

**PLAN OF OPERATION  
OF  
URBAN MALARIA CONTROL IN TANZANIA**

**SEPTEMBER 1988**

**MEDICAL COOPERATION DEPARTMENT  
JAPAN INTERNATIONAL COOPERATION AGENCY**

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国際協力事業団

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PLAN OF OPERATION  
OF  
URBAN MALARIA CONTROL IN TANZANIA

SEPTEMBER 1987

This report on the plan of operation was the results of joint studies with Tanzanian and Japanese staffs concerning with urban malaria control in Tanzania at occasion of visit by Professors Tanaka and Miyagi to Tanzania from 22 August to 28 September 1987.

This planning documents was compiled  
on behalf of

Dr. J.V. Temba, M.D. Assistant Chief Medical Officer,  
Preventive Medical Services, Ministry of  
Health (MOH)  
Dr. Mkerenga, M.D. Epidemiology, MOH  
Dr. Mponzeza, M.D. and  
Dr. Omari, M.D. Dar es Salaam (DSM) City Council  
Dr. H.A.S. Kasale, M.D. Medical Officer of Health, Tanga Municipal

by the following working group;

Mr. A.R. Majala, MSc. Entomologist, Malaria Service Unit, MOH  
Mr. J.H. Marijani. Acting Chief, Malaria Service Unit, MOH  
Mr. A.D. Mawi. Health Engr., Mosquito Control Unit, DSM  
Mr. A.J. Keto. Mosquito Control Unit, DSM  
Mr. M. Nakara. Health Statistics, DSM City Council  
JICA specialists  
Prof. H. Tanaka, Institute of Medical Science, the University of  
Tokyo ICS, Japan.  
Prof. I. Miyagi, Faculty of Medicine, the Ryukyu University,  
Okinawa, Japan.

PLAN OF OPERATION  
MALARIA CONTROL PROGRAMME IN TANZANIA

Dar es Salaam, September 1987.

1. Plan of insecticide spraying.

1.1 Stratification of areas by the mosquito control measures.

The control of larval mosquitoes has long been implemented by spraying insecticides in the waters in the central part of Dar es Salaam (DSM) city. This method will be continuously taken in the same area. Besides this, residual spraying in houses will be performed at villages in periurban areas. Furthermore, ultra-low volume (ULV) spraying of insecticide for adult mosquito control will be added in the limited areas of Oyster Bay and Msasani at experimental scheme.

Delimitation of areas for indoor spraying and larviciding is shown in Fig. C.1 in which the area of larviciding is the central part of a belt from Kawe to Manzese, Buguruni, Temeke, Mtoni, Kurasini and City Center.

The area of indoor spraying is at a periurban zone, extending from Kunduchi to Kimara, Kinyerezi, Guruka kwa Lala, Kitunda, Kongowe, Vijibweni and Mjimwema.

Both control measures are given in 3 areas, i.e., Kiwalani, Ukonga and Kigamboni as shown in Fig. C-1.

ULV spraying will be limited at areas of Msasani Peninsula, Oyster Bay and Msasani town as shown in Fig. C-2.

1.2 Time Schedule of spraying.

Monthly schedule of 3 different spraying methods is shown in Table C-1. Larviciding will be continuously conducted whole the year round about every 3 weeks depending on the conditions, and about 18 times a year.



Indoor spraying will be performed before the main rainy season which lasts usually from April to June, and before the short rainy season in October to December. The indoor spraying will be conducted on 6 working days a week for 6 weeks before each rainy season (Table C-1).

The ULV spraying will be operated in January and July just after the rainy seasons when malaria transmission is estimated to be prominent.

Since the timing of indoor and ULV spraying is dependent on the rainy season, actual time of spraying should be determined carefully with flexibility so that the insecticiding provides the maximum effect.

### 1.3 Detailed plan of each spraying method.

#### 1.3.1 Larviciding

Owing to the long experience of larviciding, the plan of operation is established systematically, and spraymen for larviciding (abbreviated as field sprayman to be distinguished from indoor sprayman) are well organized.

The larviciding areas are divided into 3 zones and further broken down into 10 subdepots in total. Each subdepot consists of 6 sections of areas as shown in Table C-2 and on a map in Fig. C-3.

Field spraymen are distributed to each subdepot at the varied number depending on the size of operational area, from the minimum of 4 at Kawe and Mbagala to the maximum of 47 at Temeke.

A group of field spraymen assigned to a subdepot moves daily, from section number 1 to 6 while spraying on the water surface from Monday through Saturday.

The existing number of field spraymen is now 132 and the number of deficit is 236 which were not filled up because of shortage of insecticides. Therefore, whenever fenitrothion 50% emulsified concentrate (abbreviated as 50EC) is available, the deficit will be filled and a total of 368

field spraymen will cover all the control area of waters, of which the maximum surface is estimated to be 4.1 Km<sup>2</sup> as shown in Table C-3.

