems with refusals and a large number of houses were partially sprayed (one out of every 5 houses was partially sprayed in Sind Province). Therefore, coverge was reduced. (2a) There were problems obtaining transportation for supervisory activities related to spraying. TA/DA's for assistant malaria superintendents (Rs 45/month for petrol and related travel costs) are not adequate. (2b) Malaria supervisors were not able to devote their full attention to spray work because they were doing ACD as well. These two problems decreased supervision time and the quality of the average spray job (the spray application in one house, observed by the ERT was poor). (3) Problems with poor quality uniforms, lack of soap and proper utensils for measuring and mixing insecticides as well as unrepaired spray equipment were mentioned. Therefore, precautionary measures, although improved over previous years, may have been relaxed. These comments suggest that the true efficiency of the 1986 spraying operation was relatively low. Nevertheless, the effort of the MCP staff, despite these problems, many of which were outside of their control, was sufficient to offset the malariogenic potential in most localities. Given the possibilities of increased vector resistance, reduce reliance on residual insecticides and increased incidence of P. falciparum, imporved efficiency may be necessary to sustain the current level of malaria control.

Training of malaria supervisors, the individuals who are responsible for supervising spray activities is carried out annually. A technical manual has been produced to cover issues related to spraying including techniques, safety precautions, protective equipment, personal hygiene, recognition of the early symptoms of poisoning and first aid easures eg. resucitation.

TABLE 4 - SPRAY OPERATIONS : SUMMARY OF STRENGTHS AND WEAKNESSES

Strengths	Weaknesses
- Impressive reduction in malaria is still being achieved by the residual wall spraying activity of the MCP. - Training of spraymen, malaria supervisors and malaria superintendents/ CDC officers is comprehensive and well organized.	- MCP personnel reluctant to support supplemental/alternative measures e.g. voluntary collaborator project was not supported - that it failed is not surprising. - Spraymen are underpaid or not paid (in Sind) and in some cases do not receive adequate support e.g. poor quality uniforms issued, proper equipment for measuring/preparing insecticide/spare parts for sprayers not provided. Provincial government not always accepting its responsibilities. - Malaria supervisors doing ACD instead of supervising spray operations - quality of work appears low as a result.

- Number of partially spraved houses increasing. More emphasis needs to be placed on health education. Supervisors and spraymen probably not motivated to convince reluctant house owners of the benefits derived from house spraying.
- Stratification, preparation of operational spray plan based solely on surveillance should be strengthened e.g. timing by spray cycle based on entomological observations is not being done.

3.4 Operational Entomology

The manpower available for this activity is listed in Table 5.

TABLE 5 - ENTOMOLOGICAL STAFF AT FEDERAL AND PROVINCIAL LEVEL - 1987

	Senior Scientist (Directorate)	Entomologist (Province)	Assistant Entomologist (District)	Insect Collector (District)
DOMC	1/1[1]	0/0	0/1	0/0
Punjab	0/0	1/1	29/29	-
Sind	0/0	1/1	10/13[2]	26/26
NWFP	0/0	1/1	12/12	48/48
Baluchistan	0/0	0/0	1/2[3]	7/48
TOTAL	1/1	3/3	52/57	-

1. Posts filled/posts authorized (PC-1 1987).
2. 6 of these have not received training (senior professional course of NMTC Lahore) due to lack of funds at provincial level.
3. located at provincial HQ.

The MCP activities related to operatinal entomology are the collection of An. culicifacies and An. stephensi to estimate vector density on a per room basis and the performance of insecticide resistance tests.

Vector density per room is the entomological index used to monitor the impact of spraying. Table 6. summarizes the number of locations and frequency of vector density collections in 1986.

TABLE - 6 VECTOR DENSITY BEFORE AND AFTER RESIDUAL SPRAYING : 1986

Province	Time w.r.t. spraying at collection site	# Collection sites	#Rooms	Density/Room	
				An. culicif.	An stephensi
Punjab	Pre	11	35	6.5	12.7
	Post 30[1]	6	76	5.6	5.67
	60	38	407	5.8	8.2
Sind	Pre	190	986	1.5	1.3
	Post	247	924	3.7	2.5
N.W.F.P.	Pre	17	126	2.8	7.1
	Post 30	17	186	0.5	2.3
	60	17	117	1.3	2.8
Baluchistan	Pre	8	95	7.1	5.1
	Post 30	9	60	0.8	0.4
	60	9	50	2.9	2.4

1. 30 - conducted 30-60 days post spray.
   60 - conducted 60 days post spray.

These data suggest that with the exception of Sind province, insecticide spraying does reduce mosquito density. However, systematic data collection during this activity could provide more information for analizing and improving the spraying operation. For example, if specific indicator sites with high vector densities been visited 3 times between May and December, ie. before and after spraying (30 days, 60 days), important information on timing of the spray cycle and the duration of the insecticidal effect could be mesured. In addition, the use of alternative tests for insecticidal impact would improve this activity. The WHO 'cone' bioassay was used in Punjab province to compare time-specific mortality rates produced by different surfaces sprayed with the same amount of insecticide. Standard use of this bioassay in conjunction with the density index, now in use, would detect insecticides that repell the vector without causing mortality. Dissection of captured females to estimate parous:nulliparous ratios and exit trap collections, was also done in Punjab. A mixture of the two techniques in addition to mosquito density measurements at indicator locations would provide more accurate entomological information about the impact of spraying.

Table 7 summarizes the malathion susceptibility testing data reported by each province during 1985-1986:

TABLE 7 - LEVEL OF INSECTICIDE RESISTANCE DETECTED IN 1985-86 BY PROVINCE

Province	number of tests giving less than 60% of mortality of An. stephensi	An. culicifacies	No. of districts reporting
Punjab	11 (38-60)[1]	0 (95-100)	25
Sind	1 (58)	0 (100)	3
N.W.F.P.	5 (34-52)	0 (90-100)	8
Baluchistan	1 (60)	0 (90)	4

1. - Range of observed mortalities (%).

There is clear evidence of resistance to malathion in An. stephensi in Punjab and NWFP. It seems likely that Sind and Baluchistan also face this problem. The data could be strengthened by increasing the number and frequency of collections per location and using fewer collection sites. The data could also be summarized at the sector level for use in the preparation of the operational spray plan.

Municipalities and villages with town committees are excluded from the provincial operational spray plan. In large cities e.g. Karachi, the municipal corporation (KMC) has a vector control program aimed at nuisance mosquitoes eg. Culex quinquefasciatus as well as urban vectors such as Ae aegypti and An. stephensi. The entomological staff of the KMC includes 1 entomologist and 1 insect collector who are responsible for evaluating anti-larval measures and conducting susceptibility tests. However, there is no regular assessment of these activities unless disease outbreaks occur. Light trapping and larval dipping, two surveillance methods commonly used in urban mosquito control projects, did not occur with regularity. The KMC receives insecticides from the DOMC but does not coordinate with district health officers who are part of the provincial control system. This unusual situation makes it difficult to exchange information and to arrange for training and logistics support.

In summary, two entomological activities were carried out in 1986 for the purpose of evaluating the effect of residual insecticides. There were: (1) collections of An. culicifacies and An. stephensi to monitor the impact of spraying on mosquito density, and (2) insecticide susceptibility testing to detect changes in resistance to malathion, the current insecticide of choice. The density collections were made in a random manner so that the resulting data is interesting but difficult to interpret. An entomological work plan specifying when and where density collections are to occur would increase the value of this activity by allowing valid pre and post spray comparisons.

The use of alternative measurements such as (1) the WHO bioassay for insecticidal deposits on sprayed surfaces (the cone test), (2) parous-nulliparous ratios in females captured by human bait, and (3) mortality rates in exit trap-collected females could also be included in the entomological operations plan since these data give important

information about the insecticidal impact of spraying. For example these techniques distinguish between a treatment that kills mosquitoes and one that only repells them. Punjab province reported the results of such studies in 1986. However, more systematic data collection must occur if meaningful results are to be obtained.

The insecticide resistance data show that An. stephensi has developed partial resistance to malathion whereas An. culicifacies remains susceptible to this insecticide. However, it should be noted that these tests do not measure the insecticidal effect of wall spraying. The WHO tube test is a standardized bioassay that is used to compare levels of resistance in the same population over time. Therefore the importance of repeated testing at selected locations (e.g. in agricultural areas where malathion is used to spray crops) should guide the application of this test in the malaria control project. Conclusions about the susceptibility, partial resistance or total resistance of mosquitoes should not be made based on one year testing data e.g. the classification of test results into R, T and S categories, using only 1 years data, is not valid.

3.5 Mosquito Resistance to Insecticides

The MCP objectives related to this topic are listed in the PP and include the following: (1) that criteria for selection of appropriate organophosphorus insecticides exist and are applied, and (2) that the problem of insecticide resistance be routinely assessed.

Dr. G. Georghiou, an authority on mosquito insecticide resistance, was a member of the MCP external review team in 1983 and 1985. Dr. Georghiou also visited Pakistan in December of 1986 when he prepared a comprehensive review of insecticide resistance in malaria vector in Pakistan. Among Dr. Georghiou's recommendations are a series of criteria for replacing malathion, the current insecticide used for residual spraying in the MCP, with fenitrothion. The World Health Organization, Division of Vector Biology and Control has, for many years also addressed the issue of insecticide resistance in mosquitoes. Their Technical Report Series No.65 entitled "Resistance of Vector to Insecticides": Fifth report of the WHO expert committee on Vector Biology and Control also outlines the issues that should be considered prior to changing pesticides in a malaria control program. Both reports urge caution in switching from malathion to fenitrothion, which is more toxic and more likely to select for resistance mechanisms that confer protection against a wide range of insecticides. Dr. Georghiou recommends a gradual phasing in of fenitrothion in Punjab based on (a) an average mortality of less than 60% in An. stephensi susceptibility tests in several localities of a district for 2 consecutive years, and (b) an unacceptably high level of malaria transmission relative to the API for the district. The WHO philosophy on discontinuing an insecticide is that "the final decision should be based on epidemiological data, since in certain situations, an acceptable level of disease control may be maintained even though the vector shows some resistance to the compound".

During the current project, the MCP has carried out resistance surveillance using the bioassay test recommended by WHO. Assuming (1) that adequate number of females are tested; (2) that tests are repeated seasonally (before and after spraying); and (3) that testing is carried out in a number of localities, it is possible to use the results to monitor relative changes in resistance by locality. Data collected in this way can be used in the regular assessment of the control program.

After examining the resistance data collected between 1981 and 1986 Dr. Georghiou concluded that its use in operations planning, was hampered by the randomness of collection sites, lack of collection at frequent intervals and shifts in treatment areas from year to year. Absence of testing in some districts, lack of follow up testing to confirm unusually high survival rate results and the absence of a standardized method of comparing resistance testing data with epidemiological information also limit the potential usefullness of these results.

What these data clearly do show is an increase in An. stephensi resistance levels and continued susceptibility of An. culicifacies. However, An. culicifacies is showing longer knockdown times during susceptibility testing. Therefore, some population of this species are experiencing selection pressure for resistance.

Table 8 summarizes the progress made and problems identified in insecticide resistance testing.

TABLE - 8 - INSECTICIDE RESISTANCE TESTING : PROGRESS MADE AND PROBLEMS IDENTIFIED

Progress	Problems
- Surveillance has become more extensive and intensive in Punjab where malaria and insecticide resistance is not pronounced. - MCP susceptibility testing produced clear evidence that: (1) An. stephensi is resistant to malathion in Punjab, Sind and NWFP; and (2) An. culicifacies is susceptible to malathion. - Important operational research, carried out by DOMC (Dr. Shah), related WHO resistance test results to insecticidal effect of wall spraying on Anopheles stephensi in Pakistan.	- Surveillance less extensive/ intensive in Sind, NWFP and Baluchistan. - Schedule of resistance testing does not take into consideration issues such as the importance of comparison testing in sprayed and unsprayed areas, frequency and timing of testing in each area and follow up testing.

3.6 Urban Malaria

Considerable progress was made during the Second Five Year Extension Plan (1982-87) in strengthening the malaria surveillance/ vigilance organizations in urban centers.

In Karachi the province provides today malaria supervisors (APCD) and microscopists for 28 major health establishments (hospitals and dispensaries) in the city. Antimalaria treatment is taken care of by the institutions themselves. An elaborate scheme has meanwhile been drafted which is expected to become operational this year, under which the city will have 16 strategically located centers for monitoring the malaria situation throughout the city area. These centers will be situated at existing dispensaries. Ten microscopists have already been trained, and microscopes ordered. Once fully functional, the provincial input will gradually be withdrawn, but liaison e.g. for cross-checking of blood smears is likely to be maintained.

In the NWF province, including Peshawar, the PCD posts in the urban areas are generally activated by personnel of the provincial MCP. The 93 PCD posts operating in the nine urban areas of the province collected in 1986 a total of 17,947 blood smears of which 1,543 were found to be positive by the respective district malaria microscopists.

