



 VECTOR BIOLOGY & CONTROL

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**ZANZIBAR MALARIA CONTROL PROJECT
EXTERNAL REVIEW**

March 1986

by

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AR-011

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LIST OF ABBREVIATIONS

ACD	Active Case Detection
CFR	Case Fatality Rate
EM	Environmental Management
EOPS	End-of-Project Status
GOZ	Government of Zanzibar
G.R.	Geographic Reconnaissance
IRR	Infant Parasite Rate
LOP	Life of Project
MCP	Malaria Control Project
MCH	Maternal and Child Health
MOH	Ministry of Health
OPD	Out-Patient Department
PACD	Project Assistance Completion Date
PHC	Primary Health Care
PCD	Passive Case Detection
RHA	Rural Health Assistance
SPR	Slide Positivity Rate
TA	Technical Assistance
ULV	Ultra-Low Volume
ZMCP	Zanzibar Malaria Control Program

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ZANZIBAR MALARIA CONTROL PROJECT

EXTERNAL REVIEW

MARCH 3 - 21, 1986

EXECUTIVE SUMMARY

I. INTRODUCTION

During the period from March 3 - 21, 1986, a Team consisting of GOZ/WHO/USAID malaria, health and project specialists made an external review of the Zanzibar Malaria Control Program. The review was organized through the collaboration of USAID/Tanzania and the Government of Zanzibar (GOZ). The Team operated under jointly approved GOZ/USAID specific terms of reference. The general purposes of the review were (1) to study the present activities of the Zanzibar Malaria Control Program (ZMCP); (2) to evaluate these activities and the assistance provided by the USAID to meet the plan of operation and project paper objectives; and (3) to provide a report on its technical, administrative, and operational findings, as well as recommendations to improve the program. The review included field visits to Unguja and Pemba where indepth studies of the various aspects of the program were carried out at national, island, regional, and district levels, both with ZMCP and the Ministry of Health (MOH). A number of reports, studies, and preexisting documents were reviewed by the Team.

II. PRESENT STATUS OF MALARIA IN ZANZIBAR

The disease of malaria in the four major hospitals of Zanzibar, V.I. Lenin, Wete, Chake Chake, and Mkoani, represented approximately one third of all hospital admissions cases in 1983 and was the number one cause of morbidity. It was reported as the leading cause of death in hospitals in 1983, as it was responsible for 26.6 percent of all deaths and 29.3 percent of all deaths among children in 1983. A review of the 1984 statistics provided a similar pattern, but there are indications that the disease is beginning to moderate in some areas due to the activities of the ZMCP in an expanded vector control program and emphasis on prompt, proper treatment. As the major species of malaria found on Zanzibar is P. falciparum, it is necessary that adequate control mechanisms be instituted and maintained if this serious health problem is to be even partially controlled in the long term.

III. OVERVIEW OF THE ZANZIBAR MALARIA CONTROL PROGRAM (1984-1985)

The Zanzibar Malaria Control Program (ZMCP) during the 1984-1985 period has continued to expand its operational activities in spray operations, vector control in urban areas, health

education, and epidemiological services. Management systems for administration, supplies, and transport also have been improved. In addition, training and community activities have been strengthened. These additional activities have been possible through increased Government of Zanzibar support from T.Shs. 8,400,000 in 1983/1984 to a reported budget of T.Shs. 10,025,415 in 1985/1986 or approximately a 19 percent increase. The USAID external inputs of commodities, training and technical assistance from the project loan funds have assisted the GOZ in developing and carrying out a meaningful anti-malaria effort. The staff levels authorized have increased from 205, including 55 temporary workers in the pre-project period, to 368, including personnel at national, island, regional and district offices in 1986. The ZMCP has developed a long-term plan of operations and is developing annual work plans through its internal executive committee.

IV. USAID MALARIA CONTROL PROJECT - (1984-1985)

The USAID Malaria Control Project (621-0163) was originally authorized on September 30, 1981. The project was evaluated by an external review team in November 1983 and it was recommended that the project be amended. A new, revised project authorization which modified the project activities was signed on June 10, 1985. Since the 1983 evaluation, major commodity inputs of insecticides and drugs have been provided, as well as project support in the form of major technical assistance and in-country and overseas long- and short-term training. The long-term advisor has continued to monitor project procurement, technical activities, and program planning, and also take part in field observations. A number of recommendations made by the 1983 review team have been implemented in whole or in part but many have not been completely acted upon by the ZMCP, especially in the fields of operations, entomology and integrated services. The Team found many of the management aspects improved, especially in the areas of supply and fiscal management. The project is presently scheduled to be completed on September 30, 1987.

V. SUMMARY OF THE MAJOR RECOMMENDATIONS AND SUGGESTIONS OF THE REVIEW TEAM

5.1 The Team recommends that USAID/Tanzania take the following actions to improve the USAID project over the life-of-project (LOP).

5.1.1 It is urgent that USAID/Tanzania finalize procurement actions on all outstanding ZMCP procurement orders. USAID/Tanzania should encourage ZMCP carefully to review each ordered item to ensure that the proposed purchase is justified and in accord with the terms of the project agreement amendment. This review should be made jointly with the ZMCP/MOH officers concerned to ensure that action on any outstanding requests as well as the PIO/C is taken on a timely basis.

5.1.2 The training aspects of the USAID project are considered a high priority. The training schedules need to be finalized and increased attention given to their successful completion. Major needs were identified for in-country training of (a) operational personnel and (b) ZMCP/MOH personnel in malaria control methodology.

5.1.3 Additional use of technical assistance through the project funding is suggested, especially in the fields of entomology and drug susceptibility testing. USAID, in coordination with the GOZ, may wish also to consider a request to WHO for longer term field operation technical officers.

5.2 The External Team offers the following suggestions to the GOZ for its consideration in implementing its anti-malaria efforts and in maintaining the gains made during the 1981 - 1986 period.

5.2.1 The Team strongly urges the ZMCP to strengthen the environmental management and biological control aspects of its vector control program, especially in the urban areas, through increased intersectoral cooperation, legislation, training, and public education. The use of technical assistance for determining suitable local larvivorous fish and training staff in this methodology is urged.

5.2.2 The proposed integration of the ZMCP within primary health care (PHC) during the next Five Year Plan is supported by the Team, but it draws the attention of the MOH to the need for a well-developed strategy, detailed training schedules for both GOZ and ZMCP personnel, a centralized malaria control unit, and a clear national policy on malaria control, including increased inter-sectoral cooperation to successfully accomplish this organizational step. GOZ plans to form a working committee on this integration process are encouraged.

5.2.3 The ZMCP can anticipate completion of construction of a new garage, repair shop for spraying equipment, and storeroom facility in Unguja and Pemba by September of this year. This

represents a unique opportunity for the program to reorganize its inventories of general supplies and spare parts in such a way as to greatly increase the efficiency of its transport and logistical support activities. This can be accomplished if advance planning is directed and a request made for a recommended three-month transport technical assistance activity.

5.2.4 Fansidar should no longer be made available for first line treatment. Its use should be strictly controlled by the ZMCP because of the threat that resistance to this drug will develop.

5.2.5 Increased health education in malaria control and prevention is strongly urged. Such education would involve schools, the political structure, communities, members of the ZMCP, MOH, and other government and private agencies.

VI. WORKSHOP

On March 19, 1986 the Team assisted the GOZ in presenting a workshop on malaria. Approximately 80 participants participated in this workshop.

VII. ACKNOWLEDGEMENTS

The Team gratefully thanks the Director of ZMCP, Dr. Juma Muchi, and the many officers and personnel of the Ministry of Health and the Zanzibar Malaria Control Program for their helpful assistance. Special thanks are given to the Minister of Health, Ho. Maulid Makame; the Principal Secretary, Mr. Maalim Kassim; and Dr. Uledi Mwita, Director of Community Health, for their interest and support.

The Team also wishes to note its appreciation to the Agency for International Development, USAID/Tanzania and the World Health Organization for its logistical and technical assistance in carrying out this review. Preparation of this document was sponsored by the A.I.D. Vector Biology & Control Project.

PROGRAM EVALUATION

MARCH 3 - 21, 1986

I. INTRODUCTION

1.1 Purpose of the Evaluation

At the request of USAID/Tanzania and in coordination with the Malaria Control Program of Zanzibar, a Team of external consultants carried out the second of three project evaluations of the Zanzibar Malaria Control Project (621-0163) during the period March 3 - 21, 1986. The first evaluation of the project took place from November 3 - 23, 1983. After the first evaluation, the project was restructured more realistically to assist the Government of Zanzibar (GOZ) in developing and carrying out an effective, technically sound malaria control activity which could be maintained after the USAID project had been completed. This project was authorized on September 30, 1981 and has a project assistance completion date (PACD) of September 30, 1987. The total amount of USAID assistance support is U.S. \$7,460,000 (loan) over the life of project (LOP). The GOZ inputs to the project are programmed at U.S. \$3,395,000.

The major purposes of the evaluation were to (1) review the progress of the program since the 1983 evaluation and redesign; (2) provide a summary of the present status of malaria on Zanzibar; (3) review the nature and extent of the administrative, operational, and technical activities and problems; (4) review a variety of specific activities including administrative management, training, health education, epidemiological and entomological reporting systems, chemotherapy and pharmaceutical aspects, the role of primary health care (PHC) workers and health institutions in malaria control following project completion, and community participation; and (5) formulate recommendations to remove identified constraints and improve the future program. The specific terms of reference are included in Annex III.9. The External Review Team was briefed by USAID/Tanzania on March 3, 1986 and was provided background on project developments since the 1983 evaluation. The Team was provided with a variety of program and working documents including the project paper, amended project paper, project agreements, technical reports of Mr. Roche (WHO) and Mr. Merrill Wood (USAID APHA), the 1985 Zanzibar Malaria Control Program (ZMCP) Annual Report, the 1983 project evaluation, and the plan of operation of the ZMCP. In addition, numerous reports on program activities were provided to the team by the ZMCP during the evaluation. Annex I lists the references used by the Team.

The evaluation is basically a course correction activity for the project as it moves towards completion on September 30, 1987. The Team concentrated its efforts on providing recommendations

and suggestions which would improve program performance, strengthen operations and technical methodology, and assist in planning for the post-project period so that the gains made can be maintained by the GOZ. Basic information on the project and the Zanzibar Malaria Control Program is included in previous documents and is not repeated except where such references are useful in understanding the evaluation's discussions and recommendations.

1.2 Evaluation Team Members

Government of Zanzibar (GOZ)

1. Dr. Uledi Mwita - Director, Community Medicine, MOH
2. Dr. Juma Muchi - Director, Zanzibar Malaria Control Project (ZMCP)
3. Mr. Fadhil Abass - Administrator, ZMCP
4. Mr. Robert Turner - Malaria Advisor
5. Mr. Abuu Makame - Island Officer Zanzibar

Agency for International Development (A.I.D.)

1. Mr. Larry Cowper - Chief, Vector-borne Diseases, Office of Health, AID/Washington (Team Leader)
2. Dr. Donald Pletsch - Entomologist (Consultant, A.I.D. Vector Biology & Control Project)
3. Mr. Herbert Schloming - Administrative Specialist (Consultant, A.I.D. Vector Biology & Control Project)

Centers for Disease Control (CDC)

1. Dr. Hans Lobel - Epidemiologist, Malaria Branch, CDC

World Health Organization (WHO)

1. Mr. Rashed Bahar - Sanitary Engineer, WHO/Geneva

1.3 Field Trip Description

Field trips were arranged for the Review Team on both Pemba and Unguja and included a review of the island offices, hospitals, health centers, and other health institutions as to their role in carrying out anti-malaria activities. Team members visiting health institutions on Unguja reviewed the work of the Bwejuu Health Centre and Makunduchi Cottage Hospital in the South Region, Donge Health Centre in North B; Kivunge Cottage Hospital in North A, and the Mahonda Health Center in North B on March 7 and March 8. Discussions about the malaria problem were held with various levels of ZMCP and MOH regional and district health personnel.

On March 10-11, Dr. Hans Lobel and Mr. Herbert Schloming visited Pemba and reviewed work in the North and South Regions, accompanied by Mr. Abdallah Said, Island Officer, Pemba. Visits were made to various health institutions, including Wete Hospital, Chake Chake Hospitals, Mkoani Hospital, and Konde Dispensary.