The necessary amount of 50EC is 200 l/Km<sup>2</sup> water surface at one time. If 50EC is sprayed on 4.1 Km<sup>2</sup> 18 times a year, a total is 200 x 4.1 x 18 = 14,760 l of undiluted 50EC. The rest of procedures, such as dilution of 50EC spraying, is followed to the instruction in Table C-4.

### 1.3.2 Indoor residual spraying

The estimated number of houses as target of indoor spraying in areas indicated in a map of Fig. C-1 is shown in Table C-5. The total of present estimation is about 50,000. Since the estimation studied in February 1987 was 48,600, operational target number should be regarded as about 55,000 to keep allowance, among which 41,000 must be made of mud wall and 14,000 of painted wall.

Fenitrothion 40% wettable powder (abbreviated as 40WP) will be sprayed in a house of mud wall at a dose of 5g/m<sup>2</sup>. As an average of spray surface in a house is about 120 m<sup>2</sup> and houses are sprayed twice a year, a total of necessary amount will be 5g x 120 x 41,000 x 2 = 49.2 tons.

Fenitrothion 80% emulsified concentrate (abbreviated as 80EC) will be sprayed on the painted wall. Since the dosage is 2 ml/m<sup>2</sup>, a total of necessary amount will be 2 ml x 120 x 14,000 x 2 = 6.8 Kl.

For operation of indoor spray, a squad of persons will be composed of 1 squad leader, 3 spraymen with 40WP and 1 sprayman with 80EC. Since a sprayman can cover 6 houses in a day on 6 days a week, a squad of indoor sprayman can spray in 144 houses a week. Since 90 squads are available, 12,960 houses will be worked out in a week, therefore 55,000 houses at target will be finished in 5 weeks.

The manpower requested to Dar es Salaam Council is 450 persons (or 90 squads) for 45 days (about 6 weeks) at each time of indoor spraying before 2 rainy seasons, so manpower will fit to the necessity. Available amount of insecticides will also fit to the necessity. Other technical

matters for indoor spraying are followed to the instruction in Table C-4.

### 1.3.3 Ultra Low Volume (ULV) spraying.

ULV spraying will be attempted at experimental design at selected areas of meteorological best conditions. Among candidate areas studied (Tab. C-6), areas of Msasani Peninsula, Oyster Bay and Msasani Town at a total area of 930 ha were selected.

For spraying, a ULV spraying machine will be operated by 2 supervisors and 1 truck driver from 6 to 8 pm on selected days with best meteorological conditions with mild breeze at constant velocity and direction, and without shower or rain. One place should be sprayed once a week for continuous 4 weeks just after 2 rainy seasons. The best conditions will be expected on the day when it rains and becomes clear before 3 p.m. without high speed wind in late afternoon, possibly 2 to 3 days in a week.

At the initial trial of ULV spraying at local conditions, 110 ha were covered in 2 hours, consuming 18.37 l of pyrethroid mixture solution (abbreviated as PS). The necessary amount of PS is at 167 ml/ha, and 930 ha will be sprayed 4 times in 4 weeks twice a year. So the grand total comes  $167 \text{ ml} \times 930 \times 4 \times 2 = 1,242 \text{ l}$ .

For actual plan of operation, the area of 930 ha is divided into 3 for each of available 3 ULV machines. A machine will finish spraying of designated 310 ha in 2 to 3 days a week for continuous 4 weeks. necessary manpower is very small for ULV spraying.

## 2. Entomological evaluation for the control activities in Dar es Salaam.

2.1 The effectiveness of control measures is assessed by the following three methods:

- a. by 0.1% pyrethrum spray catches in designated houses.
- b. by light trap (CDC battery type) in appointed stations.

c. by looking for and counting mosquito larvae collected by dippers in designated sites in waters in the treated area.

2.2 The operation area is divided into 3 zones, A. Kinondoni zone (including one ULV spraying station and 8 domestic residual spraying stations), B. Ilala zone, (including 7 domestic residual spraying stations) and C. Temeke zone (including 6 domestic spraying stations). Untreated area Kunduchi is also selected for comparison (Fig. E.1).

2.3 Routine weekly indoor spray catches for evaluation are made at 5 designated houses in Mikocheni, Ubungo, Kimara and 10 houses in Oysterbay of A. Zone, 5-6 designated houses in Upanga, Buguruni, Kinyeriezi of B. Zone, 5 designated houses in Magodoni, Kigamboni, Vijibweni, Mbogolo of C. Zone. The catches are also made at 15 houses in different stations of the untreated area, Kunduchi. Light trap collections are also made in 10 stations of different zones.

The workers assigned for the spray and light trap catches consists of a team with 2 or 3 persons. They visit the designated houses early morning and collect mosquitoes which are brought to the laboratory for identification of species.

2.4 The degree of mosquito control by the domestic residual spray and larviciding in operation are judged by comparing the data of the light trap collections and indoor spray catches in the treated area with those in the untreated area.