In Quetta the five medical institutions (hospitals and dispensaries) located in the town area carry out PCD quite successfully, producing together about 50 to 60 blood smears daily. The smears are submitted to the provincial MCP headquarters for examination.

In Hyderabad, assistant laboratory technicians at the central hospital w ll shortly be trained in malaria microscopy, after which the hospital will also cater for the malaria microscopy needs of other medical facilities in the town.

Some of the outskirts of Lahore have experienced a malaria flare-up in recent years, for which the provincial MCP authority as well as the NMTC have provided advice and operational support. Ad hoc assessments have also been carried out under the guidance of the provincial MCP as and when requested. The Lahore Municipal Corporation recently opened eight PCD posts.

Another special problem encountered in Punjab province is the existence of towns in a number of highly malarious districts, which are rural rather than urban and appear to have a considerable malariogenic potential. Since these towns fall outside the jurisdiction of the provincial MCP, they constitute highly productive malaria enclaves, surrounded by rural area where malaria is nicely under control by the MCP indoor spraying program. The town of Gakhar in Gujranwala is an example. It is estimated that about one thousand cases of malaria originating in the town area were detected in 1986 at the nearby rural health center.

3.7 Training

3.7.1 In-service Training

The National Malaria Training Center(NMTC) at Lahore has achieved its major objective of meeting the most important training needs of the Malaria Control Program. During the period of 1982-1986 NMTC conducted 45 courses with 1103 students enrolled of which 1043 were passed. An additional 15 courses were scheduled for 1987.

These courses included basic and refresher courses in malariology/entomology and microscopy. NMTC is to be commended for having the flexibility to meet the special needs of the program by providing such courses as: safe use of insecticides, malaria control for health officers, monitoring of drug resistant malaria and urban malaria control. A listing of all courses conducted by NMTC from 1982-1987 is given as Annex 8.8.

The NMTC has operated under the dual handicaps of moving from an inadequate facility to another inadequate facility and the uncertainty for all personnel inherent in a reorganization and transfer of functions which has been pending for the past two years.

Although the project objectives in terms of providing training have been met, the objective of providing adequate facilities for training has not yet been met.

3.7.2 Participant Training

3.7.2.1 Short Term Training

The Project Paper (PP) called for up to 18 man-months of training for as many as 18 participants. Training was to be provided in management/administration, epidemiology, entomology, health education, and teaching methodology.

Short term training was achieved for a total of 19.2 man-months for 39 participants. 4 participants were enrolled in a training course for 2 weeks of a 8 weeks course on Comprehensive Vector Control at the University of South Carolina. The others had 2 week observations tours - 6 in Malaysia and 29 in Thailand. None of the training covered the subjects called for in the PP.

WHO training fellowships during the same period included short-term courses on biological control, drug testing, training of trainers, attendance at professional meetings, alternative methods of malaria control, containment of P. falciparum and malariology (senior professional course).

3.7.2.2 Long Term Training

Although no long term training was provided for in the PP, it was recognized that there was a need for long term

professional training abroad and two 2 year fellowships were made available, but suitable candidates have not yet been nominated.

WHO supported an MPH candidate who received his degree in 1982 and an MSc candidate who received his degree in 1984.

3.8 Research

The Project Paper (PP) calls for the conduct of operational research by the NMTC in collaboration with PMRC and for basic research studies on larvivorous fish to be conducted in the Sind.

In spite of the heavy training schedules, the NMTC did succeed in carrying out a series of field research studies as follows: (1) sensitivity of P. falciparum to chloroquine; (2) field trial of larvicides; (3) field trials of adulticides including bendiocarb, malathion and fenitrothion; (4) malaria and mosquito surveys in Model Town, Lahore; and, (5) malaria survey in northern areas.

The basic research studies on larvivorous fish carried out in the Sind in cooperation with University of Sind has progressed as far as screening of promising indigenous species of 5 different genera and some preliminary laboratory testing. No field trials have been attempted as yet.

The original objective of developing an operational research unit and providing adequate facilities for such research has not yet been achieved. The effort to develop malaria operational research capabilities in Pakistan has been disappointing. With the exception of the few field studies listed above carried out by the NMTC, other activities, particularly those involving vector bionomics and behavior have generally not been performed.

Most of the studies carried out by the newly established NIMRT still tend to be long range theoretical or basic research. Although of academic value, there is little promise of pay off in terms of results useable by the MCP in the forseeable future. The few studies with a potential for immediate value to MCP such as insecticide and clinical studies would benefit from closer cooperation and collaboration with MCP.

In spite of general agreement as to the need for and the value of applied field research to meet the needs of the MCP, there have been inordinate delays in meeting this objective. The reason for this may be attributed to the unresolved dispute of how best to promote the development of operational research capabilities within the MCP. As originally conceived in the project paper, the NMTC was to be augmented by the addition of 9 new positions which would then form the core of an operational research unit; thereby enabling the NMTC to assume the added responsibility for field research as well as for its historic role in training. Prior to its implementation, the GOP with concurrence of the USAID, acquiesced to a request from a medical research field unit of the

University of Maryland based in Lahore, the Pakistan Medical Research Center (PMRC), for funding from the Malaria Control II project allocations to support its redirection from general medical to malaria studies. The agreement between the GOP and the University of Maryland was signed on 12/15/83 which promised $3.2 million out of Malaria Control II funds. A separate agreement was signed by the University of Maryland and AID/W on 9/13/1983 which committed $0.4 million of central AID funds to support its field unit in Lahore. Along with the new source of funding and changes in its primary mission, the PMRC also underwent a change in its designation to the International Center for Medical Research and Training (ICMRT). In the meantime, on 5/7/84, the GOP finally sanctioned the creation of 9 posts for the operational research unit to be added to the NMTC personnel roster giving 6/30/84 as the deadline for the filling of the new vacancies. After more than a full year of operation, the ICMRT was evaluated in June, 1984 by a 5-member team sponsored by the USAID Mission*. The team found that the major weakness of the ICMRT was the lack of malariology expertise in its senior staff and that "of the Center's present or proposed activities, approximately a third to a half have the potential of being useful to the MCP".

Based on the results of the report, the USAID terminated its funding to the ICMRT on 5/15/85, and reallocated its support to the National Institute of Malaria Research and Training (NIMRT) effective on 5/16/85. In the nearly 2 years since it was created, the NIMRT has been confronted with a series of problems which have greatly hindered any possibility for the Institute to make useful contributions to the malaria control effort. These problems include:

1. The NIMRT was established as an autonomous organization within the Ministry of Health but not as part of the MCP. Compounding the problem was the lack of a mechanism to provide technical supervision to ensure that the activities of the institute would be fully responsive to the needs of the MCP.

2. It has functioned without a permanent director.

3. Its inexperienced senior staff has yet to receive training in malariology.

4. The merger of the NMTC and NIMRT staff, ordered by the Ministry of Health in February, 1987, has not been harmonious due to the disparity of generally higher grades in comparable NIMRT personnel.

3.9 Integration of the MCP into the General Health Services

During the period under review, the integration of the MCP into the general health services was administratively completed.

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* An evaluation of the International Center for Malaria Research and Training (ICMRT), Lahore, Pakistan. June 17-23, 1984.

In Sind the MCP had at the district level been integrated with the general health services as early as 1974, but the re-organisation left the Provincial Chief of the MCP, until today, with functional control over the program only. The Punjab the MCP was together with other vertical programs integrated into the general health services in 1977. In Baluchistan and NWFP the MCP continued more or less as vertical programs till July 1985 when the MCP in all provinces was integrated into the general health services.

In relation to the future implementation of the MCP, the new organisation of the health services in the various provinces shows some marked differences.

The abolition of the post of malaria superintendent at the district level who in NWFP and Punjab has been or will be replaced by a CDC officer created considerable problems in NWFP where it is attempted to recruit medical officers into these posts. In Punjab these problems were avoided by the recruitment of non-medical personnel/transfer of former malaria superintendents as CDC officers. In Sind the malaria superintendent post at district level was maintained, but the planned MCP activities are severely hampered by recurrent budgetary constraints. In Baluchistan the majority of the districts will have starting this year a malaria superintendent on their staff for the first time.

While the administrative integration of the MCP into the general health services is a step in the right direction, it can not be overemphasised that it is a very first step only.

The possibility of the utilization of MCP personnel for unrelated tasks has unfortunately been proven to be very real, whereas a genuine functional integration of malaria field operations is still in its infancy.

Training of staff and personnel who have assumed new responsibilities in the implementation of the MCP has been initiated or is being planned, but a tremendous re-orientation exercise has yet to be accomplished before the integration of the MCP into the general health services can be considered to have been successfully completed.

3.10 Health Education

During the life of the project, health education activities were expanded through radio utilizing regional languages and dialects and through distribution of posters. Primary objective was to promote better acceptance of house spraying and surveillance activities. Although some improvement resulted, cooperation on the part of the villagers is still a problem.

3.11 Malaria in Afghan Refugees

The reported incidence of malaria in Afghan refugees continues in the NWFP province to be significantly higher than that in the local population living in the surrounding areas. So was the SPR

among refugees attending their camp clinics in the province of 22.2% in 1985 and 25.1% in 1986 whereas the SPR in people visiting government health posts (PCD) was 10.5% in 1985 and 13.4% in 1986.

The difference is the more surprising as the refugee camps are under indoor spraying coverage, whereas a substantial part of the houses of the local population are not, and the malaria incidence given for the latter is even somewhat inflated by refugees visiting nearby government health facilities.

Among reasons commonly given for the higher malaria incidence among Afghan refugees is the possibly higher endemicity in their places of origin together with the rather continuous influx of Afghans. Data showing whether infections found in refugees are imported or due to local transmission is not readily available.

Alternative reasons for the higher malaria incidence could be:

1. The shortage of domestic animals (cattle) in camps, which could reduce the contact between man and the highly zoophilic malaria vectors. In many camps it would unfortunately be impossible to feed cattle.

2. A heavy reliance on the camp clinics and consequently less self medication, which is thought to have reduced the SPR found in the local population.

3. Different standards of malaria microscopy and/or indoor spraying, which are carried out under the Refugee Health Sector authority independently of the provincial health services. In this connection, particularly an arrangement for cross checking of blood smears collected under the Refugees Health Sector authority by the provincial MCP laboratory is suggested.

The situation in Baluchistan is different in so far as the Refugee Health Sector microscopists have been trained by the provincial MCP. Whether the malaria incidence among refugees in this province is higher than among others is unknown and may be difficult to determine as the latter include beside genuine local population, various groups of immigrants especially from Sind and Afghanistan.

IV. RECOMMENDATIONS

The team has reviewed the GOP malaria control planning document PC-1 form and is in general agreement with the strategy proposed in this document. The team recommendations for improvement of the program are as follows:

The scope of work for the evaluation team stresses the need to reappraise Pakistan's continued heavy reliance on insecticides for vector control as its chief tool for malaria control, instead of developing a

strategy of multiple tools with particular reference to parasite control through case detection and treatment and other alternative means to reduce malaria transmission potential.

4.1 Use of Insecticides

The 18th Report of the WHO Expert Committee on Malaria states (on page 66 para 1.5.5) that, ".....Vector control is still and will remain for some time, one of the primary weapons to control malaria in many endemic countries.....the use of insecticides still remains the most practical and widely used method for malaria vector control."

It is generally accepted that as long as the mosquito vector is susceptible to the insecticide, residual spraying based on epidemiological stratification is the most cost-effective method of malaria control. This is true even with the more expensive insecticides.

Whenever it is necessary to substantially reduce malaria rates or maintain malaria at a lower level in large areas that are highly vulnerable and receptive, residual spraying is the method of choice. There are no cost-effective alternative methods available at the present time.

The future strategy of the role of indoor spraying with residual insecticides should be based on the following considerations:

1. Recognition that while this method is the most effective to control high rates of malaria transmission, it is also the most expensive. Long term planning therefore must anticipate that sometime in the future, the GOP may have to expend some $10 million of her foreign exchange per year, based on present cost of insecticide, if the current reliance on insecticide to control malaria is to continue.

2. Gradual reduction on its dependence will ensue if the following are implemented:

1. Base the selection of localities to be sprayed on the strict application of criteria already established by the DOMC and if required, modify them to meet future contingencies.

2. Improve the efficiency of spray operations in order to make the best use of the costly insecticides.

3. Recognize that until there is a major breakthrough in the development of alternative/supplemental methods, that the reduction of the parasite reservoir through efficient case detection and treatment is the only feasible means besides house spraying which has the potential of controlling malaria. Thus the efficient development of a reliable surveillance system should exert a significant impact on lessening the reliance on house spraying as the primary malaria control method.