II. STATUS OF MALARIA IN ZANZIBAR, 1984-1985

2.1 Introduction

A full-scale effort to control malaria in Zanzibar was initiated in 1958, leading to an eradication program in 1961. Despite initial successes in reducing transmission, the eradication program was terminated in 1968, but in 1972 a malaria control program was re established. The development of malaria in Zanzibar since 1973 is reflected in Annex II.1.

2.2 Morbidity and Mortality

A. Hospitals

Malaria was the leading cause of mortality in 1983, accounting for 26.6 percent of all deaths and 29.3 percent of deaths among children (Annex II.2). It is also the leading admitting diagnosis in Zanzibar hospitals, comprising 32.8 percent of all admissions (Annex II.3, II.4).

The overall case fatality rate (CFR) of four percent has not changed between 1982 and 1984 (Annex II.5). Among the age group 0-14, the CFR declined from 7.6 percent in 1984 to 5.4 percent in 1985.

B. Dispensaries

Malaria represented the greatest proportion of diagnoses among new patients, accounting for 29 percent in all categories (Annex II.6). The monthly variations of clinical malaria cases in dispensaries in 1984 on Unguja showed peaks from May through July, and in December; on Pemba peaks occurred from May through August, and in November through December (Annex II.7 and Annex II.8).

In the 2nd quarter of 1985, the number of cases reported as malaria decreased in all districts of Unguja as compared with the first quarter of 1985, with the exception of the Districts North-A and North-B (Annex II.9). These two districts also showed a considerable increase compared to the same period of 1984. Most noticeable was the decrease of numbers of cases diagnosed as malaria in Pemba; Chake Chake and Mkoani showed the lowest figures. As was the case for the first quarter of 1985, the peripheral districts of Unguja (North-A, North-B and South) have seen an increase, in both absolute and relative terms, in reported cases of malaria over the preceding one-year period.

2.3 Prevalence of Malaria - Malariometric Surveys

In accordance with recommendations of the 1983 USAID review (Annex I) malariometric surveys were conducted on Unguja and Pemba. On Unguja, these surveys were conducted in 17 localities in 1983, 21 localities in 1984, and 41 localities in 1985 (Annex II.10). The number of persons examined increased 70 percent from 1983 to 1985. The overall Infant Parasite Rate (IPR) declined from 56.8 percent in 1983 and 59.4 percent in 1984 to 33.1 percent in 1985.

On Pemba, 15 localities were included in 1984 and 16 localities in 1985. The IPR declined from 61.5 percent in 1984 to 33.6 percent in 1985 (Annex II.10).

The surveys in Unguja were conducted in 1983 and 1984 from June through August. In 1985 several additional villages were included from October through December. To determine the trends of the age specific prevalence rates in the same populations, the results of the surveys conducted in the 17 localities between June and August of each of the three years are given in Annex II.11. Between 1984 and 1985, the IPR declined 29.9 percent, from 57.3 percent to 27.4 percent. The prevalence in the one to nine year age group declined 19.5 percent from 54.1 percent to 34.6 percent.

On Pemba, 11 localities had been included in both 1984 and 1985. The IPR declined 26.4 percent, from 51.4 percent to 35.0 percent. The prevalence in the one to nine year age group declined 23.3 percent (Annex II.13), from 55.9 percent to 32.6 percent.

The changes of the prevalence rates on Unguja have not been uniform (Annex II.13). The IPR in Zanzibar Town increased 15 percent between 1983 and 1984, and four percent between 1984 and 1985, reflecting the absence of effective control measures there. Only in District South did the prevalence begin to decline between 1983 and 1984, a result of the spraying in early 1984. The first round in the other districts was conducted in late 1984. The first round in the other districts was conducted in late 1984. The surveys in 1985 showed a decline of the age-specific prevalence rates in all districts except Zanzibar Town. Most marked was the decline in District South, where the IPR was only 6.9 percent in 1985.

On Pemba, there were also geographic differences of the age specific prevalence rates in 1984 and 1985. The IPR in Wete declined from 77.8 percent to 28.4 percent, in contrast to Mkoani where the IPR was still 41.9 percent in 1985 (Annex II.14).

The changes in the IPRs reflect recent changes in the intensity of transmission and the effectiveness, or lack thereof, of measures to reduce the risk of infection.

III. REVIEW OF THE PROGRESS OF THE ZMCP AND ASSESSMENT OF SPECIFIC TECHNICAL AND OPERATIONAL ASPECTS OF THE ZMCP IN THE 1984-1985 PERIOD

3.1 Epidemiological and Entomological Reporting and Response Systems

3.1.1 Epidemiological and Entomological Reporting System

This section is based on Passive Case Detection (PCD) and Active Case Detection (ACD).

3.1.1.1 Passive Case Detection (PCD)

A total of 90,287 slides had been examined by the ZMCP for PCD; 88.4 percent of these slides came from out-patient departments (OPD) of hospitals and 11.6 percent came from dispensaries.

Dispensaries on Zanzibar had sent slides from only 6.1 percent of the 172,987 clinical malaria cases diagnosed.

PCD from Dispensaries, 1984

	Number of clinical malaria cases diagnosed	Number of slides sent to MCP	Percent
Unguja	107,380	8,786	(8.2)
Pemba	65,607	1,709	(2.6)
Total	172,987	10,495	(6.1)

On Unguja, slides from the V.I. Lenin hospital OPD accounted for 81.4 percent of the 47,320 slides collected through PCD, and for 78.9 percent of the cases detected through PCD. The other slides and cases came from dispensaries (Annex III.1.1).

The PCD on Pemba is based on slide collection in the three hospitals and from the dispensaries (Annex III.1.2). Between 1984 and 1985, the number of cases detected through hospitals declined 30 percent, but the number of slides and detected cases from dispensaries increased 63 percent and 19 percent, respectively. The increase was greatest in Mkoani Region.

The monthly slide positive rates (SPRs) in 1984 and 1985 were generally higher on Pemba than on Unguja. A remarkable decline of the SPR has occurred on Unguja since August 1985 (Annex III.1.3).

Several dispensaries were visited on Unguja and Pemba. Staff usually consists of a medical assistant, an orderly, one or two persons for the MOH clinic, and a rural health assistant (RHA). In addition, one or more malaria agents have their base of operations in a dispensary, although they are not part of the dispensary staff.

The daily case registers were well maintained and recorded name, age, sex, and address of the patient, diagnosis, and treatment given. Malaria diagnosis was based on history and signs and symptoms. Most dispensaries had treatment charts and all had adequate supplies of chloroquine tablets and chloroquine syrup. In a few dispensaries, there was a shortage of lancets and slides.

The malaria district supervisor or the regional malaria officer is to visit each dispensary periodically to collect blood slides, to ensure adequate supplies of blood slides and lancets, to take the slides to the MCP laboratory, and to report the results to the dispensary. The interval between blood slide collection and report of the laboratory results ranged from one to three weeks.

Comment:

Dispensaries are within an average of six km. of each inhabitant of Zanzibar and can effectively deliver treatment to malaria patients. Treatment in dispensaries is not dependent on the results of blood slide examination. Assigning one or more microscopists (with microscope) to the OPD of each hospital will increase the usefulness of the MCP diagnostic services.

3.1.1.2 Active Case Detection (ACD)

ACD is to be carried out by the 85 malaria agents on Unguja and the 61 malaria agents on Pemba.

In 1984, ACD on Unguja was limited to Region South, where only 1,342 slides were collected, of which 448 (33.4 percent) were positive. On Pemba, ACD slides accounted for 2.2 percent of all slides collected in 1984 and 16.1 percent of the slides collected in 1985 (Annex III.1.2).

The malaria agents make their own itineraries, they are inadequately instructed, trained and supervised, and several had no supplies, treatment schedules, drugs, lancets, blood slides, or health or education materials.

Each agent is to visit periodically two to three villages with a total population of 3,000 to 4,000. Record-keeping is very deficient. Reports on their activities could not be located.

Comment:

ACD is not necessary on Zanzibar for the delivery of treatment to malaria patients, nor for the surveillance of malaria. To develop an adequate ACD system would require a major improvement in supervision and training.

3.1.2 Entomological Reporting and Response System

As in the case of the mass blood survey aspect of epidemiological activities, entomological duties are carried out by personnel based in ZMCP headquarters or at the Pemba Island office, and reporting is done directly to senior officers at the respective bases. However, only the summaries of detailed entomological reports originating on Pemba are forwarded to the ZMCP headquarters. This unfortunately eliminates or reduces the possibility of central analysis or comparison of data as a basis for approval or modification of techniques used, or of the work carried out.

Data covering entomological activities in Unguja are logged into the respective registers in the headquarters, including: susceptibility tests, bioassay tests of duration of effectiveness of residual spray deposits; "indicator village" mosquito collections; and external (independent) larval surveys and adult bioassay trials to evaluate the effectiveness of the larviciding and ultra-low volume (ULV) personnel in Zanzibar Town. No reports are kept on the operation of the insectary, nor on the insectary production of mosquito larvae, nor of the adults so urgently needed for bioassay tests.

Review and/or analyses of reported data have evidently not resulted in conspicuous improvement in field-assigned activities. For example, of the monthly entomology exercises scheduled in each of the four "indicator villages" on Unguja (total = 78 collections), only 53 were carried out.

The results of anopheline susceptibility tests were originally reported on the globally-used World Health Organization report forms, but the ZMCP has mimeographed a highly-modified form which lacks essential background information concerning the mosquitoes used in the tests.

3.2 Laboratory Services

There are two malaria laboratories on Unguja, both in Zanzibar Town. One is located at the ZMCP Headquarters, the other at the Unguja Island Office.

3.2.1 ZMCP Headquarters Laboratory

a. Activities

- to examine slides from malarionometric surveys
 - to examine slides of patients from the Lenin OPD
 - to conduct malarionometric surveys
 - to reexamine all positive and 5-10 percent of negative slides of the ZMCP headquarters laboratory and of the Unguja Island laboratory
 - to conduct in-vivo drug sensitivity tests
- b. Personnel - five microscopists (plus two microscopists on study leave)
- c. Number of slides examined

Source of slides	1984		Percent	1985		Percent
	Exam.	Pos.	Pos.	Exam.	Pos.	Pos.
Malarionometric surveys	7,579	3,442	45.4	11,110	3,288	29.5
V.I. Lenin OPD	5,606	2,150	38.4	8,199	2,637	32.2
Total	13,185	5,592	42.4	19,309	5,925	30.7

d. Reexamination of blood slides

Goal: Reexamination of all positive and 5-10 percent of negative blood slides.

Achieved: Between October 1985 and end of February 1986, 11,221 slides, of which 2,381 were positive, had been examined at the Island Office laboratory. Of these, 472 had been reexamined at the headquarters laboratory.

	<u>Examined</u>	<u>Reexamined</u>	<u>Percent</u>
Negative	8,840	149	1.7
Positive	2,381	323	13.6
Total	11,221	472	4.2

Only 14 (0.3 percent) of the 33 initially positive slides were found to be negative on reexamination. None of the 149 initially negative slides were found to be positive.

e. Workload

At 50 slides examinations per microscopist per day, the five microscopists can examine 250 slides daily. Examining 19,309 slides requires 76 days. Conducting the 41 malarimetric surveys in 1985 required 41 days - total 117 days. There are 274 working days. Not utilized were $274 - 117 = 157$ days. Therefore, $157 \times 5 = 785$ microscopist working days per year are not used. An additional 39,000 blood slides could be examined per year by the available microscopists.

3.2.2 Unguja Island Office Laboratory

- a. Activities - to examine slides from PCD and ACD
- b. Personnel - four microscopists (plus one on study leave)
- c. Number of slides examined (1984):

<u>Source</u>	<u>Examined</u>	<u>Positive</u>	<u>Percent Positive</u>
PCD	41,714	13,074	31.3
ACD	1,342	448	33.4
Total	43,056	13,522	31.4

d. Workload

The four microscopists can examine 200 slides daily.

Examining 43,056 slides requires 215 days.

Not utilized: $274 - 215 = 59$ days \times 4 microscopists = 236 microscopist working days per year.

An additional 12,000 slides per year could be examined by the four microscopists.

Comment:

Laboratory personnel is underutilized. The quantity and quality of blood slides reexamined is deficient. In both laboratories, the microscopes, reagents, slides, lighting, and space were adequate. Assigning microscopists to OPDs of hospitals would result in more efficient service. Both laboratories could be merged into one location.