The degree of mosquito control by ULV spray in Oyster Bay is judged by comparing data with those from pre and post spraying years of the operation.

A team of 3-4 larval collectors under headman are assigned to the task of checking operational failures and effectiveness of spraying and rectifying them on the spot.

2.5 The mosquito collectors or workman in evaluation team, should pay careful attention to the following points:

a. Indoor spray catches.

Before spraying, the windows and doors of the rooms are closed and floor in the room is covered completely by white cloth up to the corner of walls. The spray catch should be carried out before sunrise (before 7:00 O'clock in the morning).

b. Light trap collection.

The trap is set up at the places sheltered from strong wind and rain. It is conducted from 6:00 p.m. to the next morning 7:00 a.m. the battery should be charged every time after conducted.

c. Identification.

All specimens collected are sent to the central laboratory at once and sorting and identification of mosquitoes should be finished within the same day of collection. All anopheline specimens (males and females) are indentified morphologically and counted. The culicine specimens maybe also identified as to species level.

2.6 Susceptibility test in vector mosquitoes with adults and larvae of the principal malaria vestors in Dar es Salaam.

An. gambiae and An. funestus against the insecticides applied, fenitrothion and others, are examined by the WHO method. The test will be continued every year with different concentrations of the insecticides.

2.7 Bio assay tests.

For checking the effectiveness of the insecticides sprayed on the walls of room and operational failures of residual spray, bio assay tests are made by the regular methods.

2.8 Evaluation Organization

1. Number of workers: 40-50
2. Number of catching station: 70-80
3. Number of visits: Once a week

The same number of workers will also be doing larval searching in the whole area of operation.

#### 2.9 Main Equipments required for entomological evaluation in Dar es Salaam.

1. Number of vehicle:  
Motor Cycle: 7  
Double Cabin Pick-up: 1
  
2. Number of Microscope  
Dissection Microscope: 3  
Compound Microscope: 2
  
3. Number of light trap: 10 (CDC 6 Battery type)  
Number of Batteries: 20
  
4. Camera: 1

Table C-1. Monthly schedule of 3 different sprayings

Month	Indoor spraying	Larviciding	ULV spraying
Jan.		X	X
Feb.	X	X	
Mar.	X	X	
Apr.	Main Rainy Season	X	
May		X	
Jun.		X	
Jul.			X
Aug.		X	
Sep.	X	X	
Oct.	X	X	
Nov.	Short Rainy Season	X	
Dec.		X	

6 working days a week for 6 weeks before rainy seasons	About every 3 weeks. Possibly 18 times a year	One place is sprayed once a week. 2 working days a week for continuous 4 weeks after rainy seasons
---	--	--

Table C-2. Areal delimitation of districts, subdepos and sections for larviciding

District	Subdepot	The number of field spraymen	Section code and local names
Kinodoni	Kawe	4	A1 Tanganyika Packers
			A2 Mazimuni
			A3 Police Baracks
			A4 CCM Office
Kinodoni	Oysterbay	8	A5 Ukwamani
			A6 Sokoni
			B1 Masaki
			B2 Msasani
			B3 Regent Estate
			B4 Ursino Estate
Kinodoni	Mwananyamala	14	B5 Oyster Bay
			B6 Ada Estate
			C1 Kijitonyama
			C2 Mwanawala
			C3 Kinondoni Shamba
			C4 Sinza
Kinodoni	Magomeni	15	C5 Hanasif
			C6 Kinondoni Moscow
			D1 Ubungo NHC
			D2 Ubungo Kisiwani
			D3 Magomeni
			D4 Ndugumbi/Manzese
Ilala	Ilala Garden	27	D5 Mabibo/Makuruwla
			E1 Vingunsuti
			E2 Buguruni
			E3 Masimbazi
Ilala	Kisutu	23	E4 Ilala
			E5 Jangwani
			E5 Mchikichini
			E5 Kariakoo
Ilala	Kipawa	10	E6 Kisutu
			E6 Upanga
			E6 Gerezani
			F1 Tazara
			F2 Kipawa
			F3 Kiwalani
Ilala	Kipawa	10	F4 Kipawa
			F5 Kipawa
			F6 Kipawa
			F6 Kipawa



Table C-2. continued

District	Subdepot	The number of field sprymen	Section code and local names	
Ilala (continued)	Ukonga	9	G1 Gongo La Mboto	
			G2 Mwembe Madafu	
			Gongo La Mboto	
			G3 Majumba sita	
			G4 Mwembe Madafu	
			G5 Majumba Sita	
			G6 Majumba Sita	
Temeke	Temeke	47	H1 Mtoni	
			H2 Kurasini	
			H3 Keko	
			H4 Tandika	
			H5 Temeke/Yombo	
			H6 Miburani	
		Kigamboni	7	J1 Kigamboni
	J2 Kigamboni/Nunge			
	J3 Nijibweni/Nunge			
	J4 Hospital			
	J5 Magogoni			
	J6 Kigamboni			
	Mbagala	4	K1	
K2 all at				
K3 Mbagala				
K4 Kiburugwe				
K5				
K6				
Total				
3	10			