4.2 Operational Entomology

4.2.1 Spray Operations

Safety measures for spray operations must include (1) documented cholinesterase testing for all spraymen (only partial records were available); (2) proper protective equipment (complaints about poor quality protective clothing and lack of proper measuring equipment for insecticide formulation were mentioned to the ERT); and (3) for proper supervision, house cards should be used.

More emphasis on supervision of spraying activities by the malaria supervisor is recommended for the purpose of improving the quality of the spray job. In regard to daily wages and TA/DA, the team understands that the current salary for a sprayman, as low as Rs 20/day, as well as the TA/DA for malaria supervisors, Rs.35/month, and assistant malaria superintendent, Rs.45/month to cover fuel and all expenses, are not adequate. Furthermore, in Sind province lack of funds for paying salaries led to a system where villages were required to pay their own spraymen. There should be no doubt that these problems handicap the MCP effort by producing supervision failures and reducing motivation and work quality. It is recommended that distribution of insecticide to the provincial governments be contingent on a demonstrable effort on their part to correct these problems.

Urban centers such as Lahore, and Karachi are carrying out limited entomological activities. However, the routine collection of entomological data to support control operations is not occurring. While malaria is normally a disease of rural areas, the Karachi epidemic of 1967 provides clear evidence that urban malaria can be a problem. The mosquito vectors of dengue and Japanese B encephalitis also breeds in urban and peri-urban foci in Pakistan. Organized larviciding and ULV exterior space treatment would be effective deterrants to these as well as the malaria problems. Therefore, additional support in terms of operational training (instruction use of ULV machinery, larviciding, control of urban mosquito problems), and technical assistance (spray equipment, vehicles, insecticides) should be made available to the major metropolitan corporations based on compliance with the modified CP of the establishment of functional surveillance systems for malaria by establishment of passive case detection (PCD) posts at selected municipal health facilities with trained staff in place. Urban malaria control programs should also promote source reduction and initiate entomological surveillance programs using light traps and larval density counts.

Finally the team supports the spraying-related recommendations of the 1983 ERT, the last team to actually observe spraying operations, and suggests that a future ERT visit be timed to occur during the spraying cycle. The 1983 recommendations include:

1. That the criteria for the selection of areas to be sprayed are based solely on epidemiologic grounds.

2. That supervisory visits by provincial, district, DOMC, WHO and USAID personnel to spray operation increase.

3. That within one month following the completion of the spray operation all remaining insecticides are collected, stored and accounted for.

4.2.2 Entomology

One objective of the MCP has been the development of a selective approach to spraying coverage based on stratification. In the process of achieving this goal, reliance of the MCP on insecticides can be reduced without a significant increase in malaria. However, success relies entirely on strengthening entomological and epidemiological surveillance and applying the data collected to stratification and, ultimately, to the operational spray plan.

It is recommended that all current entomological surveillance methods, that is resistance testing, resting collections before and after spraying to estimate mosquito density, cone bioassay tests on sprayed walls, exit trap collections and collection/dissection of female mosquitoes to estimate parous-nulliparous ratios be evaluated in light of achieving a selective approach to spraying coverage. Those methods that provide the best information and are realistic in terms of what the assistant entomologist can accomplish should be incorporated into an entomological work plan to be used in all provinces.

Entomological surveillance could be improved by (1) taking repeated measurements in selected index localities; (2) using sprayed and unsprayed areas of equal malariogenic potential to evaluate the impact of spraying on malaria (unsprayed areas with high malariogenic potential could receive increased PCD attention); (3) the use of malariometric surveys in index villages to relate entomological operations directly to malaria transmission; and, (4) the investigation of all focally sprayed (2nd round) localities to determine if they should be included in the operational spray plan for the following year.

Finally the team recommends that assistant entomologists and insect collectors at the district level be supplied with appropriate transportation and TA/DAs to carry out routine field assessment operations. The importance of entomological activities in malaria control programs should be given more emphasis.

4.3 Malaria surveillance

Since approximately 75% of the population is estimated to live in areas where malaria can be kept at an acceptable level of control through the timely detection of cases of malaria and their radical treatment with appropriate antimalarial drugs, it is recommended that the highest priority be given to the further expansion, strengthening and proper functioning of the PCD posts network, and the provision of malaria microscopy at these posts, in order to make malaria diagnostic and treatment facilities available to the people on a continuous basis.

At the same time it is suggested that from areas where PCD is operating satisfactorily, ACD, at least in its classical unipurpose form, be gradually withdrawn.

4.4 Supplementary/Alternative Methods

In terms of providing protection from malaria to the population in highly malarious areas, there is no cost effective method currently available to replace spraying of residual insecticides. However, there are supplementary methods some of which have been in use since the early 1900s and which in some cases substantially reduced malaria long before the "DDT Era."

Although these methods are generally too expensive to use on a country wide basis, there may well be certain situations where a supplementary method may become a method of choice.

4.4.1 Biological control

4.4.1.1 Larvivorous Fish

Mass rearing and distribution of larvivorous fish for control of mosquito larvae has been used as a biological control method since the early 1900s and has been utilized routinely as a supplementary method in many malaria control programs such as Iran, India and Thailand in this region. The use of larvivorous fish cannot be expected to bring about a substantial reduction of malaria as a sole method. However, under certain circumstances such as restricted breeding habitat for the vector mosquito, ready access of the fish to the larvae and a low level of malaria transmission, a combination of methods including use of larvivorous fish could reduce the risk of malaria.

The first step in determining how, when and where this method could be utilized in the Pakistan Malaria Control Program has already been started in Sind with the screening of potentially useful species of indigenous larvivorous fish. This screening and laboratory testing should be continued and extended to field trials as soon as possible.

The trials of larvivorous fish should be subjected to careful epidemiological and entomological evaluation and their use expanded when demonstrated to be beneficial.

4.4.1.2 Other biological control agents

Numerous other biological control agents are in various stages of research and development. Some are still being lab-tested, some have had extensive field trials and a few are in general use for mosquito control. Bacillus thuringiensis (BT) and Insect Growth Regulators (IGRs) such as Altocid have proven to be effective in controlling mosquito larvae in the same way as chemical larvicides but at a much greater cost.

4.4.2 Source Reduction

The engineering methods of drainage, filling, water management and ditch cleaning (weed control) were largely ignored during the "Eradication Era" yet most of the successful malaria control projects in the early 1900s were based on a combination of source reduction and larviciding. These programs were planned by teams which included physicians, engineers and entomologists.

In modern day malaria control programs, the source reduction approach has been largely ignored with only a few exceptions. Most malaria control programs do not consider source reduction a viable option because of the high cost of heavy equipment such as drag-lines, back-hoes, graders and dump trucks. Purchase of heavy equipment by the malaria program is neither necessary nor advisable. Other ministries and departments such as agriculture, public works, irrigation and highways do have such equipment and in many cases they may have the same interest in getting rid of excess water as does the MCP.

Source reduction may well be a method of choice in certain situations in Pakistan, such as water development, irrigation projects and urban areas.

The MCP has the necessary expertise to advise on the mosquito breeding potential of water development projects and the danger of man made malaria resulting from the work of other government agencies. However, the MCP would be in a much better position to push for a mosquito source reduction program in cooperation and collaboration with other government agencies if MCP could provide the services of a source reduction engineer who could advise on the solution of mutual problems of excess water which has a potential for producing malaria mosquitoes. Recruiting and training a source reduction engineer should be included in the manpower development plan.

The first step in determining the feasibility of the source reduction approach in Pakistan is a thorough study of the breeding habits of the malaria vectors in relation to a series of potential source reduction projects.

The next step would be an engineering feasibility study leading to establishment of a demonstration project. It could well be that in some irrigation projects the most valuable source reduction tool would be a hand shovel or hoe.

4.4.3 Larviciding

Control of mosquito larvae through larviciding has been a principal method of mosquito control since the early 1900s. Spreading of oil on water was followed by use of paris green, then pyrethrum and since World War II by the use of a series of synthetic insecticides including chlorinated hydro-carbons, organo-phosphates, carbamates and more recently biological control agents such as bacteria (BTI) and insect growth regulators(IGRs).

Larviciding has had limited use in malaria control/eradication programs. It cannot be considered as a viable alternative to residual spraying of houses in terms of bringing down malaria rates on a country wide basis. The cost of larviciding enough sources of the two vector species in Pakistan to have an effect on the malaria rates would be more than any country could afford.

However, there are situations in Pakistan where larviciding combined with source reduction could be expected to reduce malaria incidence over a period of time. Water development/irrigation projects, urban areas and large towns or even villages where there are a limited number of vector mosquito breeding sources are all examples of situations where this approach could be successful in reducing the risk of malaria.

In order to have an impact on malaria, however, the most cost effective larvicides (based on field testing) should be used, but only where pre-treatment inspection demonstrates the presence of anopheline larvae. Post-treatment inspection should also be carried out as a routine evaluation of effectiveness.

4.4.4 Space spraying

Thermal aerosol, cold fog, mist blowers and ultra low volume machines have been used for mosquito control since World War II. The method provides for the use of a highly concentrated insecticide in a very small volume of material which is dispersed as extremely fine droplets which are propelled through the air or are carried by a light wind. In order to be effective in killing mosquitoes, space spraying must be done in the right place, at the right time and under the right weather conditions. If there is too much wind, the material will be wasted. If there is no wind, the range will be limited. If it is too hot, the material will go straight up in the air and be wasted. If the machine is not properly adjusted and maintained, the droplets will be the wrong size and will be ineffective.

The optimum conditions of a light breeze and a temperature inversion to keep the material from floating upwards, will normally be found only for 2 to 3 hours in the morning just before and after sunrise and again in the evening just before and after sunset. Space spraying at any other time is usually a complete waste of time, effort and money.

Primarily because of their proclivity for resting outdoor in vegetation, Aedes mosquitoes are more easily controlled by space spraying than are Culex or anopheline mosquitoes which generally seek more protected hiding places. Consequently space spraying has been widely used in control of dengue-hemorrhagic fever, but to a much lesser extent for control of malaria except in special situations such as urban areas where residual spraying is not possible and in cases of threatened epidemies of malaria.

Because space spraying is spectacular (particularly fogging) and since it attracts a lot of attention, some programs use the method as a public relations tool to convince people that something is being done for them when it really is not. This can be counter-productive if there is a substantial increase of mosquitoes or malaria shortly after fogging. However, the worst feature of political use of fogging is in the development of bad work habits, i.e. space spraying in the wrong place, at the wrong time and under the wrong conditions.

Space spraying in exceptional circumstances can be a valuable supplementary method of malaria control, but only when used in response to a demonstrated need confirmed by entomological evaluation before and after spraying. Probably the greatest potential value of space spraying lies in responding to the threat of epidemics of malaria and other mosquito borne diseases such as dengue-hemorrhagic fever and encephalitis.

4.5 Research

4.5.1 Applied Field Research

Although none of the currently available supplementary/alternative methods of malaria control can be expected to replace residual insecticides and yield comparable results, there is neverthless a proper place for each of them in a well balanced malaria control program. Determining how, when and where each of these methods may be best utilized in the Pakistan malaria Control Program will require an extensive and well organized program of applied field research involving field trials against each vector under local conditions.

Given the history of the development of mosquito resistance to residual insecticides and in view of the current situation in Pakistan, it would appear to be inevitable that eventually all residual insecticides will be useless. This has already happened in parts of Central America and has left no choice but to develop a comprehensive vector control program utilizing all available methods of vector mosquito control combined with an extensive case detection and treatment system relying largely on passive case detection and voluntary collaborators.

Although there are still several alternative residual insecticides available for use in Pakistan and they should be useable for 5 to 10 more years, it is not too soon to start an applied field research program designed to develop an approach to control of malaria in Pakistan that does not rely on residual insecticides.

Presumably the present dilemma in connection with the merger of the NMTC with the NIMRT and the arrangements for a permanent facility will soon be resolved. Once this is accomplished, high priority should be given to the rapid development of an applied field research program that is designed to meet the needs of the Pakista Malaria Control Program. The Applied Field Research Program should play an essential role in the development of a future strategy for control of malaria in Pakistan. The team offers the following suggestions for insuring that the applied field research program meets the needs of the MCP:

4.5.1.1 It is suggested that priorities for applie field research be established in cooperation with DOMC and Provincial Malaria Officers.

4.5.1.2 Priorities should include, but not be limited to the following subjects:

(1) Improvement of the spray program and more efficient use of residual insecticides;

(2) Improvement of case detection and treatment;

(3) Testing of alternative residual insecticides;

(4) Field testing and evaluation of supplementary methods of vector control including source reduction, larviciding, space spraying and biological control;

(5) Vector bionomics

(6) Drug resistance studies;

(7) Studies on feasibility of community participation for malaria control.

4.5.1.3 It is recommended that the review mechanism for research proposals and protocols include DOMC and Provincial Malaria Officers.

4.5.1.4 It is recommended that external assistance be sought for the organization and conduct of a course on applied field research to cover preparation of research proposals and protocols.