3.3 Vector Control Measures in ZMCP Including Progress in Alternative Methodology and Environmental Considerations

According to the proposed Plan of Operation prepared for Malaria Control in 1980-1984, the following vector control measures have been recommended for both islands:

1. Chemical Control

- Intradomiciliary residual spraying of an effective insecticide in rural areas.
- Application of larvicide on vector breeding places in urban and peri-urban areas.
- Application of space spraying in urban areas.

2. Biological Control

Predators such as larvivorous fish, preferably indigenous ones, should be introduced into all permanent bodies of water in order to reduce larval density as much as possible.

3. Environmental Management Measures

These activities include elimination of vector breeding places through filling and drainage, cleaning and clearing of the canals, and covering of domestic water containers.

3.3.1 Chemical Control

3.3.1.1 Residual House Spraying

On the basis of entomological findings, it was recommended that two rounds of DDT, 75 percent WDP at dosage of 2 gr. a.i./m² be applied on Unguja Island and three rounds of malathion 50 percent WDP, at the dosage of 2 gr. a.i./m², be applied on Pemba Island. Due to the late arrival of insecticide and spraying

equipment, only limited spraying operations were started in South District of South Region of Unguja Island.

Spraying operations lasted from April 5 - 18, 1984. The insecticide used in this operation was from an old stock of DDT 75 percent WDP available in the store. The insecticide was applied using 30 old hand-operated compression sprayers available in the store. Only in South District was a complete geographical reconnaissance carried out prior to spraying. This district was sprayed for the first time in April 1984 and served as field training for the operations staff (Fiscal 1984, see Annex I).

After the arrival of insecticides and spraying equipment, the first round of spraying was carried out on both islands in September 1984. Details of spraying operations carried out during 1984 and 1985 are provided in Annexes III.3.1, III.3.2 and III.3.3 (prepared by Roche - See Annex I) for Unguja and Pemba Islands. Since September 1984 two rounds of spraying have been applied on Unguja and one round on Pemba Island.

During the last quarter of 1985, focal spraying was applied on both islands. Due to late arrival of insecticides, the first round of spraying for 1986 has not yet been initiated. According to available records, 1,890 kg DDT 75 percent WDP and 8,500 kg malathion 50 percent WDP are in stock on Unguja and Pemba Islands respectively at the present time. A summary of spraying operations carried out in 1984 and 1985 in Unguja and Pemba Islands is given below:

UNGUJA ISLAND

Rounds	Dates	No. of	No. of	Amount of
	From	To	Population	DDT 75%
			Protected	WDT used
				kg
1	9/11/84	12/18/84	191,110	24,280
11	2/8/85	4/12/85	156,157	19,300
Focal Spraying	9/16/85	12/19/85	175,818	19,100

PEMBA ISLAND

Rounds	Dates	No. of	No. of	Amount of
From	To	Population	Houses	malathion
		Protected	Sprayed	50% WDT
				used kg
1	10/10/84	24,031	57,570	49,323
Focal	11/18/85	50,937	13,093	12,000
Spraying				

Except for the South District, no geographical reconnaissance and no house numbering was carried out prior to spraying operations. Therefore, no true percentage for house coverage can be provided. According to existing reports (Roche-Annex I), the average dosage applied on Unguja Island is 1.83 gr. a.i/m² for the first round, and 1.87 gr. a.i/m² for the second round of spraying. However, since no weekly nozzle tips discharge rate tests had been carried out, and worn out nozzle tips were not replaced, there is a possibility of overdosing.

It is recommended that weekly nozzle tip tests be carried out by squad chiefs and/or District Malaria Officers to ensure the proper discharge rate. The handling, servicing, maintenance and repair of the spraying equipment requires improvement. The following table presents the inventory of spray pumps after two rounds of spraying.

Spraying Pumps Status - March 1986

Islands	No. of Pumps received Aug. 1984	No. of Pumps in working condition	No. of Pumps requiring major repair	No. of Pumps unrepairable
Unguja	110	65	40	15
Pemba	100	65	30	5

Except for a few items, ample amounts of spare parts for sprayers are available in the store. Several sprayers were leaking from the dip tube placement joint on the tank. Follow-up

must be done with the manufacturer for advice and/or provision to overcome this defect and for provision of remedial measures. Sprayers must be numbered, and a maintenance identity card issued for them.

Storage of spray pumps during the off-season was found to be poor as the pumps were piled up in a corner and lying directly on wet ground. Adequate shelves must be provided for safe-keeping of the sprayers when they are not in use.

It was reported that many of the sprayers were damaged during transport. Provision of holding racks in the back of the pick-up trucks for placement of the pumps during transportation would improve this situation.

The organization of field operations follows the ZMCP administrative pattern from the central office down to the village level. For details see Annex III.6.1. The number of personnel engaged in residual spraying during each round for each island is given below:

	<u>Unguja</u>	<u>Pemba</u>
Island Malaria Office	1	1
Chief of Operations	1	1
Regional Malaria Officers	3	2
District Malaria Officers	6	4
Malaria Supervisor (squad Chief)	25	16
Malaria Agents (Spraymen)	67	60
Community-Assigned Spraymen	50	66
Drivers	6	4
Pump repair man	1	1
Insecticide Packer	5	4
Storekeeper	1	1
Health Educator	<u>1</u>	<u>1</u>
Total	176	160

During the spraying operations malaria supervisors and malaria agents perform the duty of squad chiefs and spraymen, respectively. According to the operations plan, a total of 110 and 100 spraymen are required for Unguja and Pemba Islands, respectively. Since the number of malaria agents is not adequate, the remaining spraymen are provided by the community through the District Council.

The availability of field supervision was organizationally adequate in all the levels as the ratio of supervisors to persons

to be supervised was one to four or less. Report forms for all operation levels have been developed and seem to have been utilized regularly.

The field operations were carried out from one camp base at a time. This practice caused delay in spray coverage of all the area within the target time. It is certain that keeping 176 people in one camp base will cause logistic problems, especially in transport and provision of food, water, and shelter for the personnel.

It would be more practical to divide personnel into four or five camp bases using the regional or district centers rather than the present one camp system.

On Unguja Island, for a camp accommodating 176 persons, five vehicles are allocated -- two 3 1/4-ton trucks and three Land Rovers. It appeared to the Team that these types of vehicles are not suitable for this operation. Pick-up trucks, especially long base ones, are more suitable for transportation of spraying crews and their equipment than eight set station wagon Land Rovers. It is possible that this type of transport creates conditions which result in high breakages of spray pumps during field operations.

Special attention has been given to training of personnel engaged in field operations. A total of 12 man/months consultant services have been provided through WHO and USAID during the period January 1, 1984 to September 27, 1985. These consultants primarily were engaged in training operational personnel in the field of geographic reconnaissance (G.R.) and a variety of spraying techniques, i.e., residual spraying, larviciding and space spraying. In addition, these consultants produced guidelines, useful reports, and recommendations for improvement of field operations. (See Annex I, Turner 1985)

Six malaria field supervisors were sent to Sudan on a study tour and to observe field operations. Prior to each round of spraying, a four-day course was organized for squad chiefs and spraymen on spraying techniques as well as on operation, servicing, and maintenance of sprayers.

Regardless of the above, the training of operational staff is considered a continuous process; in order further to augment the knowledge and skill of the operational staff members, especially at the supervisory level, they should participate in a comprehensive specialized course on G.R. and spraying operations. This course must include an ample number of hours of practical training and actual field work.

Spraying operation personnel are provided with necessary protective clothing, including coveralls, helmets and shoes. These protective items are available in the store and will be distributed to the field personnel during the forthcoming spray rounds. As malathion is applied on Pemba Island, in addition to the normal protective clothing, aspirator masks should be provided to the spraymen, storekeeper, and packers. Cholinesterase test kits have been made available to the regional malaria officers for regular monitoring of personnel. Although island malaria officers and regional malaria officers have been trained to carry out this test, the cholinesterase kits have not been used. During the first round of spraying in 1984 - 1985, 15 spray personnel manifested signs of intoxication and were referred to hospitals and health centers. During the second round of spraying in 1985, only one case was referred to a health center for treatment. All these reported cases are believed to be due to working in certain types of houses in Pemba where ventilation is poor (See Annex I, Roche 1985). Twenty-three hospitals and dispensaries on Pemba are provided with atrophic sulphate injections for treatment of malathion cases. In Pemba and wherever organophosphorus compound will be used, the spraying crew and the residents must be continuously educated on the dangers of organophosphorus compounds and encouraged to follow the required precautionary instructions.

In summary, residual spraying operations are the most important vector control measure applied in this program. Spraying operations must be carefully planned for each year. Each spray round is to be organized well ahead of time, so that the operational requirements, including insecticide and equipment, can be ordered and received in time for the insecticide applications. For planning spraying operations, G.R. must be carried out to collect the basic data required for planning and supervision.

3.3.1.2 Larviciding

Larviciding and other anti-larval measures are planned in urban areas. To date, larviciding has been limited to Zanzibar Town on Unguja Island and the three towns of Chake, Wete, and Mkoani on Pemba Island. Very limited information and evaluation of these operations is available (Roche 1985). The type of breeding places treated are swamps, marsh and grassland, ricefields, streams, drains, ponds, household runoff, wells, and latrines.

Larvicides used by the ZMCP include:

- Diesel No. 2 mixed with 3 percent motor oil and 3 percent spreading agent - Triton No. 207. This formulation is applied at the target dose rate of 2cc/m². This mixture is applied by hand-operated compression sprayers with nozzle tip HSS 8002 or multiposition nozzle tip for larviciding.
- Temephos (ABATE) SG 1 is also applied for larviciding in shallow waters at the target dosage of 100 gr. a.i/ha (0.01cc/m²) of water surface. The Temephos SG 1 is applied by horn-seeder.

The frequency of application for Temephos SG 1 was recommended as every ten days during the dry season. Weekly applications were recommended for diesel oil. In actual operations this frequency was not strictly followed. From January 1984 to September 1985, a total of 2,112 liters of the diesel oil formulation and 1,762 kgs. of Temephos SG 1 were used in Zanzibar Town. According to Suyud Tarkojosopurb (1985) the total area to be treated in and around Zanzibar town is about 25 hectares (See Annex I).

In the towns of Pemba Island, from August 1984 to August 1985 a total of 935 liters of diesel oil formulation and 31 kg of Temephos SG 1 were used. No information on the size of area to be treated is available. For technical reasons, larviciding operations were discontinued on Pemba Island.

In a spot observation, it was noticed the nozzle tips used for larviciding are HS 8002. These nozzle tips when new will have an output of 760 cc at 40 PSI. This nozzle tip has a fan jet pattern and is suitable for residual spraying. In addition, a few multiposition (hollow cone and straight jet) nozzles are being used. It was observed that the part which produces the hollow cone pattern has been either lost or removed. As a result, the discharge rate of both types of nozzle tips are excessive and the application is more than 10cc/m². This results in wastage of larvicide and causes heavy pollution of surface water. The recommended nozzle tip for this type of operation is the hollow cone pattern with discharge rate of 150 to 200 cc/min at 40 PSI. In Zanzibar Town, eight larviciders under supervision of malaria supervisors are engaged in application of diesel oil, and two larviciders and one supervisor are engaged in application of Temephos SG 1. The town is divided operationally into five areas; each area must be covered in one day and the whole town in one week.

Larviciding is a continuous and expensive operation. The effectiveness of larviciding using the existing practices is doubtful. Most of the breeding places in and around Zanzibar Town are man-made and could be eliminated through municipality intervention, by improvement of drainage systems and drains, prohibition of rice cultivation within city limits, and provision of laws for housing (Housing Code) for improvement of design and provision of sanitary facilities which reduce the vector breeding places and man-vector contact. The existing breeding places in and around Zanzibar Town must be classified, and suitable cost-effective control measures selected for each type of breeding place. Examples include:

- o Those breeding places which could be eliminated by engineering methods such as filling and drainage;
- o The breeding places which could be eliminated by cleaning and clearing of the canals and drains;
- o Those breeding places which could be eliminated by repair of the water distribution system and leaking taps, and covering domestic water tanks and water containers; and
- o Those breeding places which could be controlled by introduction of larvivorous fish.

The remaining breeding places, if any, could be treated by larvicide.

Implementation of the above measures requires close cooperation between the Municipal Council of Zanzibar Town and the Malaria Control Program. Technical guidance should be provided by the Malaria Control Program, with the municipality implementing the recommended measures. Assignment of responsibility to a ZMCP technical officer for planning and implementation of environmental management measures would be advisable.