Table C-3. Larviciding Target Areas

Kinodoni Area	Maximum area of sprayable water surface	Km <sup>2</sup>
Msasani	0.29	
Kinondoni	0.39	
Mwananyamala	0.39	
Oyster Bay	0.29	
Magomeni	0.38	
Subtotal	1.74	
Ilala Area	water surface	Km <sup>2</sup>
Ilala	0.28	
Kariakoo	0.25	
Upanga	0.29	
City Centre	0.29	
Subtotal	1.11	
Temeke Area	water surface	Km <sup>2</sup>
Chang'ombe.	0.32	
Keko	0.37	
Temeke	0.56	
Subtotal	1.25	
Total		4.1 Km <sup>2</sup> or 410 ha

Table C-4 Methods for dilution and spraying

	Residual spray		ULV space spray	Larviciding spray
	fenitrothion 40WP (Sumithion 40WP)	fenitrothion 80% (W/W) EC (Sumithion 80EC)		
Pesticide	fenitrothion 40WP (Sumithion 40WP)	fenitrothion 80% (W/W) EC (Sumithion 80EC)	d-allethrin/d-phenothrin 6/14% (W/V) EC (Pesgard PS-201)	fenitrothion 50% (W/V) EC (Sumithion 50EC)
Dosage	5 g/m <sup>2</sup> (2 g a.i./m <sup>2</sup> )	2 mℓ/m <sup>2</sup> (2 g a.i./m <sup>2</sup> )	167 mℓ/h (10/23.4 g a.i./ha)	0.2 mℓ/m <sup>2</sup> (Depth 0.1 m) (1 ppm a.i.)
Dilution method	8 times dilution 1 kg + 7 liter of water	20 times dilution 0.4 liter + 7.6 liter of water	3 times dilution 333 milliliter + 667 milliliter of water	100 times dilution 1 liter + 99 liter of water
Spray method	Maximum initial pressure: 55 PSI Distance between nozzle and wall: 45 cm Spray speed: 45 cm/sec Spray band : 75 cm		Discharge rate: 500mℓ/min. Vehicle speed : 12 km/hr. Effective distance: 50m Spray speed : 2 ha/min.	Water depth Dose 0.1m 20mℓ/m <sup>2</sup> 1.5 sec/ 0.2m 40mℓ/m <sup>2</sup> 3 sec/ 0.3m 60mℓ/m <sup>2</sup> 4.5 sec/ m <sup>2</sup> m <sup>2</sup> m <sup>2</sup>
Operation	Dar es Salaam: 90 teams (450 persons) Tanga: 15 teams (75 persons) 6 houses/day, 45 days/Round 3R/year		One place is sprayed once a week for continuous 4 weeks. Dar es Salaam: 3 Tanga: 1 Working schedule is 2 hrs/ day in 2 or 3 days/week of the best conditions	

Table C-5. The estimated number of houses for indoor residual spraying

Area	Estimated No. of houses
Kinodoni Area	
1. Kimara	1670
2. Ubungo	3350
3. Mbezi	368
4. Mikocheni	1030
5. Kawe	3130
6. Kunduchi	1550
7. Mabibo	1105
8. Kibamba	800
subtotal	13003
Ilala Area	
1. Kitunda	815
2. Tabata	6200
3. Kinyerezi	1310
4. Segerea	1020
5. Gruka kwa Lala	2650
6. Kiwalani	3260
7. Ukonga	1835
subtotal	17090
Temeke Area	
1. Mtoni	7776
2. Mbagala	6200
3. Mji Mwema	1436
4. Nunge	500
5. Vijibweni	750
6. Yombo Vituka	3900
subtotal	20562
Total	50655

To keep some allowance, the estimated number of houses for indoor spraying is regarded as 55,000, since the previous estimation made in February 1987 was 48,600

Table C-6 Candidate experimental areas for ULV spraying.