4.5.1.5 It is recommended that a mechanism be established to insure prompt dissemination of research results to DOMC and the Provincial Malaria Officers.

4.5.2 Basic Research

Long range basic research is generally considered to be the task of universities and research organizations such as the National Institute of Health (NIH). This does not preclude the involvement of NIMRT in a limited amount of basic research, preferably in collaboration with NIH or a university. However, this type of research should be accorded a lower priority and should be of such a nature that positive results would contribute to the objectives of the MCP.

A positive contribution which NIMRT could make to long-range basic research on malaria would be collaboration with MCP in developing a priority listing of potential research subjects suitable for university research leading to an M.Sc. or Ph.D. thesis. Malaria research subjects suitable for NIH or other research organization grant proposals should also be identified. It would be appropriate for NIMRT to collaborate on a limited number of such projects as long as it did not interfere with the primary objective of pursuing applied field research for the benefit of the MCP.

4.6 Malaria Control in the context of Primary Health Care (PHC)

It is envisaged that the gradual expansion of a functional PCD cum malaria microscopy network towards the periphery will bring the lab. technician capable of malaria microscopy in due course down to the BHU level, where a PCD facility will be available as well. Mobile teams like the Health Outreach Teams in the Punjab, can extend the case detection coverage further to the village level, although only intermittently. A fully satisfactory PHC service will only have been established once there is a static health worker at the village level, whose primary tasks in the field of control of malaria should include the collection of blood smears from fever cases and suspected cases of malaria, the administration of presumptive and radical treatments and the collection of bloodsmears from malaria cases for followup. Other tasks would include:

- the promotion of acceptance of indoor spraying where applicable,
- the referral of seriously ill patients to the BHU,
- the promotion and introduction of personal and community protective measures against malaria, as appropriate, and
- the notification of environmental changes which are likely to increase the malariogenic potential of the locality.

It is envisaged that these village health workers, like in many other countries, will be volunteers recruited from the villages concerned. It is suggested that in each of the provinces an area be

selected where this PHC approach will be introduced and subsequently monitored with the purpose of arriving at a set-up which would fit best under the local conditions.

4.7 Re-orientation and support of Health Education

Progress has been made during the period under review with strengthening the health education component of the program. Emphasis has been put on acceptance of spraying and surveillance operations.

It is suggested that in the years to come health education be gradually more oriented towards an understanding of the program and program objectives and consequently towards a more active participation of the communities in MCP activities. In the further dissemination of information on malaria and the MCP, the cooperation of the education department could play an important role.

Health education efforts are still concentrated on gaining better acceptance of house spraying and case detection and treatment. More support for the health education program in the field is needed in the form of new and different audio-visual aids. It is difficult to attract the public with the same old motion pictures year after year. A new motion picture, made in Pakistan and depicting the current approach to malaria control, would be of great value. Other techniques also should be used such as flannel-board or flipsheet talks, color slide shows, and cassettes for tape recorders using the voices of nationally or locally known political leaders, movie stars or sports heroes.

In view of the changes taking place in the MCP in relation to health services and the current plans for development of primary health care, it is recommended that the malaria health education program be re-oriented and expanded to reflect these changes and that coverage be given to community participation and village self-help with an emphasis on those things that villagers can do themselves to reduce the risk of contracting malaria.

4.8 Training

4.8.1 In-service Training

The team commends the NMTC for doing an excellent job of providing appropriate basic and in-service refresher training to meet the changing needs of the MCP in spite of numerous handicaps.

4.8.2 Participant Training

Since the PP objectives were not met and in view of the critical technical manpower shortage it is recommended that a concerted effort be made to recruit, train and retrain professional personnel in the fields of epidemiology, entomology, administrative management, health education, training and research.

4.8.3 Training Facilities

In view of the importance of training and the need to avoid any interruption in the conduct of courses already scheduled for the future, resolution of the problems of merging the NMTC with the NIMRT and of location and up-grading of the facilities is critical to future success. The team urges consideration and resolution of these problems without further delay.

4.9 Drug Treatment

4.9.1 General

The current practice of radical treatment administration appears inefficient and unreliable. This very important procedure should be standardized as follows:

1. Radical treatments should be dispensed in individual daily dosing packets. The daily dosing packets for individual patients should be stapled together as a single radical treatment. For this purpose, we recommend that USAID procure sufficient plastic envelops to meet the needs of the MCP for at least the next five years.

2. The MCP should ensure that at least the first dose of the radical treatment be taken by the patient in the presence of the supervisor.

3. If the patient is not at home at the time of the treatment visit, every effort must be made to return when the patient is expected to be home. Except in the most unusual of circumstances, treatment packets should not be turned over to anyone except the patient.

4.9.2 Treatment of Vivax Malaria

1. Evaluations should be carried out to determine the efficacy of a presumptive dose of chloroquine (10 mg/kg) as a clinical curative regimen in patients infected with P. vivax. Results of such evaluations would have obvious implication for decisions on whether or not to administer radical treatment.

2. In addition, the MCP should assess the rate of radical cure (absence of future relapses) in vivax infections treated with the five day regimen of primaquine.

4.9.3 Treatment of Falciparum Malaria

1. The ERT endorses the addition of a single dose of primaquine to the presumptive treatment as is the current practice in some problem districts of the Punjab. We suggest that other provinces confronted with similar problems such as many of the districts in the Sind in which falciparum malaria is the predominant species, may wish to follow this practice.

2. The ERT can not over-emphasize the need to minimize the spread of drug resistant falciparum malaria by the use of prompt and appropriate alternative treatments. The procedure devised by the DOMC to deal with this problem by the use of alternative drugs is sound. We agree that the most practical way to implement this strategy is to require a blood smear one month after administration of radical treatment which would promptly identify the infection as being caused by resistant parasites in the event of a positive smear. The importance of this post treatment followup is such that the USAID may wish to consider linking future commodities procurement to the degree of compliance by the districts in meeting the monthly followup requirement.

3. Since Fansidar remains as the most suitable alternative drug to chloroquine resistant falciparum malaria, every effort must be made to intensify monitoring studies to constantly evaluate its efficacy against local falciparum strains and at the same time educate the medical profession not to contribute to the hastening of resistance development by its indiscriminate and unjustified use.

4. In anticipation of the future failure of Fansidar to treat chloroquine resistant falciparum malarias, the MCP should intensify evaluations of all available alternative drugs.

4.10 Integration of MCP into the General Health Services

The administrative integration of the MCP into the general health services during recent years appears to have been completed. It is noted, however, that there are still a few problems which need to be resolved for ensuring a proper implementation of MCP field operations.

Foremost among these is the fact that under the present set-up in Sind province, the office of the Chief MCP of the province continues to have virtually no administrative control over the program's implementation within the districts.

It is therefore recommended that, as is the case in the other provinces, the provincial MCP office be integrated within the Directorate of the Health Services in Sind in such a way that the provincial Chief MCP will have adequate functional and administrative control over the implementation of the MCP at district level.

MCP field operations in NWFP province were found to be endangered here and there by the abolition of the posts for district malaria superintendents, and an alarming number of vacant posts for CDC officers, who are assumed to replace the malaria superintendents. It is suggested that this matter be given the necessary attention, so that further disruptions in the smooth implementation of MCP field operations can be avoided.

4.11 Geographical Reconnaissance and Stratification

The annual up-dating of GR and stratification is apparently done from the bottom-up, thus utilizing the intimate knowledge of the

local malaria worker of his own territory. Decisions would be easier to make with greater use of maps, particularly maps showing the location of positive cases in relation to sprayed and unsprayed areas for the previous year. Up-dating of stratification would be more meaningful if epidemiological and entomological information relating to receptivity and vulnerability were utilized.

It is recommended that greater use of maps be promoted at the local level. This could be accomplished through a committee representing DOMC and the four provinces charged with the responsibility of recommending standardized use of maps in the malaria program based on political boundaries instead of the artificial boundaries of the malaria eradication program.

It is further recommended that entomological information be gathered and analyzed for the specific purpose of revising and up-dating stratification.

4.12 Urban Malaria

Marked progress has been made in the development of a malaria vigilance organisation in most of the major cities, notably in Karachi, indicating that malaria in these urban centers is presently under control.

Monitoring of vector/mosquito density is not being carried out with consistency nor are standard methods of measuring this index in use. The team recommends that in addition to routine larval surveys, monitoring of adult mosquitoes, using relatively simple methods such as New Jersey light traps be considered.

Problems exists however in relation to a number of smaller towns which may have extensive rural outskirts and are particularly in Punjab situated in some of the potentially most malarious districts. These are, wherever indicated, under effective indoor spray coverage with malathion, but as the provincial MCP has no jurisdiction over the towns, their rural outskirts which are probably as malarious as the adjacent rural localities, are not covered.

It is suggested that the necessary arrangements are made for controlling malaria in these outskirts, which are estimated to produce at the moment several thousands of cases of malaria annually.

4.13 Supervision

The 1983 ERT cited inadequate supervision as the primary cause of problems associated with spray operations. Factors that reduced the effectiveness of supervision included (1) diversion of MCP workers (e.g. CDC officers) to EPI activities during the spray cycle; and, (2) inadequate TA/DAs for supervisory staff. During the present visit these complaints were reiterated. A CDC inspector in Punjab estimated that

only one day per week was devoted to supervision activities during the 1986 spray round. Complaints about low TA/DAs and lack of transportation (Section 4.2) were also expressed.

Ways to improve the spray operation are openly discussed, however implementation of these ideas must come from the top levels of the provincial health services. These methods include use of accountability, constant upgrading of training at all levels, increased emphasis on planning strategies and data collection for epidemiological and entomological surveillance and the use of surprise inspections.

The team heard that spray cards for houses, an important supervision aid, were eliminated from the MCP because they were viewed as being too efficient a measure of checking on the performance of spray teams. Successful malaria control, as pointed out by the ERT in 1983 "requires unflinching determination at the highest level. Without it, spraymen perform these chores in a perfunctory way and supervisors tend to over reporting". The efficiency of the control program suffers as a result.

Despite the availability of spraying manuals and the presence of a malaria/CDC supervisor during spray operations, it is concluded from the very few observations made by the ERT, that the spraying technique and coverage is here and there considerably below standard. This is particularly disappointing considering all the preparations and movements one has gone through for bringing the spraymen at the right time on the right spot.

It is suggested that the training as well as the supervision of spraymen, be strengthened where indicated, including the attention paid by higher echelons to the operational evaluation of spray operations (consecutive supervision).

4.14 Evaluation of Indoor Spraying Operations

There are virtually no data on the epidemiological evaluation of the indoor spraying program. In view of the cost involved in this program, the team wishes to reiterate the recommendation of the 1985 ERT that the reporting of the number of malaria cases detected in the district, province and country through the various mechanisms would be considerably more meaningful if they are recorded for sprayed and unsprayed localities separately.

As the malaria year in Pakistan starts around 1 July, cases found during the first half of the year are largely if not exclusively due to the transmission which occurred in the previous year, and should therefore be listed as occurring in sprayed or unsprayed areas dependent on whether the locality was sprayed or unsprayed in the preceeding year.

The more elaborate method of epidemiological evaluation of indoor spraying operations through serial parasite surveys in selected locations should be kept in reserve for areas where there is evidence that the spray operations are not producing the expected results.

V. UNMET NEEDS OF THE PROGRAM IN RELATION TO POSSIBLE EXTERNAL ASSISTANCE

5.1 Training

The major unmet need is for resolution of the problem of provision of new facilities and the merger of NMTC with NIMRT.

A second unmet need is for provision of the newest and most appropriate equipment and materials available for teaching. This should include projectors, screens, film strips, slides, training films, teaching microscopes etc. The National Malaria Training Center in Thailand is a good example of a well-equipped training center.

The further development of the PCD organisation suggested under paragraph 4.3 above would entail a massive orientation and training program on the objectives and techniques of the methodology for all officers concerned.

As noted earlier some orientation and training for DHO's and ADHO's, officers-in-charge of health institutions and technicians who will be involved in the actual collection of blood smears and their microscopical examination have been initiated by the NMTC some time ago.

In order to expedite and facilitate this activity on a country wide basis including the expansion of malaria microscopy to more peripheral PCD posts, it is anticipated that external assistance may be available to the MCP for carrying out this huge training task as well as for the provision of the necessary laboratory supplies and equipment for the peripheral laboratories envisaged to be subsequently involved in malaria microscopy.

5.2 Research

The obvious primary unmet need is for the provision of adequate permanent facilities and equipment for the conduct of research. Since the emphasis should be on applied field research it is recommended that in addition to the main research building, consideration be given to the establishment of field research stations in each province or where needed with a small laboratory, office and equipment storage room.

A second unmet need is the training or re-orientation of all personnel involved in research on the design and conduct of applied field research projects. Since the emphasis is on field research, adequate transportation must be provided.