3.3.1.3 Space Spraying

Since 1983, the program procured the following space-saving machines:

Microgen G9 vehicle mounted	5
Microgen G7 trolley mounted	4
Microgen G3 shoulder sling	5

Microgen G3 G7 tricycle mounted	1
Dyna fog 2616 shoulder sling	5
Dyna fog, small shoulder sling	1

These machines are distributed to Island Malaria Offices for application of insecticides in urban areas. The insecticide used is 0.03% pyrethrum in kerosene. This formulation is applied by Microgen ULV generators to the basements of certain buildings, covered drains, and houses near major breeding places. This equipment was observed to be calibrated incorrectly. The personnel, although trained, are not well acquainted with application, maintenance and repair of ULV equipment. For these reasons, the dosage applied is not known. From January 1984 to September 1985, a total of 645 liters of pyrethrum 25% and 6,575 liters of kerosene has been used. There is one chief malaria supervisor, three squad chiefs, eight operators, and one driver engaged in this operation for Zanzibar Town. The effectiveness of this method is not known and may be considered doubtful. During a field visit, it was noted that the same mixture is being applied by thermal fogger, which only results in flushing out mosquitoes from their shelter. Actually, it would be more cost effective to provide wire mesh for the opening of the basements to prevent entrance and exit of the vector, rather than weekly applications of pyrethrum with ULV machines.

The municipality, by introducing a housing code for urban areas, could legally prevent establishment of such types of breeding places and shelters in and around houses.

The presence of ULV machines on the island would be useful in case of occurrence of a vector-borne disease epidemic when quick action must be taken to interrupt the transmission. For a state such as Zanzibar, with limited hard currency, trained personnel, and spare parts to operate, maintain and repair the machines, routine space spraying for disease vector control is not advisable. Training of a mechanic for maintenance and repair of the ULV machinery is recommended. Establishment of a workshop for repair of spraying equipment is considered necessary.

3.3.2 Biological Control of Vectors

Biological control of mosquito vectors is mentioned as one of the alternative methods of vector control in the Zanzibar Malaria Control Program. The Team observed, however, that since the initiation of the project, little attention has been given to field application of this method. In the past, larvivorous fish have been introduced to Zanzibar. Some of these fish must still exist in water bodies of these two islands. In view of the

presence of extensive breeding places in and around the communities, especially urban settlements, it is considered economical to introduce larvivorous fish in appropriate water bodies to reduce mosquito density.

Attempts also should be made to identify a local larvivorous fish adapted to the prevailing ecosystem. This local fish would be preferred to an exotic (imported) species which may cause an imbalance in the ecosystem and be harmful to local aquatic biota.

It is recommended that ZMCP seek the services of an ichthyologist with background in taxonomy of fish to carry out a survey in Zanzibar and identify, if possible, a suitable larvivorous fish. Later, this expert can train some of the malaria staff to breed, rear, and distribute the fish.

3.3.3 Environmental Management Measures for Vector Control

Environmental management (E.M.) for control of disease vectors was one of the major activity components of malaria control in Zanzibar. There are many breeding places in urban as well as in rural areas which could be easily and economically eliminated. Unfortunately, no activities for implementation of this method have been carried out over the last few years. For example, in Zanzibar Town there are many places with water collections which can be drained or filled to eliminate breeding places. These actions would result in tremendous savings by reducing need for repetitive larviciding. Moreover, reclaimed land could be put to good use for development of playgrounds and parks, etc. Many storm drains inside the town are clogged and form permanent breeding sites. Through regular cleaning and clearing of these drains, a large number of breeding places could be eliminated.

One of the persistent breeding places in Zanzibar Town is basements of the newly developed housing project, Kilimani. These buildings, due to a defect in their foundation construction, allow ground water and rainwater to penetrate into the basement. A body of permanent water always remains there, favorable for breeding as well as sheltering of mosquitoes. Presently, these basements are treated weekly with space spraying by applying 0.03% pyrethrum aerosols which only flush out the mosquitoes. If the entrances to these basements were covered with wire mesh, there would be no need for weekly space spraying. Alternatively and/or simultaneously, larvivorous fish could be introduced to the water bodies in the basement until such a time that the problem can be corrected and water prevented from penetrating into the basements.

There are also rice plantations within the city limits which produce a large number of mosquitoes, including anophelines. According to the laws of Zanzibar, planting of rice was prohibited within the city and three miles away from the post office (town center). Zanzibar authorities might well consider updating, reactivating and implementing this law (See Annex I, Laws of Zanzibar).

There are also many opportunities in the rural areas to implement environmental management for control of disease vectors. According to the socio-political organization of Zanzibar, there are People's Councils down to village level. Through these councils, the community could be mobilized to eliminate breeding places. The Malaria Control Program must be in a position to provide technical assistance for these types of activities. A technical officer or an engineer could be recruited by the Malaria Project or Ministry of Health for this purpose.

It should be noted that at present, about 8,000 ha. of land is under rainfed rice cultivation; by the end of 1986, a total of 500 ha. will be brought under irrigated rice cultivation on both islands. By year 2000 a total of 20,000 ha. rainfed land and 5,000 ha. irrigated land is to be brought under cultivation. These rice cultivations are major breeding places for malaria vector species. It is advised that the Ministry of Agriculture, in collaboration with the Ministry of Health, determine what can be done to minimize the health hazards in cultivation. As there are already Irrigation Committees at national and regional levels, malaria control should be represented. This activity is a suitable point of entry for cooperation with irrigation authorities on prevention of vector-borne diseases in and around areas when rice is cultivated. Similarly, irrigation authorities could be invited to participate in health councils at national and regional levels.

In conclusion, and in view of the high cost of insecticide and the development of resistance of mosquito vectors to insecticides, serious efforts should be made to promote application of environmental management measures which provide effective and long-lasting vector control. Environmental management could be implemented by the individual and by communities, with technical assistance by health authorities.

3.4 Health Education and Public Information

During the last two years, the ZMCP has carried out an organized campaign of health education and public information through a variety of media mechanisms, such as community gatherings, radio and TV, printed posters, and articles in the press. The ZMCP supported a rather novel way of advertising the Zanzibar malaria effort through printed T-shirts and Khangas (traditional women's wrap) (Annex III.4.1). The usefulness of this approach has not been evaluated, but certainly this effort produced more public awareness of the program.

As could be expected, there has been a rise in refusal rates in the sprayed areas. The increase in "closed" houses can really be "refused" houses in a number of situations. If the ZMCP is to spend a large amount of money on residual spraying, the operation should include a very intensive health education activity to ensure that the communities accept spraying.

The Team believes that health education training should be included for all personnel in order that the program can be properly explained to the public. One of the methods used in the past was to provide teachers with malaria control information and make this subject a part of the school educational program. In some situations, an experiment can be designed which provides an observational experience for students to actually see mosquitoes hatch from the aquatic stage to adult stage. The physical materials would include a jar and a bit of plastic wire screening to make a cage. After the experiment, students do a home survey to determine if they find mosquitoes breeding and report back to the class. The basics of environmental management to reduce and/or eliminate mosquito breeding are not difficult to demonstrate and learn - drain, fill, or use fish or water management on mosquito breeding areas.

Community participation in malaria control practices has increased considerably throughout the world. Many countries have developed their own treatment and referral centers within the villages. Major mosquito breeding sites can be eliminated and controlled by community action. The political and community leaders may be encouraged to participate in such activities if given information through a day-long workshop presented by the ZMCP.

3.5 Training

The subject of training has been dealt with in each of the specialized sections of this report. This emphasis on training clearly indicates the importance that the Team places on this subject. Training, retraining, refresher training and overseas training have been a part of the ZMCP effort in the 1984-1985 period.

The USAID project has supported training activities by providing external technical assistance to train personnel within the country, and funding to support overseas academic and observational training. ZMCP personnel have taken an active part in training their staff in operations and other activities. The Team congratulates the ZMCP on this effort and encourages them to move ahead on their own training activities and to finalize plans for training under USAID or other external agency support. The project between the GOZ and USAID has supported one MPH degree in the United States which has been completed. Another MPH degree program is in progress at Tulane University. During the 1984-1985 period, a total of 10 study tours have been completed under USAID funding. Of these, six were in Sudan for three weeks; one was in Sudan for 10 days; and three were in Nairobi for five weeks. Courses in Nigeria in public health have also been completed.

The training schedules for the period 1986-1987 have now been developed in detail. The Team was pleased to observe the large amount of planning which has gone into this schedule. There is a sense of urgency in finalizing these plans because the USAID project will close in September 1987. The Team believes that this activity should be a priority in the coming months (See Annex III.5.1 and III.5.2).

The Team was disappointed to find that personnel carrying out the ULV and larviciding operations were not more familiar with standard practices and evaluation. The recommendation on this subject presented by the Team in Section 5.3 is underscored because this activity is costly, time-consuming, and should be done correctly by trained staff.

The Team did not observe any in-country training, but it supports ZMCP plans to make a determined improvement over the next two years in this area. Special training support in the form of external technical assistance for supply and transport management is considered essential for these key personnel.

3.6 Administrative Management

3.6.1 General Administration

The Zanzibar Malaria Control Program (ZMCP) falls under the administrative control of the Department of Preventive Services and Health Education. It is administratively divided into four sections -- Administration, Health Education, Epidemiology, and Field Operations. For malaria control purposes, the country is divided into the two islands with main operational offices in Zanzibar Town (Unguja) and Chake Chake (Pemba). On Unguja there are three regions: North, South and West/Urban, and two districts in each of the regions. On Pemba Island there are two regions: North and South, each with two districts (See Annex III.6.1). In the administration, operations, and technical areas of activities, the consensus is that general supervision is weak and needs strengthening. In most cases, supervisors have not been given written supervisory guidelines or "checklists." Though all employees except Malaria Agent Supervisors have job descriptions, many do not seem to have a clear conception of the full scope of their job. There is a need for guidance to rearrange and set up files, especially in the headquarter's administrative area, so that filed material can be located without time-consuming search. As an example, data relating to PIO/Cs is interspersed with other unrelated file material. Separate file folders need to be set up for each PIO/C to consolidate in one place the original request for procurement action, PIO/C copies, correspondence, copies of procurement documents, shipping and receiving documents. At present it is almost impossible to reconstruct the status of any procurement action. Offices have adequate space, furniture, office machines, duplicating and filing equipment, and two Apple personal computers. Considerable improvement since the last evaluation in the organization of office space is noted, and it is now adequate for efficient operations. A competent administrative officer and a general services officer have been selected pursuant to the 1984 recommendation of the administrative and supply consultant. The chief storeman has received special supply training from the short-term administrative/supply consultant.

3.6.2 Transport

The program currently has 23 vehicles, of which seven are in the garage awaiting spare parts. One is 1977, two are 1978, 15 are 1982 and five are 1984-1985 models (Land Rovers, Isuzus and Toyotas). Though the ProAg provides for only 11 new vehicles, the ZMCP has asked for procurement of 19 additional vehicles. Eleven of these are to replace 1982 and older models and eight to

provide vehicles to personnel not presently assigned them. Included in this latter group are three 3 1/3 ton Isuzu trucks, two of which are to supplement the three existing 3 1/4 ton trucks and one to replace a fourth existing 3 1/4 ton truck. Also included in the fleet are eight Honda motorcycles, 12 Bejaj motorscooters, and 129 bicycles. The attached Annex III.6.3 describes the utilization of this transport fleet.

Vehicle Maintenance and Repair

The program has no established historical repair and maintenance data file for each separate vehicle. Records of preventive maintenance in vehicle log books are not always used as a basis for scheduling future maintenance, nor is there a central schedule indicating when drivers should bring vehicles to the garage for maintenance. All vehicles have been found to contain up-to-date log books. Vehicles driven by the Director, Malariologist, Assistant Director, Island Officers, and Regional and Operations Officers do not require assigned drivers. A few of the remaining vehicles do not have regular drivers assigned. There is no garage either on Unguja or Pemba where vehicles can be properly repaired and serviced; the areas being used are primitive at best, with little protection of mechanic's tools and spare parts. Security is minimal and theft of spare parts is not uncommon.