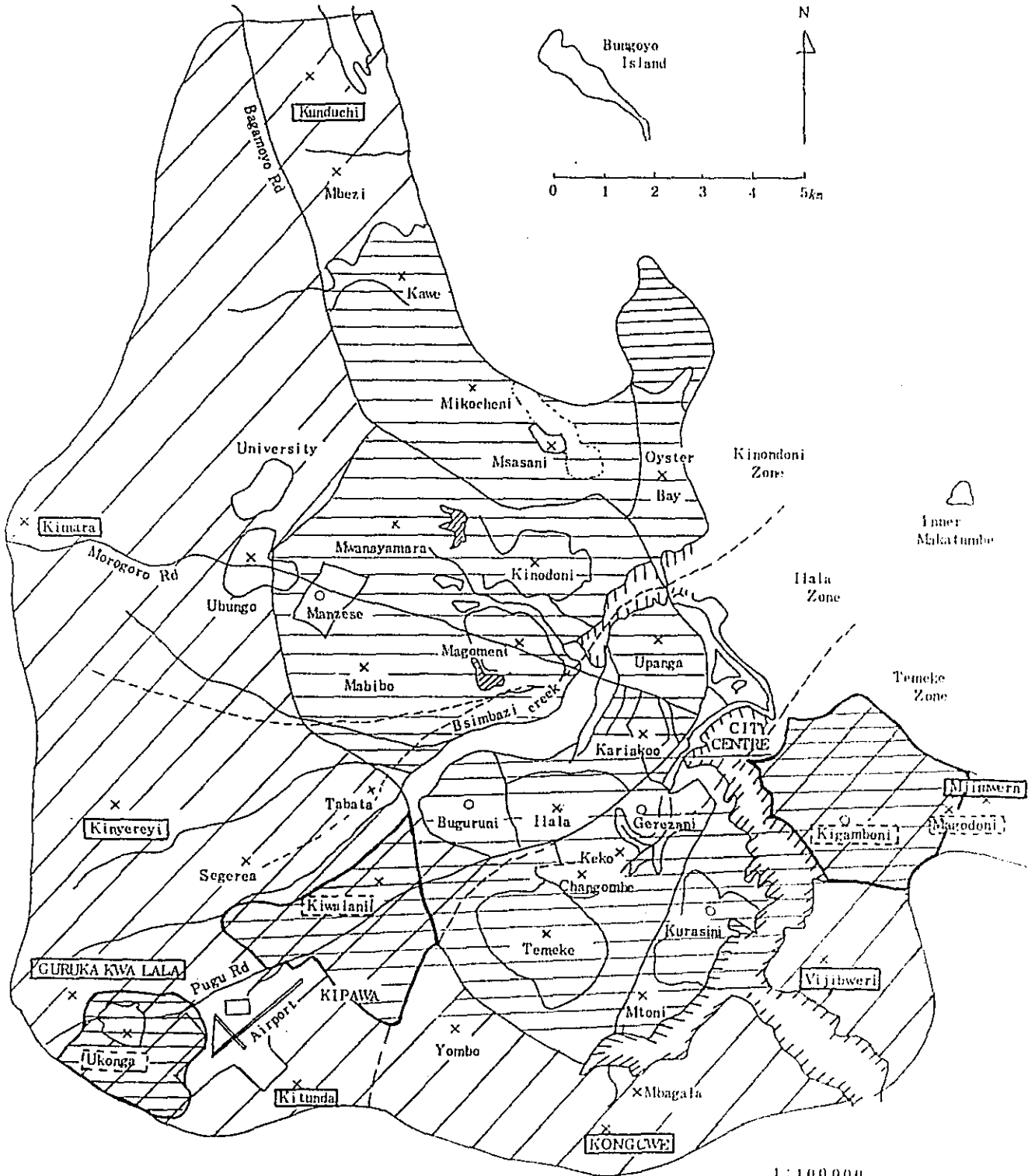
	Kinondoni Zone	Area in Km <sup>2</sup>
X	1. Msasani Peninsula	4.2
X	2. Oyster Bay	2.6
X	3. Msasani Village	2.5
	4. Kidondoni	6.4
	5. Mwananyamala	4.6
	6. Magomeni	6.3
	7. Mikocheni	5.6

Among those candidate areas, 3 places, that are Msasani Peninsula, Oyster Bay and Msasani Village, will be selected for the experimental areas because of the preferable meteorological conditions.

Although a ULV spray machine on a truck can spray on an area of 2.4 Km<sup>2</sup> or 240 ha in 2 hours, the coverage of spraying at local conditions was only 110 ha in 2 hours from 6 to 8 pm in a day by experimental trials.

One place will be sprayed once a week for 4 continuous weeks in selected 2 days of best conditions in a week.