An additional unmet need of importance to both training and research is updating of the library at NIMRT. Subscriptions to scientific journals have lapsed and should be reinstated and back issues purchased. Subscriptions should be taken out for the most appropriate American, European and Asian scientific journals. The most appropriate text books and scientific treatises published in the past few years should also be purchased.

5.3 Transport

The vehicles in use during the current MCP include 4-wheel drive station wagons, jeeps, motorcycles and bicycles. The majority of the station wagons and jeeps are at least 10 years old. However, in 1980, 15 pick-up trucks, 6 jeeps and 5 sedans were purchased with funds from the Government of Japan. The motorcycles were purchased in 1979 and given on an ownership (installment) basis to assistant malaria superintendents at (sub-sector level). These motorcycles are now paid off and the owners resent having to use them for official business. No record on bicycles, the means of transportation used by the malaria supervisors who administer spray teams, was available.

The MCP II did not procure new vehicles for rural spray operation. Money to procure 50 urban malaria control vehicles for use with ULV machines was included in the project. However, few urban areas qualified for this assistance due to inability to meet current CP.

The specific output indicator for vehicles states that the total vehicular fleet off-the-road for repairs will not exceed 10%. Table 9, compiled in 1986 shows that the current situation with regard to vehicles is much worse.

TABLE - 9 - PERCENTAGE OF MCP VEHICLES CURRENTLY IN REPAIR OR NONREPAIRABLE STATUS

Province	% Off the Road	Total Number in Repair or Non-repairable
Punjab	95	(92/99)
Sind	53	(17/32)
N.W.F.P.	78	(32/41)
Baluchistan	46	(16/35)

The majority of these vehicles are probably 10 or more years old. Given that the average life of a malaria vehicle is 5 years, the number of off-the-road units is understandable.

Clearly any new initiative to support malaria control will have to include sufficient funds to replace the majority of the MCP vehicles.

5.4 Spray Equipment

The PP requires assessment of and recommendations on the condition and maintenance of spray equipment. Table 10 summarizes the current status of Hudson and Expert sprayers, which are used to do residual wall spraying.

TABLE - 10 - HUDSON SPRAYERS : SURVEY OF NEEDS AND ON-HAND STOCK BY PROVINCE, 1986

Province	Needed[1]	Functional	Broken/ repairable[2]	Broken non-repairable
Punjab (Kasur Dist)	838	344	203	296
Sind	5553	3553	700	1300
N.W.F.P.	400	200	50	150
Baluchistan	600	300	100	211

1. Based on estimated number of spraymen.

2. Most commonly mentioned problems:

- Rubber gaskets needing replacement.
- Collapsed cylinders (tube adaptors).
- Nozzle tips plugged.

During the current project, 5,000 (8 liter size) Hudson sprayers and 40,000 nozzles were procured. In the preceding project (1975-1980), 11,394 Hudson units, 1,394 Expert sprayers, 55,000 tube adaptors and 30,000 nozzle tips were purchased. Therefore, the equipment listed in Table 10 indicates that most are probably at least 10 years old and will need to be replaced.

Purchase of new spraying equipment should be contingent on a commitment by the DOMC/each provincial government to supply two uniforms/sprayman, rubber gloves for mixers, three buckets (for mixing insecticide)/team, standard containers for measuring insecticide, funnels for straining suspended insecticide, and adequate amounts of soap and atropine.

The MCP II included funds for the purchase of 50 pickup mounted ULV spraying machines. However, none of these were ordered because of a CP which was not met (see Section 3.3).

Because An. stephensi, the vector associated with urban malaria is endophilic, the impact of exterior space treatment with ULV on malaria is problematical. However, proper ULV spraying could reduce the density of Aedes aegypti, an urban mosquito that carries dengue. Therefore, purchase of such equipment would be beneficial from the standpoint of vector control.

Larviciding may also be a useful antivector activity in urban/semi urban areas where breeding sites are limited. Purchase of sprayers and nozzles for this activity should be considered.

5.5 Microscopes

The additional need for microscopes has been referred to under 5.1.

5.6 Insecticides for Larviciding and Space Spraying

Larviciding is advantageous in antimalaria programs for urban areas where indoor residual spraying is not practical and where breeding sites are relatively limited in number and size. The effectiveness of larvicides depends greatly on the quality of the water treated varying from weeks to only days. Therefore higher dosages are required for treating polluted water. Most oils used in larviciding are refined. However, due to increased cost and limited effectiveness its use has declined. In most cases larviciding must be repeated every 10-14 days. Practical training, proper equipment and use of the correct insecticide are essential. Without these components, larviciding will accomplish very little.

The PC-1 Malaria Control Project document of the Planning Commission for 1987-1993 discusses strategy for future urban malaria control. This blue print places emphasis on engineering improvements in urban drainage (source reduction) and PCD with space spraying as a supplemental measure for areas that cannot be dealt with by source reduction methods.

An important unmet need is support for this comprehensive program. The ERT also recommends that an engineer be assigned to the malaria control project in order to reinforce the source reduction approach. WHO has provided this service in the past however, at present no individual is assigned these responsibilities. Cities and towns having more than 20,000 population are included in the urban malaria control plan of the PC-1. Under this plan, there will probably be a greater emphasis on spraying in smaller localities where expensive source reduction projects are unlikely to be funded. The unmet needs of this program are a source of funds for training, source reduction equipment, sprayers, larviciding nozzles, equipment for spraymen and insecticides.

Exterior space treatment may be useful during malaria epidemics, and for control of exophilic vectors such as Aedes aegypti. Treatments are required on a weekly or less frequent basis during the transmission period. There are funds available in the current MCP for purchasing 50 ULV machines plus trucks to transport them. Authorization to procure this equipment is controlled by a CP and should continue to be contingent on the development of functional systems to monitor malaria incidence.

Tables 2 and 3 in the WHO publication "Chemical Methods for the Control of Arthropod Vector and Pests of Public Health Importance", WHO Geneva, 1984 list candidate insecticides for larval and exterior space spraying activities. Funds to procure sufficient amounts of these insecticides is an unmet need that all future programs will have to deal with. The quantities of insecticides required are estimated in the PC-1 document.

5.7 Health Education

A major unmet need is the training or re-orientation of the health educators towards the current reality of malaria as a part of

health services and the future direction of malaria in the context of primary health care with an emphasis on community participation and self-protection. Training should also be given on the use of a wider variety of audio-visual aids.

The second unmet need lies in the provision of audio-visual aids including color slides, slide projectors, cassette tape recorders and new movies.

VI. MAJOR PROBLEMS INTERFERING OR WITH A POTENTIAL FOR INTERFERING WITH FURTHER PROGRESS IN THE CONTROL OF MALARIA IN PAKISTAN

6.1 Lack of funding for support of field program at the local level

The MCP is supported by Federal and Provincial funds. In general there are no serious financial difficulties with the implementation of the antimalaria program that is annually agreed upon by the health authorities concerned in consultation with USAID and WHO, except for the funding of the program in the province of Sind, where the planned activities have repeatedly not been carried out because of cuts in the budget made available for the MCP.

It is recommended that this matter be brought to the attention of the proper Government authorities for an urgent solution.

6.2 The scarcity of technical manpower

The shortage of qualified and experienced senior officers in the MCP, as malariologists and medical entomologists is another matter of great concern.

It is recommended that highest priority be given to a search for promising candidates who would after appropriate training and experience here and abroad, be available for future senior positions in the MCP.

6.3 Training and Research

Training and research are given the highest priority in most malaria control programs of the world today. Pakistan should be no exception. A vigorous applied field research program is essential to insure continued effectiveness of the malaria control program in Pakistan and is vital for reduction of dependence on expensive insecticides. In view of the lack of technical manpower, the turnover of personnel and the changing needs of the program, training is equally important.

Further delays in resolution of the problems impeding development of the Training and Research program will have far-reaching effects on progress towards better control of malaria in Pakistan.

6.4 Technical Problems Confronting the Program

6.4.1 Chloroquine resistance in P.falciparum

While this problem appears to still be a limited problem in the country, it is realised that further studies are required to determine its exact magnitude, and subsequently additional antimalaria measures including the use of alternative antimalarial drugs and vector control measures to check the further spread of chloroquine resistant strains.

6.4.2 Resistance of vectors to insecticides

Although malathion which is presently used as the insecticide for indoor spraying appear to be in general still effective in checking the transmission of malaria by major vectors, it is noted with concern that these vectors have been found to be increasingly less suspectible to this insecticide. This may necessitate in due course a switch to an alternative insecticide. In the meantime the situation has to be closely monitored.

VII. ACKNOWLEDGEMENT

The team wishes to acknowledge with sincere appreciation the assistance, courtesy and hospitality extended at every provincial, district or local office visited by the personnel of the malaria program and the general health services. The 38 times the team was provided with tea or refreshments testifies to the generous hospitality received in the field.

A special word of thanks is owed to those who accompanied the team and provided information, assistance and support all along the way. Special thanks to Dr. William Chin, Dr. Rifaq Ismail, and Mr. Babar Hussain all of USAID/Pakistan.

The team would also like to express appreciation to Ray Martin, Chief/Health, Population and Nutrition, USAID/Pakistan and Dr. Imtiaz Hussain Shah, Director, DOMC for their efforts in organizing and supporting the evaluation. We would also like to thank Mr. Mohammed Yawar Jan of USAID who struggled valiantly in his efforts to decipher the handwriting of the team members and who put in many hours of overtime in typing the report.

VIII. ANNEXES

8.1 TERMINAL EVALUATION OF THE MALARIA CONTROL II PROJECT (391-0472) - EVALUATION - SCOPE OF WORK

I. Activity to be Evaluated

The Mission requests terminal evaluation of the Malaria Control II Project. The Project was authorized on May 19, 1982, with life of project funding of US $41 million and Rs.21 million (approximately US $2 million) in Mondale rupees and Project Assistance Completion Date (PACD) of September 30, 1987.

II. Purpose of the Evaluation

Since the PACD of the project is September 30, 1987, the purpose of this assignment is to conduct a terminal evaluation of the project. Objectives are to evluate the progress of the Project from authorization to date, and to assess to what extent it has contributed in attaining Project objectives as outlined in the Project Paper. The evaluation will assist Mission management in identifying continuing or new problems which could be addressed in the design of a possible extension to the Project. This terminal evaluation may also assist in making appropriate modifications in objectives and implementation techniques and provide quidelines for future malaria control strategies in Pakistan.

III. Background

The project was designed to assist the Government of Pakistan (GOP) to implement its malaria control program from 1982 thru 1987. The previous AID-assisted malaria project which ended in 1980, was successful in achieving an annual parasite incidence (API) of .5 case per thousand or 500 cases per million population. The current project was built on achievements of the previous project by assisting the Government of Pakistan (GOP) to contain or further reduce the incidence of malaria by expanding the capacity and increasing the capabilities of federal, provincial and municipal health services to effectively control malaria. The Project was designed to assist Pakistan Malaria Control Program from a vertcally organized program, emphasizing total coverage house spraying and active case detection surveillance, to an integrated program utilizing a selective mix of vector control measures and a better balance between active case detection and passive case detection and treatment methods.

IV. Scope of Work

The evaluation team shall review the efforts made from the date of project initiation i.e. May 19, 1982 with a view toward identifying progress made in accomplishing project objectives and key factors contributing to this progress. The evaluators shall also identify major problems encountered in meeting project objectives, and develop recommendations for possible new approaches. The evaluators

shall also review the heavy reliance of the Government of Pakistan on spraying of insecticide for malaria control, and recommend appropriate ways and means to reduce it as a long range goal.

The terminal evaluation shall include but shall not be limited to:

1. Assess the progress of the Malaria Control II Project (391-0472) as compared with project objectives and outputs as outlined in the Project Paper.

2. Review current operational strategies and program in Pakistan's Malaria Control Program assisted under the Project and advise regarding effective modification or continuation. In particular, reappraise Pakistan's continued heavy reliance on insecticide for vector control as its chief tool for malaria control, instead of developing a strategy of multiple tools with particular reference to parasite control through case detection and treatment and other alternative means to reduce malaria transmission potential.

3. Identify areas of unmet needs by the current Project and indicate areas in the Pakistan Malaria Control Program where further USAID assistance would be most useful and effective.

4. Review current problem of chloroquine resistant P. falciparum malaria and recommend measures to address the problem.

5. Review malaria surveillance operations in passive case detection system of the current integrated health services, active case detection and laboratory services for its effectiveness and recommend methods for its improvement to provide reliable picture of malaria case load in the country.

6. Evaluate operational research conducted by NIMRT and NMTC and recommend measures to strengthen their research capability, including appropriate future research topics.

7. Evaluate status of incountry training and long term training supported by the Project to develop local expertise in malariology and recommend necessary modifications or continuation.

8. In view of the above analysis, make concrete recommendations regarding the future scope and direction of AID's involvement in malaria control in Pakistan.