Vehicle Spare Parts

Spare parts and tires are stored with general supplies in the general supply warehouse where, because of inadequate space, a large number of spare parts are stored in undesirable storage rooms at headquarters. Severe crowding makes it almost impossible to store spare parts in logical and orderly "groups" on shelving provided. Nonetheless, the condition of the spare parts and containers is good. The ZMCP has been provided with excellent steel shelving and special storage bins for loose parts. ZMCP and ministry mechanics work cooperatively on both ZMCP and ministry vehicles. However, ZMCP spare parts are not installed on ministry vehicles except for a few isolated instances approved by the Director of ZMCP. Written supply procedures exist but need amendment and amplification to conform to present practices, and to ensure consistent ordering and accounting of spare parts used to repair vehicles. Stock record cards have been set up for each spare part; however, based on the loose procedures now followed, it is difficult to assume that all items are covered and all issues and receipts are accurately recorded thereon. Reorder control levels are not set on all items to prevent premature exhaustion of stock. In October 1985,

to cover their projected needs through September 1987, the ZMCP submitted a list of spare parts requirements to USAID. There appears to be no record of a PIO/C having been prepared pursuant to this request except for a few Chevrolet parts. Used, worn-out, useless spare parts removed from repaired vehicles are saved and now occupy valuable warehouse space.

Transport Relevancy and Adequacy to Meet ZMCP Goals

A Peace Corps Volunteer with an automotive mechanic's background has been working closely with ZMCP mechanics, most of whom now demonstrate adequate vehicles repair training. An acceptable level of repair and vehicle maintenance can be projected, provided that basic needs, such as adequate garage working space, tools, equipment and spare parts, are provided. The distances travelled, as reflected on the transport analysis (See Annex III.6.3), appear to be excessive given the small size of the islands. This reflects a lack of vehicle-use control. Controls to eliminate personal and unauthorized use of ZMCP vehicles do now exist, however, and are observed to be carried out. No controls are exercised on the use of motorcycles and motorscooters, because unlike the regular vehicles, they are not garaged each night in a designated secure and controlled area. The composition of the fleet of vehicles, including motorcycles, motorscooters, and bicycles presently on hand and proposed for new procurement (See Annex III.6.3) is well balanced and adequate to carry out the transport requirements of the program.

3.6.3 Supply Management

General

Pursuant to recommendations made by an administrative and supply consultant during a six-week short-term consultancy in 1984, job descriptions for all administrative and supply personnel were published, new supply forms were designed, and procedures for order processing, stock record card maintenance, issuing, receiving, shipping, warehousing, materials handling/storage, stock replenishment, and physical inventory were written. Forms and procedures for non-expendable inventory accounting were also written and published. A very adequate and secure warehouse was located and laid out, and steel shelving was erected, basically to accommodate only general supply items.

Stock Control

The ZMCP has now established stock record cards on Kardex housed in new Kardex files, on both Unguja and Pemba, for all

general supplies and vehicle, pump, and bicycle spare parts. The newly designed stock cards are being used, but unfortunately, they were mimeographed instead of printed. Reorder control levels have been entered on most stock cards, and issue and receipt entries appear neat and accurate. When items are replenished, the quantities ordered have not been entered in the space provided on the stock card. On Pemba the stock cards were kept under the stock itself and the new Kardex cabinet file was not used. This has been corrected.

Order Processing

The written procedures for order processing are not being followed, though the new multi-purpose requisition/shipping/receiving report form is being used on Unguja. On Pemba the Ministry requisition forms are still used but a supply of the new form will be used in the future.

Warehousing/Materials Handling

The ZMCP has not been able to take full advantage of the excellent warehouse space and steel shelving provided for general supply items. Severe crowding caused by the storage of vehicles spare parts and bulky items such as tires and windshields, make it almost impossible to have easy access to items stored on the shelves. Bulk items in original containers are not stacked properly, using the "binding" stacking methods. In the case of malathion stored on Pemba, the stacks are leaning and the bottom cartons show carton fatigue, bulge and compression of insecticide; this is due also to stacking too high. On Unguja, DDT is stored in the Public Works Department warehouse which can easily accommodate shipments scheduled through September 1987. The area is well protected from the elements and security is good; only obsolete DDT and "survey" material is stored at this location. Serviceable and unserviceable pumps and the pump repair facility are located in cramped quarters in the Forodhani area. Severe crowding also prevents exercise of proper housekeeping practices at Unguja. The warehouse on Unguja is secure; the roof, however, leaks in several places. The storeroom on Pemba is located in the headquarters building in Chake Chake. The provision of a separate warehouse for vehicle, bicycle, and pump spare parts will go a long way towards solving the storage problems in the Unguja general supply warehouse.

Physical Inventories

When stocks were moved to the new general supply warehouse, a complete physical inventory was taken (the new pre-tagging

physical inventory procedure was followed) and recorded on the stock record cards. Past records are such that it appears impracticable to reconstruct past receipts and issues in order to reconcile the physical inventory to determine the magnitude of differences.

Though a procedure has been written and forms designed, no physical inventory of non-expendable items has been taken. An initial inventory is required to set-up custodian inventory/receipt forms and non-expendable stock record cards.

Commodity Management/Procurement

Except for very small items, there is practically no local procurement in Zanzibar or Dar es Salaam. Most ZMCP requests have been directed to USAID/Dar es Salaam, usually by attaching a list of requirements to a transmittal letter. These requirements are reviewed by the Project Director, the Contractor (Malariologist) and the USAID/Tanzania Project Officer. Certain items lend themselves to procurement in Kenya, and PIO/Cs are sent to REDSO/Nairobi for procurement action. All others are forwarded by PIO/C to A.I.D./Washington, which designates a procurement agent to conduct the procurement and arrange export shipment. A number of problems have arisen between the ZMCP and the USAID/Dar es Salaam procurement specialist. These seem to center around allegations of inadequate purchase descriptions, excessive quantities, too-frequent orders, lack of prompt submission of PIO/Cs, lack of status information and follow-up with the procuring agent, and shipping documents required for port commodity release not reaching the customs clearing office within the Ministry prior to the time the shipments reach the port. These problems result in unnecessary delays in receiving shipments, and in costly port warehouse demurrage charges. A review of the document distribution and shipping instructions sheet attached to all PIO/Cs indicates that there should be no problem. Some blame is placed upon the poor postal system between commodities' origin and Zanzibar. A review of current PIO/Cs confirms that some descriptions thereon are not complete, especially for those items not citing a catalog number in a recognized commercial catalog.

3.6.4 Financial Management

A financial analysis of the Amended Project Agreement LOP funding of \$7.46 million (See Annex III.6.4) reflects funds committed as of September 30, 1985 (updated 12/18/85) to be \$3,908,000, pending PIO/Cs obligate \$1,774,000 and proposed additional expenses of \$1,497,000. This results in a net balance

of \$281,000 of funds not committed. There is a strong possibility that one \$700,000 PIO/C may be overobligated. This should, in the final analysis, increase the net balance available considerably, allowing for procurement of unanticipated future requirements. There are some imbalances among the expense items vis-a-vis the projections in the Project Agreement, most significantly in commodities. However, funds originally reserved for Other Costs, Inflation and Contingency appear also to be overstated. The data (See Annex III.6.5) concerning fiscal contributions by the Government of Zanzibar, as provided by the Office of Planning in the Ministry of Health, indicates that the ZMCP has received, and can expect to continue to receive, adequate financial program support for malaria control.

3.7 Chemotherapy Activities and Their Suitability to ZMCP Needs

In-vivo chloroquine sensitivity studies from 1982 through 1984 demonstrated the presence of chloroquine-resistant P. falciparum (Annex III.7.1) in several localities throughout Unguja and on Pemba, but there is no clear evidence that resistance has increased in degree. Both in 1982 and 1984, the failures were limited to the A-2 type. Amodiaquine was found to be slightly more effective in 1982. Susceptibility tests for other antimalarial drugs have not been conducted.

The ZMCP continues to use chloroquine as the first-line drug for treatment at an adult dose of 25 mg/kg body weight, over three days. This treatment schedule is now widely available in health centers.

Quinine is available to hospitals through the ZMCP. Use of pyrimethamine/sulfadine (Fansidar) was discouraged by several review teams (Annex I) to control the occurrence and spread of Fansidar-resistant falciparum malaria. Nevertheless, Fansidar had been imported in large quantities, and had been widely distributed and used in Zanzibar hospitals since mid 1985 (Annex III.7.2 and III.7.3). Where no data is available, clinical failures and recrudescences are reportedly not common following treatment with chloroquine.

Due to chloroquine resistance of P. falciparum, use of chloroquine at a dose of 5 mg/kg body weight for prophylaxis is extremely unlikely to have any positive effect on morbidity and mortality, and was discouraged by several teams (See Annex I). In addition, using chloroquine for prophylaxis may well accelerate the spread, frequency and degree of chloroquine-resistant P. falciparum (See Annex I).

3.8 Entomological Services

The debilitating and sometimes mortal effects of malaria have long been recognized, and have been combated by administration of appropriate drugs. However, the discovery that the disease is normally transmitted only by mosquitoes of the genus Anopheles opened the possibilities of malaria control by practical measures against those mosquitoes. Planning of the Zanzibar Malaria Control Program took into account such measures and recognized the need for entomological work to furnish the following basic information:

- a. identification and distribution of those anopheline mosquitoes responsible for transmission in Zanzibar;
- b. studies of habits of potential vectors, including their preferences for feeding on man and animals, and their indoor and outdoor biting and resting habits;
- c. identification of breeding places of potential vectors and the characteristics of such habitats;
- d. determination of the susceptibility of vector species to the insecticide(s) considered safe for use against infective mosquitoes; and
- e. in the case of the insecticide(s) of choice, the study of the duration of effectiveness of insecticidal action when applied on various indoor wall and roof materials, so that they can continue to kill female Anopheles which may bite or rest inside of houses. Without such information, the timing of spraying of the houses cannot be planned in the most effective and economical manner.

The ZMCP Project Paper Amendment 1 of July 1985 (page 6) outlined a five-point program to "...effect a reduction in malaria prevalence..." of which the third point called for:

"reduction of vector populations through residual spraying of all houses in rural and peri-urban areas and by the elimination of breeding sites by anti-larval activities or treatment in urban and peri-urban areas."

A review of our available knowledge on the types of entomological information described above -- knowledge essential for attaining the Amendment 1 "reduction of vector population" objective-- reveals the following information (also see Annex III.8.1).

3.8.1 Identification and Distribution of Malaria Vectors in Zanzibar

Status

Three important malaria vector species (Anopheles gambiae, s.s., An. arabiensis, and An. funestus) have been collected in human dwellings in Zanzibar and identified by recognized specialists, using sophisticated, costly and time-consuming techniques. Each of these species has been incriminated in Zanzibar or in many parts of Africa as an important vector of malaria (McCarthy, 1941; Oedetoyinbo and Davidson, 1968; and Petrarca, 1985). The sophisticated use of electrophoresis techniques by ZMCP personnel to further identify the components of the Anopheles gambiae complex are not essential for the practical reduction of malaria vectors in Zanzibar.

Distribution data on Anopheles mosquito species on Unguja and Pemba are far from complete. Collecting should be done opportunistically. A basic collection of these mosquitoes should be established on Unguja and Pemba for reference and for teaching purposes, along with registers of collected material showing dates, collectors, and habitat description.

3.8.2 Habits of Potential Vectors, Including Their Preferences for Man and Animals, and Their Indoor and Outdoor Feeding and Resting Habits

Status

Ten "indicator villages" (six on Unguja and four on Pemba) were programmed for monthly field work to monitor densities and habits, and to yield live material for susceptibility tests. Only eight of the 10 programmed villages were established (four on Unguja and four on Pemba). Unfortunately, during the 22 months from May 1984 through February 1986, no more than 16 exercises were carried out in any of the four villages on Unguja. Inasmuch as the Pemba parasitology/entomology unit submits summary reports rather than detailed data, review and analysis in ZMCP headquarters is virtually impossible.

Human bait catches made indoors and outdoors from 6:00 p.m. to 6:00 a.m. have provided valuable information, despite the discontinuity of the field work (See Annex III.8.2). Heaviest biting, both indoors and outdoors, has occurred between 9:00 p.m. and 3:00 a.m. Heaviest densities have been found in Kikobweni (North "A"), in Mwera (Central), and in Muwanda (North "B"). Only a single specimen was captured in Makunduchi (South), where

the coral substrate provides almost no suitable breeding places.

Significantly, outdoor biting has been consistently heavier than indoor biting, including the period before residual spraying in any of the houses (See Annex III.8.2). Seasonal differences in densities can be seen, but may have little validity because of numerous interruptions in the field work.

Following the completion of night catches, suction tube captures are made in four houses; unfortunately no record is kept of the locations of resting anophelines which are captured, although the live specimens are kept for susceptibility tests.