Fig. C-1



1:100,000

DELIMITATION OF INDOOR SPRAYING AND LARVICIDING




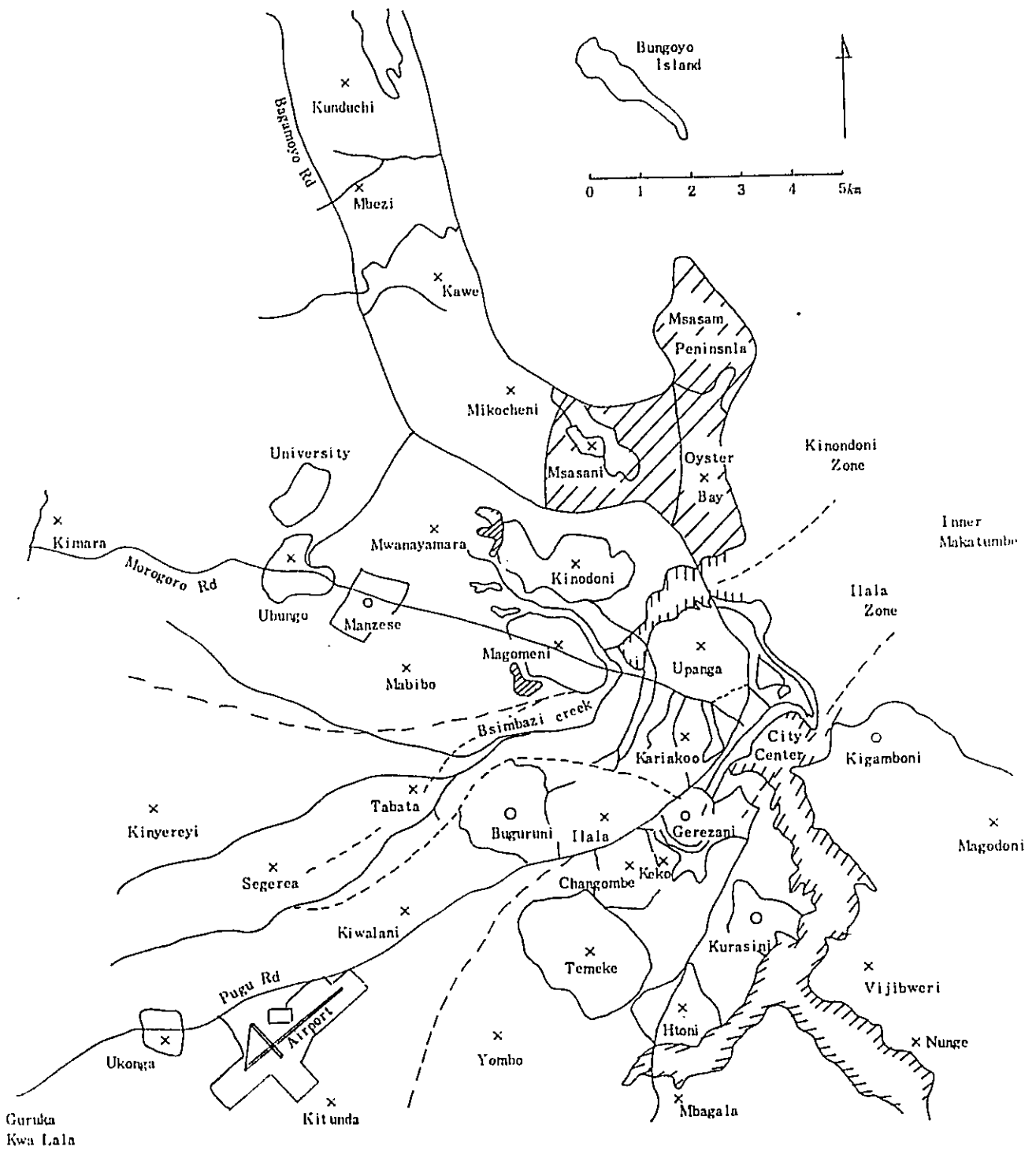

-  INDOOR SPRAYING
-  BOTH INDOOR SPRAYING AND LARVICIDING
-  LARVICIDING

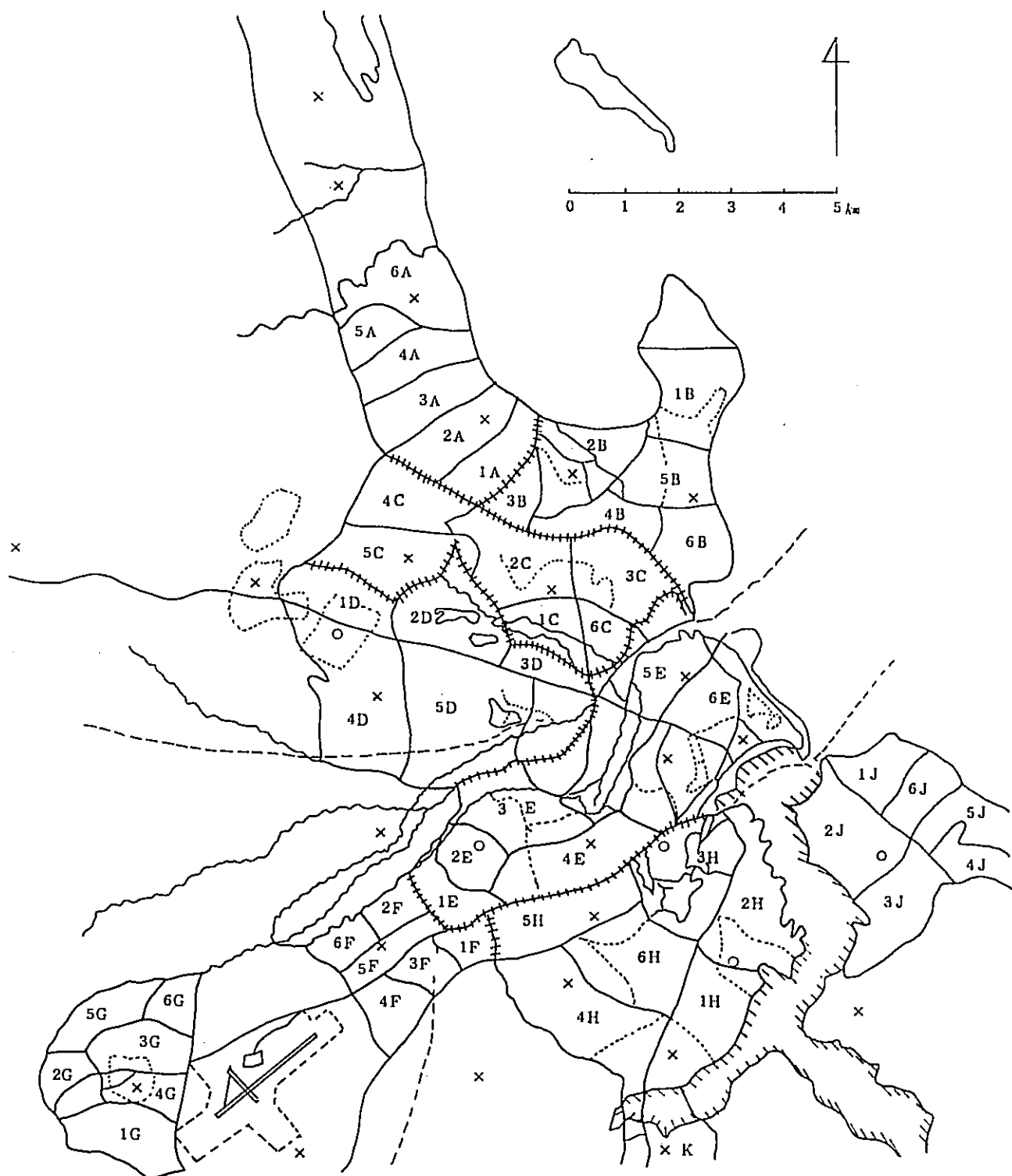
Fig. C-2



KEY  
 ULV SPRAYING AREA

1 : 100,000

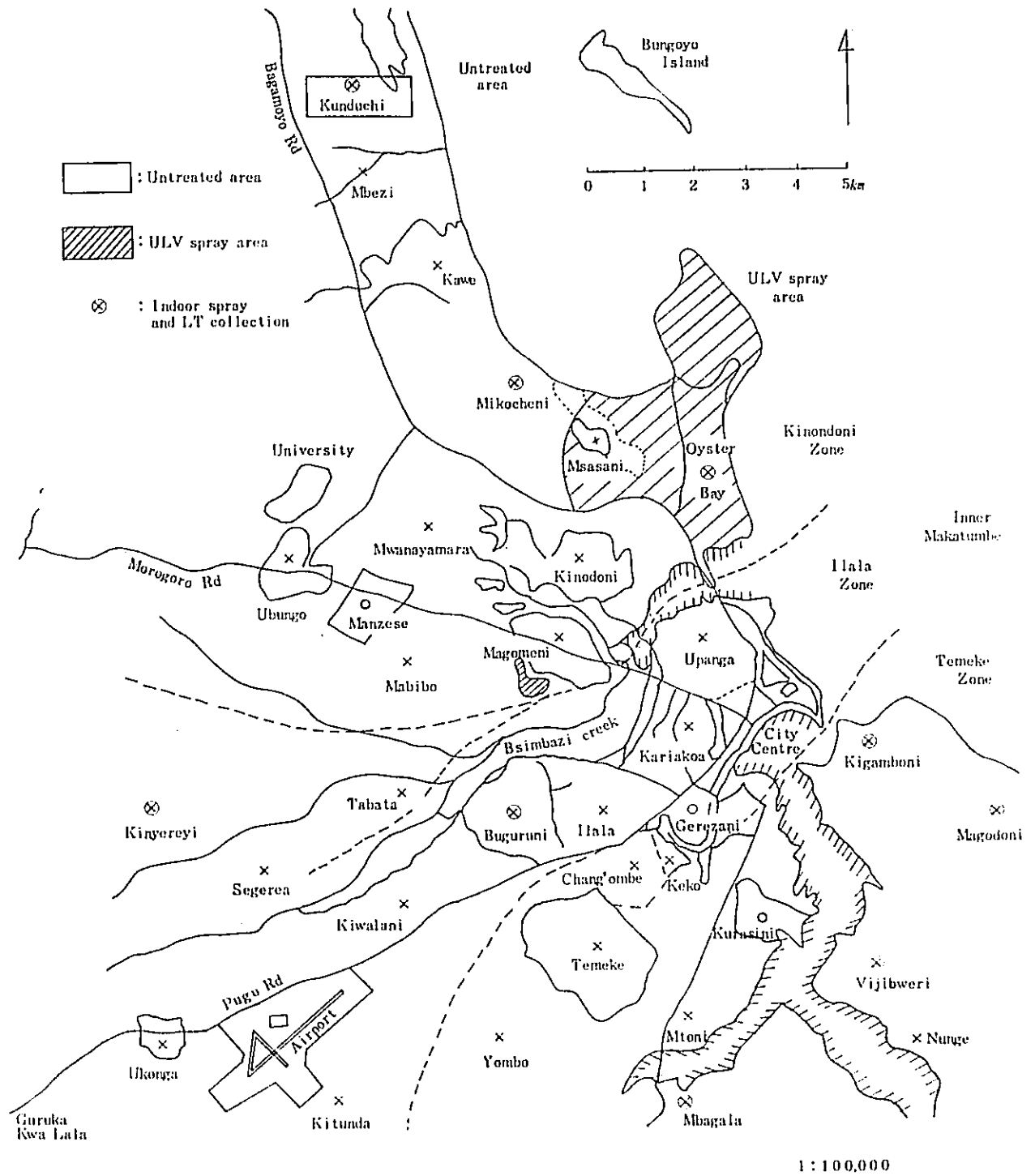
Fig. C-3



Delimitation of subdepots and their six divisions for larviciding against malaria



Fig. E. 1



### 3. EPIDEMIOLOGICAL SURVEY AND EVALUATION

The aims of mosquito control are to reduce the morbidity of malaria among dwellers living at risk areas. For this, besides monitoring the mosquito density, follow-up studies on the change of prevalence at malaria areas are unavoidably necessary to be considered by medical doctors in MOH and Dar es Salaam Council.

Since microscopic examinations have been carried out only in limited hospitals and clinics here, and no passive case detection (PCA) or active case detection (ACD) have ever been experienced in this country, where WHO malaria control tactical number 1 has been undertaken, the health statistics from dispensaries and PCA by microscopic examinations in 4 designated dispensaries will be the practical epidemiological means of choice in malaria control evaluation.

For collecting health statistics from dispensaries, existing flow of health information will be utilized (Simple Evaluation). As soon as microscopes are made available, Dar es Salaam Council will assign a microscopist to each of 4 dispensaries (Detailed Evaluation). For