V. Team Composition

1. A malariologist.
2. An entomologist.
3. Malaria epidemiologist (to be provided by WHO.

The team will be assisted by resource persons including Dr. William Chin, long-term advisor and Dr. Rifaq A. Ismail, Project Officer/MCP II. In addition, Mr. Ray Martin, Chief/HPN and Dr. Imtiaz Hussain Shah, Director, Directorate of Malaria Control (DOMC), entomologists and epidemiologists and officials of federal and provincial health and malaria control program will also act as resource persons. The evaluation work will take no more than 25 working days to complete, which will involve working in the field in all the four provinces of Pakistan for at least three working days in each province. O/HPN will assign the long-term advisor and a representative from its office whereas GOP will assign two officials to assist the evaluation team to accompany on field visits. Assistance in locating necessary data will be provided jointly by USAID and GOP. Secretarial assistance in the typing of the report will be provided by USAID.

VI. Format of the Report

The final report shall contain at a minimum the following sections:

1. Basic project/program identification sheets.

2. Executive summary of not more than three single spaced pages reviewing major findings, conclusions and recommendations.

3. Main report, which reviews and analyzes the questions raised in the Statement of Work and concludes with a list of conclusions and recommendations regarding possible USAID interests in malaria control during the post 1987 period.

Annexes which include as a minimum:

1. The evaluation scope of work.

2. A bibliography of individuals and sources consulted.

3. A completed evaluation summary in the format provided by AID/W.

4. Field data presented in summary form.

Ten copies of the final report shall be submitted to USAID/Islamabad for distribution in Pakistan.

VII. Other Requirements

The evaluation shall be completed in not more than four weeks; six-day work weeks are authorized if necessary. Individual members of the team shall make every effort to coordinate simultaneous

arrivals and departure times, to ensure that all members are involved in conducting the evaluation, preparing the final report, and presenting evaluation findings to the Mission and the GOP.

8.2 The Evaluation Team

The Terminal Evaluation Team consisted of the following members:

1. Mr. Edgar A. Smith, Malariologist/Entomologist, USAID (retired).

2. Dr. Willem J.O.M. van Dijk, Malariologist/ Epidemiologist, WHO (retired).

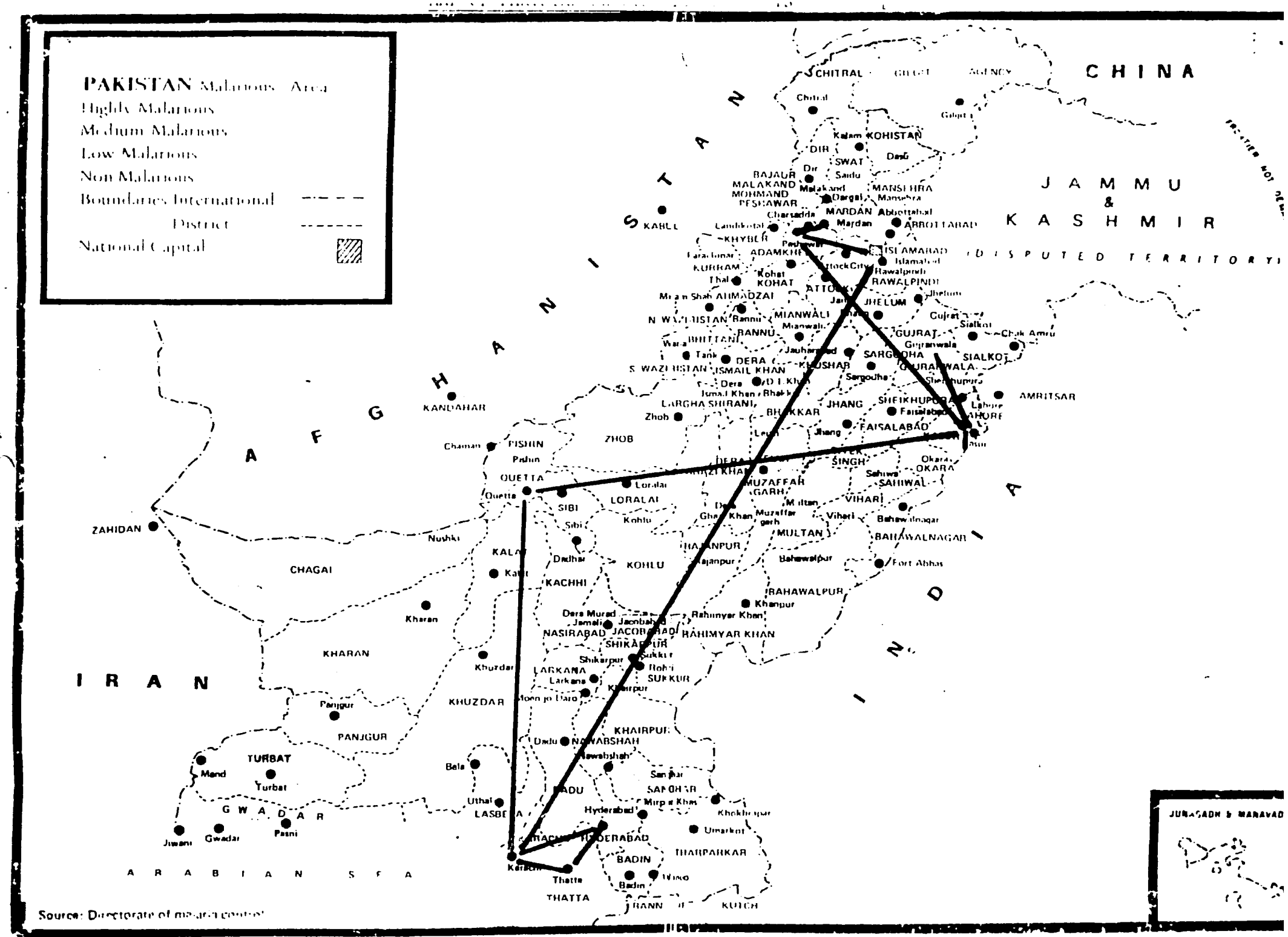
3. Dr. Ray Beach, Entomologist, CDC/Guatemala.

4. Ch. A.A. Mujahid, Entomologist (DOMC).

The team was accompanied and assisted on the field visits to all four provinces by resource persons from USAID, DOMC and the provincial malaria offices.

8.3 Schedule of Visit of External Review Team

Date	Particulars
04/04/87:	Arrival of Team Members at Islamabad
05/04/87:	Visit to USAID Visit to Directorate of Malaria Control Visit to Ministry of Health, Islamabad
06/04/87:	Visit to USAID for further discussion and travel arrangements
07/04/87:	Departure: Islamabad (at 0700 hrs) BY ROAD Arrival : Peshawar (at 0900 hrs)
08/04/87:	Stay in NWFP. Meeting with Provincial Health Authorities Evaluation of the Program
09/04/87	Departure: Peshawar (at 1720 hrs) BY AIR Arrival : Lahore (at 1855 hrs) PK673
10/04/87	REST
11/04/87 to 14/04/87	Stay in Punjab Meeting with Provincial Health Authorities Evaluation of the Program Visit to NIMRT on 14/04/87
15/04/87	Departure: Lahore (at 1230 hrs) BY AIR Arrival : Quetta (at 1400 hrs) PK321
16/04/87	Stay in Baluchistan Meeting with Provincial Health Authorities Evaluation of the Program
17/04/87	Departure: Quetta (at 1630 hrs) BY AIR Arrival : Karachi (at 1750 hrs) PK323
18/04/87	Departure: Karachi (at 0700 hrs) BY ROAD Arrival : Hyderabad (at 0900 hrs) Meeting with Provincial Health Authorities Evaluation of the Program
19/04/87	Departure: Hyderabad (at 1400 hrs) BY ROAD Arrival : Karachi (at 1600 hrs)
20/04/87	Visit to Karachi Metropolitan Corporation Departure: Karachi (at 1600 hrs) BY AIR Arrival : Islamabad (at 1755 hrs)
21/04/87 to 27/04/87	Preparation of Report
28/04/87 A.M.	Symposium on Malaria
29/04/87	Presentation of External Review Team's Report
30/04/87	Presentation of Report to USAID
02/05/87	Dispersal of Team Members.



Source: Directorate of malaria control

ANNEX 8.5 - LIST OF CONTACTS MADE BY THE EVALUATION TEAM DURING THE FIELD VISITS FROM APRIL 7-20, 1987

HEALTH SECRETARIAT, NWFP, PESHAWAR
(April 7, 1987)

1.	Dr. Ali Sher Khan	Secretary Health

DIRECTORATE OF HEALTH SERVICES, NWFP, PESHAWAR
(April 7, 1987)

1.	Dr. Mohammad Ayaz Khan	Director Health Services
2.	Dr. Mohammad Iqbal	Assistant Director (Malaria)
3.	Mr. Fazle Raziq	Entomologist
4.	Mr. Shaukat Pervez	Assistant Entomologist
5.	Mr. Abdul Aziz Khan	Malaria Superintendent
6.	Mr. Murtaza Khan	Malaria Superintendent
7.	Mr. Mohammad Hashim Khan	Malaria Superintendent
8.	Mr. Shaukat Ali	Sanitarian, Urban Malaria

MUNICIPAL CORPORATION, PESHAWAR
(April 7, 1987)

1.	Dr. Khaista Mir Afridi	Medical Officer
2.	Dr. Anisuddin	Medical Officer
3.	Mr. Masood Ahmed	Malaria Superintendent

DISTRICT HEALTH OFFICE, MARDAN
(April 8, 1987)

1.	Dr. Mohammad Khan	District Health Officer
2.	Dr. Syed Abdul Saboor Shah	Assistant District Health Officer
3.	Mr. Mohammad Anwar	Assistant Malaria Superintendent

PCD POST, TAKHAT BHAI (RURAL HEALTH CENTRE) - DISTRICT MARDAN
(April 8, 1987)

1.	Dr. Ayub Khan	Medical Officer

SHEIKH YOUSUF (BASIC HEALTH UNIT) - DISTRICT MARDAN
(April 8, 1987)

1.	Mr. Mohammad Ishaq	Medical Technician Incharge

HEALTH SECRETARIAT, PUNJAB, LAHORE
(April 12, 1987)

1.	Mr. Mohammad Ayub Sulairya	Additional Secretary

DIRECTORATE OF HEALTH SERVICES, PUNJAB, LAHORE
(April 11, 1987)

1.	Dr. Elahi Buksh Soomro	Director Health Services
2.	Dr. Mohammad Rafique	Deputy Director (CDC)
3.	Dr. Arshad Awan	Assistant Director (Malaria)
4.	Mr. Javid Iqbal Malik	Assistant Entomologist
5.	Mr. Mukhtar A. Shah	Parasitologist
6.	Mr. Matin-ul-Haque	CDC Officer
7.	Mr. Sana A.K. Mehmood	CDC Officer
8.	Mr. M.A. Ashraf	CDC Officer
9.	Mr. Abdul Rauf	CDC Officer

DISTRICT HEALTH OFFICE, LAHORE
(April 11, 1987)

1.	Sheikh Sardar Ahmed	Assistant Entomologist
2.	Sheikh Eusan	CDC Officer

RURAL HEALTH CENTRE, RAIWIND (DISTRICT LAHORE)
(April 13, 1987)

1.	Dr. Fahim Haider	Senior Medical Officer
2.	Dr. Azra Chaudhary	Women Medical Officer
3.	Mr. M. Siddique	CDC Microscopist

DISTRICT HEALTH OFFICE, GUJRANWALA
(April 12, 1987)

1.	Dr. Abdul Rashid Khan	District Health Officer
2.	Mr. Mohammad Saleem Sheikh	Assistant Entomologist
3.	Mr. Mohammad Ashraf Chaudhary	CDC Officer
4.	Mr. Aziz-ud-Din	Senior Microscopist

GHAKHAR RURAL HEALTH CENTRE (DISTRICT GUJRANWALA)
(April 12, 1987)

1.	Dr. Imtiaz Ali Cheema	Senior Medical Officer
2.	Dr. Liaquat Ali Zia	Medical Officer
3.	Dr. Mrs. Bushra Anjum	Lady Medical Officer
4.	Mr. Mohammad Yahya	Microscopist (CDC)
5.	Mr. Mohammad Iqbal	Laboratory Assistant

BHRO KE CHEEMA (BASIC HEALTH UNIT), DISTRICT GUJRANWALA
(April 12, 1987)

1.	Dr. Altaf Hussain	Medical Officer
2.	Mr. Riaz Mumtaz	Medical Technician
3.	Mrs. Nusrat Jahan	Female Medical Technician

LOCALITY UJLA KHURD (DISTRICT GUJRANWALA)
(Out Reach Team) - (April 12, 1987)

1.	Abdul Hamid	CDC Supervisor
2.	Mr. Iftikhar	Vaccinator
3.	Rana M. Amin	CDC Inspector

DISTRICT HEALTH OFFICE, KASUR
(April 13, 1987)