Pyrethrum spray/sheet collections should be made in four houses, distinct from those which have been disturbed by the suction tube captures. The field personnel have been using the same houses, permitting no useful density comparisons of the two techniques.

An unwritten protocol and the report forms call for carrying out mosquito trapping procedures (window, animal bait, pit trap) during each month's visit. Almost none of these has been accomplished, except for some pit trap collections at Mwera, using a pit trap dug by non-ZMCP entomologists. Pit trap collections may yield valuable information on outdoor resting preferences of anophelines; such traps should be dug and used at all indicator villages, except Makunduchi, where the coral substrate makes this impractical.

3.8.3 Identification of Breeding Places of Potential Vectors and the Characteristics of Such Habitats

Status

The only efforts which have been made to identify vector breeding places are those by larviciding personnel, and the only classification or characterization of these has been a rather loose "permanent" or "temporary." Little effort has been made, or curiosity shown, by central entomology personnel to locate and associate larval habitats with the anopheline adults they are collecting. In view of the very conspicuous ecological difference between the coral-limestone southern region and the rest of Unguja, location and monitoring of larval productivity of the scarce breeding places in the south might justify immediate or near-future reduction in vector control measures there, if supported by malaria case-findings.

3.8.4 Determination of the Susceptibility of Potential Vectors to the Insecticides Considered Safe for Use Against Infective Mosquitoes

The report of the November 1983 Program Evaluation Team urged that the ZMCP give a high work priority to testing the susceptibility of vector mosquitoes to the insecticides to be used for residual spraying. ZMCP responded vigorously in 1984 by accomplishing 60 DDT tests on Unguja, where that insecticide was to be used. In 1985, 20 DDT tests were made on Unguja and eight on Pemba. During the same year, seven malathion tests were made on Pemba, where that insecticide was being used, and 11 malathion tests were made on Unguja. The only tests carried out to date in 1986 have been two malathion tests on Pemba. The following table summarizes the results of tests from 1984 to date (Also see Annex III.8.3).

<u>Insecticide and Year</u>	<u>Place</u>	<u>No. of Tests</u>	<u>Mortality Range (%)</u>	<u>Mean Mortality (%)</u>
<u>DDT</u>				
1984	Unguja	60	17.5-85.9	54.8
	Pemba	0		
1985	Unguja	20	23.5-84.4	49.8
	Pemba	8	21.2-100.0	60.1
1986	Unguja	0		
(Jan., Feb.)	Pemba	0		
<u>Malathion</u>				
1984	Unguja	0		
	Pemba	0		
1985	Unguja	11	100.0	100.0
	Pemba	7	100.0	100.0
1986	Unguja	0		
(Jan., Feb.)	Pemba	2	100.0	100.0

Comparisons of the mortalities among anophelines exposed to DDT and to malathion show the superiority of the latter, and it was initially planned for use on Pemba, where anopheline susceptibility to DDT was lower than on Unguja. Unlike the initial DDT testing at the beginning of the program, the 1985 tests in Pemba showed mortalities equal to or higher than the DDT

initial DDT testing at the beginning of the program, the 1985 tests in Pemba showed mortalities equal to or higher than the DDT mortalities on Unguja. Inasmuch as malathion application involves more precautions on the part of the spraymen, and frequent monitoring of cholinesterase levels), it is suggested that an extensive series of DDT susceptibility tests be carefully made in all regions of Pemba and Unguja. Should those tests confirm that the mosquito mortalities on Pemba are equal to or higher than those on Unguja, serious consideration should be given the use of DDT for residual spraying on both islands.

3.8.5 Testing Duration of Effectiveness of Insecticidal Action

Status

After an appropriate compound has been selected and used as a residual insecticide inside houses in any malaria control program, it is essential that the resulting residues on wall or roof surfaces be tested at reasonable intervals (preferably monthly) on the various house construction materials (mud, cement, thatch, wood, etc.) to determine the duration of effectiveness of those residues against anopheline mosquitoes. Rather obviously, mosquitoes used in these "bioassay tests" must come from populations which are susceptible to the insecticide residue being tested. The confinement and exposure of these mosquitoes to the residues is thus not a test of their susceptibility, but of the lethal effectiveness of the residue at various intervals since the last spray cycle was accomplished. When a house (or houses) in a given village (for the ZMCP, houses in the "indicator villages" are best used) has been selected for the tests, the periodic repetitions of the test should be carried out in the same house. Within each house used for any test, the test areas on wall and roof should be those which have not been subjected to rubbing or disturbance by hanging, clothing, swaying curtains, or routine household cleaning tasks. Mosquitoes confined in the plastic cones used in the tests should be exposed not only to the sprayed surfaces of varied wall materials, but also to a clean sheet of paper fastened to the wall (as a "control" of the care used in handling) and to a standard sheet of paper impregnated with the insecticide being tested (DDT 4 and/or malathion 5%).

Entomology personnel of the ZMCP have carried out only five bioassay tests in sprayed houses since the beginning of the program (all in 1985), and have ignored almost all of the above-mentioned conditions. The mosquitoes used have been field-caught from populations in areas where some insecticide resistance has been recorded; tests have not been repeated

It must be emphasized that mosquitoes for the tests must be anophelines collected from populations with confirmed susceptibility or ideally, from anopheline adults reared in the ZMCP insectary. Lamentably, the once-established colony of anophelines in the insectary has dwindled to almost nothing, and no records have been kept of colony maintenance procedures to give any clues concerning the decline of the colony. Assistance from an experienced field/laboratory entomologist is obviously needed to train ZMCP personnel in the establishment and maintenance of an anopheline colony and in the proper execution of bioassay tests of effectiveness of ULV applications in Zanzibar Town.

3.8.6 Determination of Anopheline Sources of Blood Meals

When anopheline females are collected from inside houses, resting on walls, roofs, or in other locations, it is highly probable that the blooded specimens have obtained their blood meals from the occupants of the house. However, blooded specimens collected from outdoor resting situations may have blood-fed on humans inside the house or they may have fed on humans or domestic or other animals outside of houses without exposing themselves to the sprayed surfaces inside the houses. In order to answer this important question, the sources of outdoor-resting anophelines' blood meals may be determined by "precipitin testing," based on blood from the mosquitoes' stomachs deposited on filter paper. Only one series of stomach contents for precipitin testing has been taken during the Zanzibar program, and the material was sent to a laboratory in England which is equipped for such testing. To date, no results from the tests have been received. A follow-up is in order on that initial test series, and additional material should be collected from outdoor locations, such as pit traps; if precipitin testing of specimens from such locations indicate human blood, the tests may explain failures to halt transmission.

IV. PRESENT AND FUTURE ROLE OF PHC WORKERS AND RURAL HEALTH CLINICS IN THE ANTI-MALARIA PROGRAM

There are a number of excellent reference documents which describe in detail the organization, specific tasks, and historical background of the development of health services in Zanzibar. This information is not repeated in this document except where necessary to support observations (Annex I).

In brief, the Zanzibar Ministry of Health is responsible for the delivery of health services to all citizens of the Island. Under the leadership of the Minister, the activities function under a Principal Secretary. There are three major divisions-- Hospital Services; Planning, Development, Administration and Finance; and Community Health. The Malaria Control Program is under the responsibility of decentralized organization system which includes three regions on Unguja, (North, West and South) and two regions on Pemba (North and South). The Malaria Control Program follows a similar pattern in its operational services (See Annex III).

In addition to four hospitals and the cottage hospitals, the Zanzibar primary health care network consists of 73 health centers (dispensaries) located in rural and peri-urban districts, including 38 on Unguja and 35 on Pemba. Most of Zanzibar's citizens live within an average of 6 km distance of such institutions. These centers provide a combination of curative and preventive services. The officer in charge is normally a hospital assistant or medical assistant who carries out a wide variety of curative and preventive functions. However, it was observed by the Team that this officer is primarily engaged in curative actions. There are maternal and child health (MCH) activities functioning as a program within these health centers.

The malaria control activities are at present being carried out on a vertical basis, and the implementation of operational field activities is not shared by the primary health care (PHC) system, except for treatment of clinically diagnosed cases and some health education efforts. The permanent staff of the malaria control project (MCP) holds positions with the Ministry of Health (MOH). The integration of its staff in a broader health function is eased as the ZMCP moves towards integration within PHC.

The process of integrating malaria control activities into general health services has been going on in various countries for a decade or more. During this period, a number of lessons have been painfully learned by countries where malaria is an endemic problem. Among the more important lessons learned are that (1) there must be a functioning, well-qualified central malaria unit within the MOH prepared to develop policy, provide technical guidance, carry out evaluation, and act as a central support group for funding, and specialized technical personnel to assist other levels of the PHC system; (2) integration of malaria control within a general PHC system should be carefully considered if a widespread program of vector control is to be carried out, as the PHC system is not set up to plan, implement

and evaluate such programs without specialized technical and operational support; (3) the country must prioritize the importance of malaria within its disease control activities and determine a national policy, (i.e., how much malaria is economically, socially and politically acceptable) and develop a firm strategy to meet that policy; and (4) the PHC system alone, in malaria situations such as Zanzibar, will not influence the disease prevalence to any great extent, but can provide prompt clinical relief to malaria patients.

There are numerous examples of poorly planned integration of malaria control services into PHC systems, resulting in massive epidemics and emergency situations. Basic to such integration is a well-prepared plan that has been created by a knowledgeable working group over time, with specific adaptations to fit the individual country's health needs. The Team urges such a plan to be carefully developed and approved. Experience has also shown that in order to begin such a planning effort, it is necessary to have an analysis of the status of malaria and its epidemiological pattern.

Through an epidemiological approach, the disease can be stratified, appropriate technology selected, and organizational adjustments considered. The strategy development includes a variety of components, including (1) definition of the problem and feasibility of maintaining a level of control; (2) identification of goals and objectives in terms of public acceptability; (3) identification of available knowledge; (4) definition of infrastructure levels in the health sector where support and referral staff should be established; (4) necessary monitoring and information systems; and (6) what specialized services are to be established for prevention and control services (i.e., entomological and parasitological activities).

With a strategy in mind, a period of reorientation and training of malaria control and health personnel is required. Such training is to be provided to all health workers in the community, as well as those health workers involved in (1) technical support; (2) referral system for the treatment of severe cases; (3) epidemiological services; (4) personnel involved in drug monitoring; and (5) epidemic response to focal outbreaks. Clearly, there is a continuing need to generate scientific and technological knowledge and to apply it within the health system - new tools for diagnosis, chemotherapy, immunology and vector control. With the provision of a strategy and the initiation of training and support for research and development, it is now necessary to select the appropriate malaria control measures to be carried out at the PHC level.

The primary responsibility of the PHC system is to provide for the diagnosis and treatment of cases and to support individual and collective activities for the prevention of malaria. Diagnosis and treatment can be carried out by community hospitals, health centers, malaria clinics (such as developed in Thailand), volunteer drug distributors (India, Nepal), and volunteer surveillance agents (Central and South America). Individual efforts encouraged by health education can be increased to support malaria clinics and mobilize community support. Special anti-malaria protection for pregnant women, infants and children can be developed, such as the present MCH clinics in the Zanzibar PHC system. It should be noted that chemoprophylaxis in children under five is no longer recommended. Specific instructions for clinical use of chloroquine, amodiaquine, sulfadoxine-pyrimethamine, mefloquine (where applicable), quinine, and primaquine, as well as chemoprophylaxis are to be standardized and distributed throughout the PHC system for use by assigned personnel.

Support, referral and technical orientation systems for malaria control to implement the strategy now need to be put into place in accord with the level of control required. An organizational structure and necessary support systems leading from the central level to the community base, and individuals within the structure are to be established and implemented. Included in this organization are referral systems, training schedules, vector control and measures to limit man-vector contact. Such measures might include use of bed-nets, residual spraying, control of mosquito breeding places, integrated control and intersectorial cooperation.

The present plan of the MOH is to retain a central malaria unit which contains a support system for the PHC system. The assignment of malaria control expertise at the regional and district levels also appears to be a sound acceptable mechanism for Zanzibar's PHC development activity. It is certainly appropriate that there should be funding available to adequately support this specific malaria activity. In summary, the role of PHC in malaria control activities must be developed carefully by national authorities through the planning and creation of a long-term strategy suitable to national needs. In the case of Zanzibar, where the present status of malaria would overwhelm a PHC system, it appears that a strong centralized malaria control unit will be necessary for the future to guide antimalarial activities within the PHC structure. Every opportunity to apply new technology should be used to provide a more efficient and cost effective operation.