1.	Dr. Fazal Haq	District Health Officer
2.	Mr. Iftikhar Hussain	Assistant Entomologist
3.	Mian Mushtaq Ahmed	Admin. Officer + CDC Officer

RURAL HEALTH CENTRE (BHAI PHERU) - DISTRICT KASUR
(April 13, 1987)

1.	Dr. M. Iqbal	Senior Medical Officer
2.	Dr. Amin Chaudhary	Medical Officer
3.	Mr. M. Saddique	CDC Microscopist
4.	Mr. Rohail	Laboratory Assistant

RAO KHAN WALA (BASIC HEALTH UNIT) - DISTRICT KASUR
(April 13, 1987)

1.	Dr. Mohammad Fiaz	Medical Officer

LOCALITY HAVALI AJAIB SINGH (DISTRICT KASUR)
(April 13, 1987)

1.	Mr. M. Hanif	CDC Supervisor
2.	Mr. M. Sardar	EPI Vaccinator

MALARIA TRAINING CENTRE, LAHORE
(April 14, 1987)

1.	Rai Mushtaq Ahmed	Assistant Scientific Officer (Malariology)
2.	Mr. S.D. Pervez	Assistant Scientific Officer (Entomology)

NATIONAL INSTITUTE OF MALARIA RESEARCH & TRAINING, LAHORE
(April 14, 1987)

1.	Dr. Zafar Ahmed	Senior Medical Officer
2.	Dr. Pervez Ahmed	Senior Medical Officer
3.	Miss Ghazala	Scientific Officer
4.	Mr. Iqbal Ahmed	Admin. Officer

MUNICIPAL CORPORATION, LAHORE
(April 14, 1987)

1.	Mian Shujauddin	Mayor
2.	Dr. Mohammad Hanif	Chief Health Officer
3.	Dr. Asadur Rehman	Infectious Disease Officer

DIAGNOSTIC CENTRE, MAZANG, LAHORE CITY (PCD POST)
(April 14, 1987)

1.	Dr. Mushtari Khanum	Medical Officer

DIAGNOSTIC CENTRE, KILA LASHMAN SINGH, LAHORE CITY (PCD POST)
(April 14, 1987)

1.	Dr. Zia-ud-Din	Medical Officer

HEALTH SECRETARIAT, BALUCHISTAN, QUETTA
(April 16, 1987)

1.	Dr. Mohammad Akbar	Health Secretary
2.	Dr. Iqbal Mohammad	Director Health Services

PHQ MALARIA QUETTA, BALUCHISTAN
(April 16, 1987)

1.	Dr. Naimatullah Gichki	Provincial Malaria Chief
2.	Dr. Sultan Mahmood	
3.	Mr. Abdul Sattar	Senior Malaria Superintendent
4.	Mr. Ali Ahmed	Assistant Entomologist
5.	Miss Atya Mughal	Senior Microscopist
6.	Mr. Abdul Jalil	Supervisor PCD, PHQ

MUNICIPAL CORPORATION, QUETTA
(April 16, 1987)

1.	Dr. Naqueebullah	Medical Officer

HEALTH SECRETARIAT, SIND, KARACHI
(April 20, 1987)

1.	Dr. Safdur Rehman	Additional Secretary
2.	Dr. Nisar Ahmed	Deputy Secretary

OFFICE OF THE PROVINCIAL CHIEF, MALARIA CONTROL PROG. HYDERABAD
(April 18, 1987)

1.	Dr. Khawaja Rasheed Hussain	Provincial Chief
2.	Dr. Abdus Sattar Rajput	Epidemiologist
3.	Mr. Mohammad Anwar Shaique	Admin-cum-Supply Officer
4.	Mr. Abdul Majid Khan	Senior Malaria Superintendent

5.	Mr. S. Ghayas Haider	Entomologist
6.	Mr. Sumar Sadruddin	Senior Evaluator
7.	Mr. Mohammad Abbas Khan	Transport Officer
8.	Mr. Taj Mohammad Sheikh	Health Education Officer

DISTRICT HEALTH OFFICE, HYDERABAD
(April 18, 1987)

1.	Mr. Mohammad Murad	Malaria Superintendent
2.	Mr. Mohammad Ishaque	Non Medical Evaluator
3.	Mir Ali Khan	Assistant Entomologist

MUNICIPAL CORPORATION, HYDERABAD
(April 18, 1987)

1.	Mr. Ahad Yousuf	Mayor
2.	Dr. Habib Ullah Memon	Medical Officer

DISTRICT HEALTH OFFICE, THATTA
(April 19, 1987)

1.	Mr. Ghulam Nabi Shamsher	Malaria Superintendent
2.	Mr. Mohammad Ismail Broni	Non Medical Evaluator
3.	Mr. Anwar Ali Shahin	Assistant Entomologist

APCO POST, JHERRUCK - RURAL HEALTH CENTRE (THATTA DISTRICT)
(April 19, 1987)

1.	Dr. Hafiz-ul-Haq	Medical Officer

PCO POST, SONDA - CIVIL DISPENSARY (THATTA DISTRICT)
(April 19, 1987)

1.	Dr. Capt. Abdul Sattar Channa	

KARACHI MUNCIPAL CORPORATION, KARACHI
(April 20, 1987)

1.	Dr. Abdul Sattar Sumro	Director Health Services
2.	Dr. Ahsan-ul-Haq	Director Medical Services
3.	Mr. Hamid Naq	Malaria Superintendent
4.	Mr. Mohammad Altaf	Entomologist

ANNEX 8.6 - EPIDEMIOLOGICAL DATA 1982 TO 1986 BY PROVINCE

1982

Provin :	A. S. D			P. S. P.			Other Sources			TOTAL							P.v : P.f.
	Slides	+ve.	SPR%	Slides	+ve.	SPR%	Slides	+ve.	SPR%	Slides	+ve.	V	F	M	Mix	SPR%	
PUNJAB	1502496	16369	1.09	92033	3649	3.96	182208	4367	2.40	1776737	24385	18164	6089	3	71	1.37	74 : 26
SIND	364108	3544	0.97	110131	2549	2.31	46679	859	1.84	520918	2951	4604	2389	-	42	1.33	66 : 34
N.W.F.P	622301	8158	1.31	118753	8161	6.87	155756	7001	4.49	896810	23320	22538	820	-	38	2.60	97 : 3
BALUCHISTAN	66217	521	0.79	20302	783	3.86	22083	400	1.81	108602	1704	1389	347	-	23	1.56	80 : 20
PAKISTAN:-	2555122	28592	1.12	341219	15142	4.44	406726	12626	3.10	3303067	56360	46696	9845	3	174	1.71	82 : 18

1983

PUNJAB	1272858	19953	1.57	75443	3972	5.24	131785	5693	4.32	1480486	29618	19773	9927	4	86	2.00	67 : 33
SIND	184939	2578	1.39	197004	7219	3.66	64130	2668	4.16	446073	12465	8379	4154	-	68	2.79	67 : 33
N.W.F.P	487690	2956	0.61	58528	3189	5.45	65777	2010	3.06	611995	8155	7219	957	-	21	1.33	88 : 12
BALUCHISTAN	24201	369	1.52	15675	729	4.65	9490	260	2.74	49366	1358	748	658	-	48	2.75	52 : 48
PAKISTAN:-	1969688	25856	1.31	347050	15109	4.53	271182	10631	3.92	2587920	51596	36119	15696	4	223	1.99	70 : 30

1984

Province	A. C. D Slides	A. C. D Pve.	A. C. D SPR%	P. C. D Slides	P. C. D Pve.	P. C. D SPR%	Other Sources Slides	Other Sources Pve.	Other Sources SPR%	TOTAL Slides	TOTAL Pve.	V	F	M	Mix	SPR%	P.v.:	P.f
PUNJAB	1702940	30861	1.81	151606	11562	7.63	229689	11380	4.95	2084222	53823	34275	19648	-	100	2.58	64 :	36
SIND	275527	4738	1.72	128090	4368	3.41	360893	428	1.19	439706	9534	5996	3611	-	73	2.17	63 :	37
N.W.F.P.	541394	5069	0.94	79120	3431	4.34	48378	1265	2.61	668892	9764	8784	1083	-	67	1.46	89 :	11
BALOCHISTAN	27499	236	0.86	15175	488	3.22	20359	151	0.74	63033	875	520	366	-	11	1.39	59 :	41
PAKISTAN:-	2547360	40923	1.61	373988	19849	5.13	334515	13224	3.95	3255853	73996	49539	24708	-	251	2.27	67 :	33

1985

Province	A. C. D Slides	A. C. D Pve.	A. C. D SPR%	P. C. D Slides	P. C. D Pve.	P. C. D SPR%	Other Sources Slides	Other Sources Pve.	Other Sources SPR%	TOTAL Slides	TOTAL Pve.	V	F	M	Mix	SPR%	P.v.:	P.f
PUNJAB	1694917	24415	1.44	181614	11674	6.43	253562	9327	3.68	2130093	45416	28527	16979	-	90	2.13	63 :	37
SIND	292120	6689	2.29	115867	5204	4.49	57800	2372	4.10	465787	14265	5988	8417	-	140	3.06	41 :	59
N.W.F.P.	346337	5855	1.69	90716	9100	0.10	36140	1773	4.91	473193	16728	13616	3139	-	27	3.53	81 :	19
BALOCHISTAN	26365	363	1.38	16540	620	0.37	7717	215	2.79	50622	1198	425	79.	-	19	2.49	35 :	65
PAKISTAN:	2359739	37322	1.58	404737	26598	6.57	355219	13687	3.85	3119695	77607	48556	29327	-	276	2.49	63 :	37

1986

Province	A. C. D.			P. C. D.			Other Sources			TOTAL							P.v. : P.f.
	Slides	Pve.	SPR%	Slides	Pve.	SPR%	Slides	Pve.	SPR%	Slides	Pve.	V	F	M	Mix	SPR%	
PUNJAB	1483997	27107	1.83	207882	13286	6.39	196642	6694	3.40	1888521	47087	32051	15091	-	55	2.49	68 : 32
SIND	289025	7237	2.50	118068	7050	5.97	66978	2802	4.18	474063	17089	6775	10444	-	130	3.60	39 : 61
N.W.F.P.	304992	5948	1.95	137338	17521	12.77	62326	2003	3.21	504656	25472	21872	3684	-	84	5.05	86 : 14
BALUCHISTAN	15551	168	0.11	11964	565	4.72	4265	12	0.28	31780	745	409	339	-	3	2.34	55 : 45
PAKISTAN:	2093565	40460	1.93	475252	38422	8.08	330203	11511	3.49	2899020	90393	61107	29558	-	272	3.12	67 : 33

ANNEX 8.7.1 - THE MONITORING OF FALCIPARUM MALARIA PARASITES SUSCEPTIBILITY TO ANTIMALARIALS BY THE NMTC, 1976-86

DATE	DISTRICTS*	LOCALITY CODE NO.	TEST METHOD	DRUG** EVALUATED	TOTAL CASES WITH COMPLETE FOLLOWUP	RESULTS NO. (%) SENSITIVE	RI	RII	RIII
JAN-FEB 1976	D. G. KHAN JHANG MUZAFFAR GARH	-	MACRO IN-VITRO	CHLOROQUINE	50	50 (100%)	0	0	0
DEC-JAN 1977-78	D. G. KHAN	b-16-01 b- 2-08	IN-VIVO	CHLOROQUINE	58	58 (100%)	0	0	0
NOV-DEC 1978	BAHAWALPUR	a- 9-07	"	"	28	28 (100%)	0	0	0
OCT-NOV 1980	GUJRAT	e-15-02	"	"	60	60 (100)%	0	0	0
JAN-FEB 1981	SUKKUR	j- 4-06	"	"	27	27 (100%)	0	0	0
OCT-NOV 1981	SHEIKHUPURA	e- 3-02	"	"	60	58 (97%)	2 (3%)	0	0
FEB 1982	SHEIKHUPURA	b-13-12 b-13-13	"	"	39	39 (100%)	0	0	0
NOV-DEC 1983	JHANG	c-14-06	"	"	60	56 (93%)	4 (7%)	0	0
DEC-JAN 1983-84	BAHAWALNAGAR	b- 7-14	"	"	33	17 (52%)	15 (45%)	1 (3%)	0
OCT 1984	LAIDRE	b- 7-03	MICRO IN-VITRO	"	16	6 (38%)	10 (62%)	0	0
DEC 1984	KARACHI	e- 5-10	"	"	2	2 (100%)	0	0	0
NOV 1984	KASUR	c-13-09	IN-VIVO	"	42	16 (38%)	24 (57%)	2 (5%)	0
DEC-JAN 1984-85	OKARA	e- 3-18	"	"	15	6 (40%)	9 (60%)	0	0
	OKARA	e- 3-18	"	AMODIAQUINE	14	3 (21%)	8 (57%)	3 (21%)	0
	OKARA	e- 3-18	"	FANSIDAR	14	13 (93%)	0	1 (7%)	0
DEC-JAN 1985-86	SIALKOT	d-14- 1	"	CHLOROQUINE	35	5 (14%)	28 (80%)	2 (6%)	0
	SIALKOT	d-14- 1	"	AMODIAQUINE	23	10 (43%)	13 (57%)	0	0
	SIALKOT	d-14- 1	"	FANSIDAR	17	8 (47%)	8 (47%)	1 (6%)	0
NOV-DEC 1986	SARGODHA	-	"	CHLOROQUINE	67	45 (67%)	21 (31%)	1 (2%)	0