V. SPECIFIC RECOMMENDATIONS OF THE EXTERNAL REVIEW TEAM

5.1 Epidemiological and Entomological Report

5.1.1 Epidemiological Reporting and Evaluation

5.1.1.1 Until prevalence rates decline to 3 percent or less in the 2-9 year age group, malarimetric surveys -- conducted each year between June and August in the same villages covered in 1985 -- should form the basis for evaluating program effectiveness.

5.1.1.2 The present system of ACD activities is unregulated and unsupervised. Malaria agents should not collect slides from suspected malaria cases because the results of slide examination are not being used for treatment or evaluation.

5.1.1.3 The ZMCP should continue to be responsible for monitoring the malaria situation, and for evaluating the effectiveness of control measures.

5.1.1.4 The ZMCP should consider requesting periodic external epidemiological evaluations as an important aid in guiding program activities.

5.1.2 Entomological Reporting

5.1.2.1 Entomology personnel in Pemba should be encouraged to review and analyze the data from their field activities, but complete, detailed reports should be forwarded to ZMCP headquarters to permit analysis and comparison with Unguja data for the formulation of the most appropriate strategy.

5.1.2.2 Following the preparation of much-needed guidelines for the operation of mosquito insectary, detailed records and reports should be maintained documenting insectary procedures being used, and quantifying the daily production of anopheline larvae, pupae, and adults.

5.1.2.3 Vigorous measures should be taken to insure the accomplishment and reporting of the monthly night-catching and other activities in each of the indicator villages in Unguja and Pemba.

5.1.2.4 The results of anopheline susceptibility tests should be recorded on the standard WHO forms, with information copies being forwarded to the WHO Regional Office and Geneva Headquarters through the local WHO representative.

5.2 Laboratory Services

5.2.1 Re-checking of positive and negative blood-slides should be improved in quality and quantity. At this time, only 14 percent of positive slides and 1.3 percent of negative slides are being re-examined.

5.2.2 Laboratory services should be provided directly in the Out-Patient Departments (OPD's) of all hospitals.

5.3 Vector Control Operation

5.3.1 Spraying operations must be planned for each year, and for each round, well in advance. Only in this way can insecticides be ordered and distributed, or equipment be put into shape or ordered, to ensure adherence to the established spraying schedule. Proper planning of the spraying operations requires the completion of geographic reconnaissance (G.R.) and its periodic updating (G.R. is also needed for entomologic and epidemiologic work).

5.3.2 Training of the operational staff must be a continuous process. All operational staff, and especially those at supervisory level, must participate in comprehensive, specialized courses on geographic reconnaissance and spraying operations. These courses must include substantial proportions of field work, with "hands-on" practical experience.

5.3.3 Field operations can be organized in a more practical manner if four or five smaller base camps are established in district or regional centers.

5.3.4 It is strongly recommended that squad chiefs or district malaria officers direct the weekly measure of the nozzle tip discharge rate from each spray pump, to ensure the application of the recommended dosage.

The handling, servicing and maintenance of spray pumps must be improved. If sprayers are transported in a four-wheel drive vehicle, racks should be installed to hold the spray pumps firmly and avoid serious damage when travelling over rough roads. Similarly, shelves must be provided in the store for the spray pumps when they are not in use. As soon as any spraying cycle is finished, a complete overhaul of the spray pumps should be made, instead of storing them until the next spraying operation is scheduled.

Each sprayer should be numbered in a permanent fashion, and one card should be prepared for each unit, for notation of its history, including all repairs and replacement of parts.

A follow-up is recommended with the manufacturer for remedial action concerning the leakage encountered at the junction of sprayer tank top and the connection of the dip tube. During the checking of all spray pumps for the next spraying cycle, a detailed record should be kept of this leakage or other mechanical failures of the units.

5.3.5 Pick-up trucks -- especially those with long wheel-bases -- are more practical for spray operations than station wagons. In pick-ups, the much-needed racks can be installed to support the spray pumps. In addition, to ensure that the householders protect themselves, children, animals, and foodstuffs, they should be advised to ventilate the house for a minimum of one-half hour after spraying before re-entering their home.

5.3.6 Suitable nozzles must be used for application of larvicide. The recommended one has a hollow-cone pattern for discharge at a rate of 150-200 cc/minute at a pressure of 40 p.s.i.

Larviciding in and around Zanzibar Town should be selective. The existing breeding places must be mapped with great care, and classified for each type of cost-effective control measure (see paragraph 3.3 above). This will reduce any unnecessarily repetitive application which is costly in terms of time, labor, and money.

5.3.7 Biological control of malaria vectors through the use of larvivorous fish on each island must be promoted and implemented through community action. It is recommended that the services of a field-oriented ichthyologist with a taxonomic background be sought to carry out a survey in Zanzibar to identify any native larvivorous fish. The specialist should be capable of training the appropriate ZMCP personnel concerning the breeding, rearing, and distribution of any appropriate species.

5.3.8 In the field of environmental management, legislation is needed to counteract procedures which are producing mosquito breeding places: excavation, overflow of household water, leaking mains, rice plantations within city limits, etc. Zanzibar already has legislation for this specific purpose (See Annex I, Laws of Zanzibar references). Many larviciding problems may be avoided or eliminated if this legislation is updated and enforced.

In rural areas, the People's Councils in the communities are not yet being mobilized to eliminate mosquito breeding places. The ZMCP must be in a position to provide technical assistance for such activities. It is hoped that a technical officer or an engineer may be found within the MOH or recruited by the ZMCP for this purpose.

Inasmuch as rice production in Zanzibar is being encouraged and expanded, attention should be given to its possible role as a source of potential vectors of malaria. If the paddies are confirmed as breeding places, the MOH and the Ministry of Agriculture might well explore any means of solving this problem.

Because of the threat of anopheline resistance to the insecticides now in use, and the high cost of newly developed effective insecticides, attempts should be made to promote environmental management (E.M.) measures for vector control. E.M. could be implemented by individual households as well as by community action if some technical assistance is available from the health authorities.

5.3.9 The presence of ultra-low volume (ULV) machines in Zanzibar will be useful in event of any vector-borne disease epidemic. Because of hard currency constraints for the purchase of ULV formulations of insecticide for effective applications, the non-availability of trained personnel, and lack of spare parts to operate, maintain and repair the ULV equipment, routine space spraying for vector-borne disease control is not advisable.

A repair shop for spraying equipment and machinery should be established. A mechanic should be specially trained to maintain and repair existing ULV equipment.

5.4 Health Education

5.4.1 Increased health education in malaria control and prevention is strongly urged. Such education would involve schools, the political party structure, communities, members of the ZMCP, the MOH, and other government and private agencies.

5.4.2 The Team suggests that District level one-day workshops be organized with community and political leaders to discuss the malaria problem in Zanzibar and to provide information on environmental management, importance of proper treatment, and acceptance of spraying.

5.4.3 Inter-sectorial cooperation should be promoted and

strengthened in the production of educational material for the public in general and school children in particular. The material being produced should aim at informing the public concerning the cycle of malaria transmission, and about measures which can be carried out individually and collectively to reduce the risk of transmission.

5.5 Training

5.5.1 Training aspects of the joint GOV/MCP effort are considered a priority. While considerable achievements have been made in this area over the last two years, much more is required, especially for in-country training of operational and entomological personnel. Use of technical assistance for such training should be considered; the emphasis, however, should be on GOZ/MCP personnel doing the training.

5.5.2 Training in malaria control basic methodology and purpose is urged for MOH personnel in order that they can assist more effectively in this national effort.

5.6 Administrative Management

5.6.1 The ZMCP should request short-term administrative/supply technical assistance to train personnel and assist with the following projects:

- a. Review all stock cards, develop complete descriptions/specifications, and set re-order control levels.
- b. Set-up complete PIO/C files and transfer quantities ordered but not yet received, to the appropriate stock card, and thereafter record quantities due-in on the date they are ordered.
- c. Re-write order processing procedures to accommodate current conditions.
- d. Initiate an inventory of non-expendable items and establish custodian receipts and stock record cards.

5.6.2 Communications should be coordinated between ZMCP and the USAID/Tanzania Procurement Specialist to resolve the problems cited above relative to export documentation, expediting, and item identification. Frequent one-on-one meetings between ZMCP supply personnel and the USAID/Tanzania Procurement Specialist are recommended during which they will develop adequate purchase descriptions/specifications to be used before any item is placed

on a PIO/C. If necessary, they will also ensure receipt of status/shipping information and export documentation, and will hand carry such documentation from Dar es Salaam back to ZMCP and to the Custom Clearing Office within the Ministry.

5.6.3 An Export Shipment Status Record should be established that records sequentially for each line item or group of items on a PIO/C the data ordered, purchase document number, export invoice number, ocean bill number, name of vessel, ETD, ETA, port, and date received.

5.6.4 The administrative and technical sections of the ZMCP should assign "form numbers" to all forms used in the program. A special procedure and forms control register has already been developed and should be put into operation. Reproduce without change all conventional forms (e.g., WHO Forms) where these are globally or regionally recognized. Reproduce and store all forms in the General Supply Warehouse in anticipation of future use. Set up stock cards for all forms to record use, and establish controls to reproduce forms prior to exhaustion of stock.

5.6.5 All 1982 and older vehicles, most of which are in only fair condition and have logged more than 60,000 km, should be replaced.

5.6.6 ZMCP has requested 19 new vehicles, including replacement of 1982 and older vehicles (See Annex III.6.3). This requirement can be reduced to 16.

- a. Three (3) new 3 1/4 ton Isuzu trucks should be reduced to two (2). The present fleet of four trucks augmented by two new trucks and the use of Isuzu pick-ups should be adequate to transport all insecticide needed during the spray cycle planned in 1987.
- b. Cancel two (2) Isuzu pick-ups intended for use by the two Pemba Regional Officers who are now using 1982 Land Rover station wagons. When these are no longer operable, these officers can use Honda motorcycles for their supervisory activities.

5.6.7 A responsible driver should be assigned to every vehicle to ensure regular repair and preventive maintenance.

5.6.8 Motorcycles and motorscooters should be garaged at the close of each work day employees and should not be allowed to take them home.

5.6.9 Drivers must be responsible for recording all preventive maintenance performed on their vehicle in their log books. This should be recorded on the bound pages of the log book.

5.6.10 Copies of all job orders and requisitions for spare parts should be filed in an individual vehicle file folder, and permanently maintained as a historical repair record.

5.6.11 Newly constructed vehicle repair facilities located 5 km from the center of Zanzibar Town in the new Mwamakwerekwe Industrial Area, including a garage, office space, and spare parts storeroom, are scheduled to be completed in Unguja and Pemba by September 1986. A spare parts storeroom layout and arrangements of spare parts by "groups" (i.e., electrical, transmission, engine, etc.) on appropriate shelving (open, special drawers, and bins which the ZMCP has available) should be planned well in advance of the target occupation date. Space permitting, the "plan" should allocate shelf space for bicycle and spray pump parts, storage of pumps in good condition and those to be repaired, and a space for a pump repairman. The program may consider requesting three months of transport technical assistance because of the priority of this important advance planning and implementation.

5.6.12 Recurring survey actions should be scheduled regularly to remove, by sale or disposition, unusable worn-out spare parts returned to the warehouse by mechanics.

5.6.13 Upon completion of the relocation of spare parts to the new garages, inventories should be taken to update the general supply and spare parts stock record cards in both quantity and description.

5.6.14 On a priority basis, review and reconcile with USAID/Tanzania all items open on all PIO/C's and those items requested that are not yet placed on PIO/C to determine if the item and quantity requested is still essential to the needs of the program. Cancel or change items ordered as appropriate.

5.6.15 Automotive tires and chloroquine in original shipping containers obligate 95 percent of the available bulk storage space in the general supply warehouse. It is recommended that the ZMCP immediately search for temporary, economical, secure space for the tires elsewhere, and transfer the chloroquine to the ministry general store. This would relieve the cramped space situation and would allow warehouse personnel time to rearrange some stocks and perform some housekeeping prior to the spare parts relocation in September 1986.

5.6.16 A special effort should be made to unpack original shipping containers containing multiple items received on PIO/C shipments that were received some time ago in order to prepare receiving reports for USAID/Tanzania. To simplify and expedite preparation of these receiving reports, prepare a form satisfactory to USAID/Tanzania and consider using a copy of the PIO/C (or purchase document if available), appropriately marked with quantities received, to serve as an attachment to a receiving report form.

5.7 Use of Antimalarials and Surveillance of Parasite Susceptibility to Drugs

5.7.1 Minimizing the risk of resistance developing to alternative drugs is essential. This can best be done by ensuring that these drugs are only used when specifically indicated for treatment. The widespread and almost uncontrolled use of Fansidar in Zanzibar hospitals well may lead to unnecessary resistance to this important but expensive drug.

The MOH and the ZMCP should strongly consider the recall of Fansidar from the hospitals and storage of all Fansidar in-country by the ZMCP for control purposes. This drug should only be used in those cases where the infection is unresponsive to chloroquine or amodiaquine. The Team urges that the ZMCP carefully monitor the storage, distribution, and clinical use of Fansidar.

5.7.2 Chloroquine should remain the first-line drug for treatment. Alternative drugs such as Fansidar and Metakelfin should only be considered as first-line drugs for treatment of infections in very young children when R-3 resistance to chloroquine has been demonstrated in more than 10 percent of children tested in adequate in vivo field tests.

5.7.3 Determination and continuous monitoring of the extent and degree of resistance is essential if a rational policy for the use of drugs is to be developed. In vivo chloroquine sensitivity tests should be done annually in the same localities where such tests were carried out in 1982-1984. It is urgent that susceptibility to other drugs, including amodiaquine, quinine, and Fansidar, should be assessed before the end of 1986.

5.7.4 Chloroquine should not be used for chemoprophylaxis because it is very unlikely to reduce morbidity or mortality due to malaria in Zanzibar, and it may further accelerate chloroquine resistance of P. falciparum.

5.8 Entomological Services

5.8.1 Inasmuch as the 1985 anopheline susceptibility tests with DDT on Pemba showed mortalities equal to, or higher than, the equivalent tests on Unguja, it is recommended that extensive DDT test series be conducted soon on both islands.

5.8.2 It is urged that the monthly night catches be resumed in south "indicator villages" (Makunduchi), inasmuch as the noteworthy anopheline negativity to date may reinforce the ZMCP awareness of the ecologic differences characterizing that coral/lime area -- differences which, along with essential epidemiologic data, may dictate a strategy distinct from that on the rest of Unguja.

5.8.3 The monthly night-catches in each of the four Unguja "indicator villages" provide useful information regarding anopheline habits, but are inconclusive because of the frequent interruptions in execution during the past 22 months. It is suggested that administrative measures be taken to ensure the maximum possible numbers of monthly studies in all of the "indicator villages" in both Unguja and Pemba.

5.8.4 The ZMCP insectary has never produced enough DDT-susceptible adult anophelines so urgently needed for the bioassay tests to determine whether spraying of inside walls remains effective. It is recommended that the conditions responsible for this shortfall be studied and corrected.

5.8.5 Because the identity of mosquitoes breeding in ricefields in Zanzibar is not known, it is suggested that entomology personnel, following the appropriate ZMCP/MCH contacts with the Ministry of Agriculture, make larval collections and accomplish rearings in the insectary to determine what anopheline species, if any, are breeding in that habitat.

5.8.6 Because of the importance of the entomological activities treated in 5.8.1 through 5.8.5 above, and due to the rather irregular record of accomplishment of those activities, it is recommended that the short-term services of a field entomologist be contracted to upgrade the level of that discipline within the ZMCP by demonstrations and "hands-on" training.

5.9 Integration of Services

5.9.1 The Team endorses the integration of the ZMCP with the Primary Health Care (PHC) during the next Five Year Plan, but draws the attention of the Ministry of Health (MOH) to the need

for a well-developed strategy, detailed training schedules for both GOZ and ZMCP personnel, a central malaria control unit, and a clear national policy on malaria control, including increased intersectorial cooperation, to successfully accomplish this organizational step. GOZ's plans to form a working committee on this integration process are encouraged.

5.9.2 Dispensaries should be the primary delivery system of malaria treatment with referral to cottage hospitals.

VI. PROGRAM PROGRESS IN RELATION TO THE A.I.D. ASSISTANCE AND OBJECTIVES DURING THE 1984 - 1985 PERIOD

6.1 Present Progress Toward Project Objectives

The project goal is to assist Zanzibar in developing a health service system which can improve the health status of the people sufficiently for them to enjoy life, participate fully in community development activities, and contribute to the goal of self-reliance.

The project purpose is to reduce the prevalence of malaria on Zanzibar to a level at which it no longer constitutes a major health problem, through the adaptation of known control methods to local conditions in such a way that the Government of Zanzibar will be able to maintain effective control with its own resources.

The end-of-project status (EOPS) has nine specific targets. These targets are listed below and an evaluation of the activities of the ZMCP to accomplish these targets is provided to demonstrate progress towards these objectives in the 1984-1985 period.

<u>EOPS</u>	<u>Present Status</u>
<p>1. Malaria parasite rates as determined at the end of the project by malariometric surveys are not to exceed 3 percent in children 2-9 years.</p>	<p>The malariometric surveys indicate a lowering of infant parasite rates over the project period from the 50-40 percent to approximately 20 percent on Unguja North and 7 percent on Unguja South. The parasite rates in the 2-9 age group in 1985 were 35 percent on Unguja and 33 percent on Pemba, according to malariometric surveys. It appears that the 3 percent goal will not be reached.</p>

EOPSPresent Status

2. Organized and operating larviciding programs are in place in Zanzibar Town, Chake Chake, Wete, and Mkoani. Program has mapped permanent breeding places, a regular written schedule of work is used, and 90 personnel have been trained in larviciding techniques.

3. An ultra-low volume (ULV) program has been developed, with a clear policy and program guidelines, a work plan, and 20 ULV operators trained.

4. Residual spray cover in target structures is no less than 85 percent during any given round of spraying.

5. The out-patient malaria attendance rates in hospitals and health clinics should not exceed 10 percent of total patients in attendance.

The larviciding program has begun its program but a great deal of organizational work is required to ensure a cost-effective operation. A viable work plan needs to be developed. Approximately 15 people have been trained in larviciding techniques. Biological control and environmental management were not initiated.

A ULV program is in the process of implementation but work plans based on technical assessment have yet to be developed. Approximately 12 ULV operators have been trained.

NOTE: Entomological surveillance required in both items 2 and 3.

- a. Unquja
April 5 - December 19, 1984, reported 91.5 percent total coverage.
- b. February 9 - April 12, 1985, reported 91.5 percent coverage.
- c. Pemba
October 10, 1984 - May 18, 1985, reported 96.43 percent total coverage.

NOTE: In the absence of a complete geographical reconnaissance (G.R.), house coverage figures are questionable.

- a. Malaria represented 33 percent of all hospital admissions in the four hospitals and 27 percent of all hospital recorded deaths in 1983.
- b. It is estimated that malaria represents 29 percent of OPD visits to dispensaries.

EOPSPresent Status

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| 6. The malaria case fatality rate (laboratory-confirmed) in hospitals and health clinics should not exceed 0.4 percent. | The case fatality rate is given as 10 percent in the projected 5-year plan. It is believed that a 4 percent rate is more suitable and obtainable. |
| 7. Ninety-five percent of all houses in rural areas of the country are visited by the malaria active case detection (ACD) agents at least once per month. | Not accomplished; the Team believed that ACD is of marginal value at this stage of the program. |
| 8. One hundred percent of all GOV health institutions have received directives describing the appropriate drug treatment schedules for malaria and are fully supplied with malaria treatment schedules and preventive drugs. | The Team found that such instructions were generally available at the health institutions visited, except Bwejuu Health Centre in the South. Adequate drug supplies were available at all institutions visited. |
| 9. An adequate system of technical and operational evaluation is in place within the program with trained supervisory staff. | This area needs great improvement and an annual plan of action which includes targets. |
| 10. An interministerial malaria control committee and a technical advisory committee will be formed and will meet quarterly. | Interministerial committee formed and met on January 16, 1985 and July 24, 1985. The technical advisory committee has not been formed. |

6.2 Present Situation with Regard to A.I.D. Project Inputs

The Agency for International Development (A.I.D.) is providing a series of project inputs to assist the GOZ in its antimalaria efforts. These LOP inputs are evaluated up to the period through January 1986 to illustrate progress in providing this mutually agreed support to the GOZ.

<u>A.I.D. Inputs</u>	<u>Present Status</u>
<u>1. Technical Assistance (TA)</u>	
a. Provision of 4.5 years (54 mos.) of long-term TA.	Twenty-one months of service provided. Approximately 40 months will be provided through Life of Project (LOP).
b. Approximately 40 persons months of short-term consultant services are to be provided.	Approximately 12 person months have been provided to date. It is estimated that 15 months of TA will be used over LOP.
<u>2. Training</u>	
a. <u>Participant training</u>	
Six senior project personnel scheduled for degree training (3-MPH, 2 MSc (Ent/Para), 1 MSc (Epi))	One MPH completed; one MPH in progress; four MPH scheduled mid-1986.
b. <u>International conferences</u>	
Director, Dep. Director, and contract malariologist to attend.	Meeting in Malawi (1985) Meeting in Hawaii (1985)
c. <u>Study tours to Third World Countries</u>	
Nine ZMCP staff to participate in 3-6 week study tours.	6 to Sudan-3 weeks 4 to Nairobi-5 weeks 5 to Philippines-10 weeks 4 to Philippines-4 weeks 5 to India-4 weeks
<u>3. Commodities</u>	
a. <u>Vehicles and spares</u>	
A.I.D. will provide 30 4-WD vehicles and 520 2-WD vehicles, spare parts, drugs, office supplies.	Twenty vehicles, eight motorcycles, Honda 1000; Basjaj motor scooters have been provided.

A.I.D. InputsPresent Status

A.I.D. will also provide ten (10) replacement 4-WD vehicles in 1986 and one 3-ton truck.

Under review are 19 vehicles including three trucks and 10 motorcycles; 150 bicycles are also to be procured.

b. Computers

Two computers will be purchased to store malaria-related data, control program accounts, and will be used as word processors.

Two computers purchased. One computer not installed.

c. Communication system

A communication system between the Islands, ZMCP Headquarters, and the mainland consisting of four radios will be installed.

This activity will not be carried out under the project.

4. Construction and other costs

A.I.D. will finance construction of a small warehouse and garage, a storage facility on Unguja, and a small garage on Pemba.

Unguja: The plans are now approved and the building should be available by September 1986.

Pemba: Same as Unguja.

VII. FUTURE RECOMMENDATIONS TO A.I.D. FOR ASSISTING THE ZMCP THROUGH SEPTEMBER 1987

7.1 The Team recommends to USAID/Tanzania that the following actions be taken to improve the USAID Project over the life of project (LOP).

7.1.1 USAID/Tanzania should finalize on an urgent basis all outstanding ZMCP procurement orders. ZMCP should carefully review as soon as possible each item ordered to ensure that the proposed purchase is justified and in accordance with the terms of the project agreement amendment. This final review should be made jointly with the ZMCP/MOH officers concerned.

7.1.2 The training aspects of the USAID project are considered to be of priority importance. The training schedules need to be finalized, and increased attention given to their successful completion. Major needs were identified for in-country training of (1) operational personnel and (2) ZMCP/MOP personnel in malaria control methodology.

7.1.3 Additional use of technical assistance through the project funding is suggested, especially in the fields of entomology, biological control and drug susceptibility testing. USAID, in connection with the GOZ, may wish to also consider a request to WHO for longer-term field operation technical officers.

7.1.4 USAID should follow up with ZMCP to ensure that susceptibility tests to alternative antimalarial drugs, including amodiaquine and Fansidar, are carried out before the end of 1986.

7.1.5 Recommend approval to procure five Land Rover station wagons, five Isuzu 4x4 pick-ups, four Isuzu 2-cabin 4x4's, and two Isuzu 3-1/4 ton trucks.

7.1.6 Provide two-week administrative/supply and three-month transport technical assistance to ZMCP; the latter to assist in planning and implementing the relocation to the new garage.

7.1.7 Provide ZMCP with a current procurement status report on all open incomplete PIO/Cs, and a report by PIO/C of the original amounts obligated, amounts committed and disbursed, and the amounts available for deobligation so that the program can begin to determine the funds still available to cover any future unanticipated procurements.

7.1.8 Convene as soon as possible a Board of Inquiry to investigate the theft of approximately \$8,000 worth of Land Rover station wagon spare parts on PIO/C 621-0163-4-10054 towards reimbursing the ZMCP before end of project (EOP).

VIII. ACKNOWLEDGEMENTS

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