ANNEX 8.7.2 - IN-VIVO MONITORING OF FALCIPARUM MALARIA PARASITES' SUSCEPTIBILITY TO ANTIMALARIALS BY PROVINCIAL/DISTRICT PERSONNEL

PUNJAB

Date	District	Drug Evaluated**	Total cases	Result No. (%) Sensitive	RI	RII
Jan-Feb 1985	Lahore	Chloroquine	57	1 (2%)	34 (60%)	22 (38%)
Feb-Mar 1985	Kasur	Chloroquine	44	1 (2%)	11 (25%)	32 (73%)
1985	Sheikhupura	Chloroquine	31	15 (48%)	16 (52%)	0
1985	Muzaffargarh	Chloroquine	34	0	4 (12%)	30 (88%)
Dec 85-Feb 86	Gujranwala***	Chloroquine	51	19 (37%)	29 (57%)	3 (6%)
		Amodiaquine	31	19 (61%)	7 (23%)	5 (16%)
		Fansidar	13	12 (92%)	1 (8%)	0
Jan-Mar 1987	Sheikhupura***	Chloroquine	79	19 (24%)	60 (76%)	0
		Amodiaquine	52	17 (33%)	26 (50%)	9 (17%)
		Fansidar	43	42 (98%)	1 (2%)	0
N.W.F.P						
Nov. 1985	Mardan	Chloroquine	50	18 (36%)	32 (64%)	0
Nov. 1986	Bannu	Chloroquine	32	14 (44%)	18 (56%)	0

* - All test districts located in Punjab except Karachi.

** - Chloroquine and Amodiaquine Dosages: 25 mg base/kg body weight in 3 daily doses.
Fansidar: Sulfadoxine 25 mg/kg plus pyrimethamine 1.25 mg/kg in single dose. (Adult dosage : 3 Fansidar tablets).

*** - In-vivo assessments by personnel from Directorate of Health Services, Lahore. Other tests performed by district entomologists of Punjab and NWFP.

ANNEX 8.8 - COURSES CONDUCTED AT MALARIA TRAINING CENTER, LAHORE YEARWISE (JANUARY TO DECEMBER) FROM 1982-1985

Name of Course	Duration	Participated	Qualified	Punjab	Sind	NWFP	Baluchistan	A.K.	Total
1982									
1. 53rd Microscopist Cr.	19/12/81-10/03/82	16	16	2	4	7	2	1	16
2. 28th Junior Course	20/02/82-09/05/82	12	10	6	-	1	-	3	10
3. Training for Blood Smears Collection at PCD posts by Paramedical staff (five batches)	08/03/82-06/04/82	42	42	42	-	-	-	-	42
4. 54th Microscopist Cr.	15/05/82-05/08/82	26	21	14	4	-	-	3	21
5. 22nd Senior Course	04/10/82-27/12/82	7	7	-	-	4	3	-	7
		103	96	64	8	12	5	7	96
1983									
1. 53rd Microscopist Cr.	14/12/82-14/03/83	25	22	5	8	3	-	6	22
2. 29th Junior Course	08/01/83-22/03/83	14	14	-	-	2	3	9	14
3. 56th Microscopist Cr.	16/04/83-07/07/83	14	14	8	1	-	1	4	14
4. 14th Sr. Micro. Course	24/09/83-15/10/83	9	9	-	3	6	-	-	9
5. Short Cr. on Space Spraying and Spraying Latest Techniques	15/11/83-17/11/83	9	9	6	1	1	1	1	9
		71	68	19	13	12	5	19	68

1984									
1. 30th Junior Course	12/11/83-29/01/84	20	16	10	-	1	-	5	16
2. 57th Microscopist Cr.	21/01/84-05/04/84	19	18	11	2	4	-	1	18
3. 3rd Cr. in Mal. Epid. and Field Supervision for District Health Officers	11/02/84-16/02/84	18	18	15	3	-	-	-	18
4. Refresher Cr. on Safe use of Organophosphorus Insecticides for DHOs/Entomologists/CDC Officers Mal. Supdts/Asst. Entomologists (at Lahore & Hyderabad)	23/02/84-26/02/84	58	58	58	-	-	-	-	58
	27/02/84-28/02/84	35	35	14	-	21	-	-	35
	21/04/84-22/04/84	46	46	-	34	-	12	-	46
5. 4th Entomological Tech. Course	24/03/84-17/04/84	16	7	-	1	1	1	4	7
6. Training of Lab. Techs./Assistants	05/05/84-17/05/84	10	10	10	-	-	-	-	10
7. Training for in-vitro micro. tests for the detection of Chloroquine resistance in P. falciparum	24/10/84-01/11/84	5	5	5	-	-	-	-	5
	09/12/84-13/12/84	6	6	6	-	-	-	-	6
	22/12/84-27/12/84	8	8	-	8	-	-	-	8
		241	227	129	48	27	13	10	227
1985									
1. 31st Junior Course	23/12/84-12/03/85	30	28	23	-	-	2	3	28
2. 15th Sr. Micro. Cr.	21/04/85-13/05/85	29	28	23	2	2	-	1	28

3. 58th Microscopist Cr.	30/12/85-04/04/85	17	14	11	-	2	-	1	14
4. Refresher Course on Safe Use of Organo-phosphorus insecti-cides for MCP offi-cers (2 batches)	25/06/85-26/06/85	60	60	46	-	10	-	4	60
	03/07/85-04/07/85	31	31	-	22	-	9	-	31
5. 4th Cr. in Mal. Epid. and Field Supervi-sions for DHOs/ADHOs	14/07/85-18/07/85	8	8	8	-	-	-	-	8
6. 3rd Refresher Cr. for in-service Microscopists.	28/07/85-08/08/85	8	8	8	-	-	-	-	8
7. Refresher Course for Lab. Assts/Techni-cians (3rd.)	29/09/85-17/10/85	18	16	16	-	-	-	-	16
8. Refresher Course for Lab. Assts/Techni-cians (4th.)	27/10/85-14/11/85	23	20	20	-	-	-	-	20
9. Training Course in Chloroquine Resis-tance Studies	11/11/85-19/11/85	6	6	6	-	-	-	-	6
10. Training Course in Chloroquine Resis-tance Studies at Peshawar (NWFP)	24/11/85-02/12/85	14	14	-	-	14	-	-	14
11. Refresher Course for Laboratory Assts/ Technicians (5th)	24/11/85-15/12/85	26	23	23	-	-	-	-	23
		262	256	184	24	28	11	9	256

COURSES CONDUCTED AT MALARIA TRAINING CENTRE, LAHORE DURING THE YEAR 1986 - (JANUARY TO DECEMBER)

Name of Course	Duration	Parti-cipated	Quali-fied	Punjab	Sind	NWFP	Balu-chistan	A.K.	Total
1. 6th. Refresher Course for Lab. Assistants/ Technicians	26/01/86-13/02/86	24	20	20	-	-	-	-	20
2. 32nd. Junior Course	02/02/86-14/04/86	32	25	25	-	-	-	-	25
3. 7th. Refresher Course for Lab. Assistants/ Technicians	23/02/86-13/03/86	23	16	16	-	-	-	-	16
4. 10th. Refresher Course in Entomology	24/03/86-03/04/86	34	34	20	5	7	-	2	34
5. 8th. Refresher Course for Lab. Assistants/ Technicians	04/05/86-22/05/86	26	22	22	-	-	-	-	22
6. 59th. Microscopists Course	11/05/86-13/08/86	13	13	9	-	4	-	-	13
7. Refresher Course on Safe Use of Insecti-cides for Punjab	04/06/86-05/06/86	55	55	55	-	-	-	-	55
8. -do- for NWFP	15/06/86-16/06/86	40	40	-	-	40	-	-	40
9. -do- for Sind	18/06/86-19/06/86	46	46	-	46	-	-	-	46
10. First Workshop on Malaria for Distt. Health Officers at Peshawar Club	15/07/86-17/07/86	18	18	-	-	18	-	-	18

11. Second Workshop on Malaria for Distt. Health Officers at Peshawar Club	19/07/86-21/07/86	30	30	-	-	30	-	-	30
12. Third Workshop on Malaria for Distt. Health Officers at Peshawar Club	27/07/86-29/07/86	23	23	-	-	23	-	-	23
13. Ninth Refresher Cr. for Lab. Assistants/ Technicians	27/08/86-21/09/86	7	5	5	-	-	-	-	5
14. Tenth Refresher Cr. for Lab. Assistants/ Technicians	16/09/86-02/10/86	6	5	5	-	-	-	-	5
15. Advanced Malaria Trg. Course for Senior Health Officers of Baluchistan (Quetta)	21/09/86-23/09/86	16	16	-	-	-	16	-	16
16. 23rd Senior Course	21/09/86-18/12/86	19 412	14 382	12 189	- 51	- 122	2 18	- 2	14 382
WHO Regional Workshop for Monitoring P.f. response to Anti-malaria drugs	03/08/86-20/08/86	14	14						14
Total		426	396	189		122	18	2	396
GRAND TOTAL 1982-86		1,103	1,043	521	144	201	52	49	1,043

NATIONAL MALARIA TRAINING CENTRE, LAHORE
TENTATIVE SCHEDULE OF COURSES FOR 1987

Sr. No.	Name of Course	Duration	From	To
1.	2nd Refresher Course for Senior Microscopists	3 weeks	04/01/1987	22/01/1987
2.	60th Microscopists Course	12 weeks	13/01/1987	09/04/1987
3.	5th Course in Urban Malaria Control	2 weeks	15/02/1987	26/02/1987
4.	3rd Refresher Course for Senior Microscopists	3 weeks	02/03/1987	27/03/1987
5.	33rd Junior Course	10 weeks	09/03/1987	15/05/1987
6.	5th Refresher Course for Entomological Technicians	2 weeks	06/04/1987	24/04/1987
7.	Refresher Course in Safe Use of Insecticides for Punjab, NWFP & Azad Kashmir	2 days	07/06/1987	08/06/1987
8.	Refresher Course in Safe Use of Insecticides for Sind and Baluchistan at Quetta	2 days	14/06/1987	15/06/1987
9.	24th Senior Course	12 weeks	05/07/1987	24/09/1987
10.	6th Course in Urban Malaria Control			
11.	61st Microscopists Course	12 weeks	04/10/1987	10/12/1987
12.	6th Course in Chloroquine Sensitivity Tests for Baluchistan	2 weeks	10/11/1987	24/11/1987
13.	7th Course in Chloroquine Sensitivity Tests for Punjab	2 weeks	29/11/1987	10/12/1987
14.	Refresher Courses for AMS/ CDC Inspectors/Laboratory Technicians (subject to the availability of candidates)	2 weeks	November/December 1987	
15.	National Workshop on Drug Resistant Malaria		27/12/1986	08/01/1987

ANNEX 8.9 - ABBREVIATIONS USED IN REPORT

ABER	:	Annual Blood Examination Rate
ACD	:	Active Case Detection
APCD	:	Activated Passive Case Detection
API	:	Annual Parasite Incidence
BHS	:	Basic Health Services
BHU	:	Basic Health Unit
CDC Atlanta	:	Centers for Disease Control, Atlanta, Georgia
CDC Officer	:	Communicable Diseases Control Officer
CHW	:	Community Health Worker
CP	:	Condition Precedent
DDHS	:	Deputy Director Health Services
DHO	:	District Health Officer
DHS	:	Director Health Services
DOMC	:	Directorate of Malaria Control
EPI	:	Expanded Program on Immunization
ERT	:	External Review Team
GOP	:	Government of Pakistan
GR	:	Geographical Reconnaissance
HE	:	Health Education
ICMRT	:	International Center for Medical Research & Training, Lahore
IGR	:	Insect Growth Regulator
MCP	:	Malaria Control Program
NIMRT	:	National Institute of Malaria Research & Training, Lahore

NMTC	:	National Malaria Training Center, Lahore
NWFP	:	North West Frontier Province
OP	:	Organophosphate
PC-1 Form	:	A Government of Pakistan planning document similar to the Project Paper
PCD	:	Passive Case Detection
PHC	:	Primary Health Care
PMRC	:	Pakistan Medical Research Center
RHC	:	Rural Health Center
SPR	:	Slide Positivity Rate
TA/DA	:	Travel Allowance and Daily Allowance