these data collections and for supervising microscopists and examination of cholinesterase level of indoor sprayers, Drs. Mponesia and Omari at Dar es Salaam Council have an intention to assign a health official, possibly a clinical technologist, specific to Malarial Control Programme.

#### 3.1 Simple Evaluation

For Simple Evaluation, the number of clinically suspected malaria (CSM) and its percentage to a total of attendance (%CSM) informed by all dispensaries will be used. Data in 1986 and 1987 are used for the Base Line.

##### 3.1.1 Existing System of Flow of Health Information From Dispensaries to the City Council

There are 47 dispensaries in 3 districts in Dar es Salaam. Health records in dispensaries are submitted monthly to each statistic centre

in the assigned dispensary or hospital. The centres are located at Mnazi Moja Dispensary in Ilala District., Magomeni Dispensary in Kinondoni District and Temeke District Hospital at Temeke District.

Received monthly records are kept by a medical recorder in each centre. The recorder adds the all dispensary records to make a monthly report to be submitted to the Health Statistic Unit of Dar es Salaam Council (Dr. Omari and Mr. Mecameca Nakara). The individual dispensary records are not kept at City Hall but at 3 statistic centres mentioned above. The following studies were made by Mr. Nakara and Dr. Tanaka as an exercise for the forthcoming programme.

### 3.1.2 Filing Method of Records at Statistic Centre

At statistic centres, monthly dispensary records are filed by month without routine way in good order except at Temeke District Hospital, where the reports from a dispensary are filed in the same folder in the order of the date of report.

Fortunately, in the Health Statistic Section of Dar es Salaam City Council, all dispensaries were classified into 4 groups from A to D and individual dispensaries were given the number.

Using this group name and the number, all dispensaries and other medical care facilities were coded this time as shown in Table P-1 and their locations are shown on a map in Figure P-1. Besides Temeke Hospital, in the centres, the records were classified at first by month and were put the code number. Then the records were re-arranged in the order of month of report and the code number.

This code number of dispensaries and the appropriate filing method will provide a great usefulness to the health information system in Dar es Salaam. By looking through the records in a folder, one can easily identify the dispensaries which did not submit the monthly record.

### 3.1.3 Collection of Number of CSM and % CSM

The descriptions of the number of clinical suspected malaria (CSM) cases and a total attendance were transcribed to the prepared form, of which example after description is shown in Table P-2.

Since the purpose of collecting CSM and % CSM is the evaluation of malaria control at each locality and by the difference of control measures, records of hospitals or large dispensaries, where many people came from a long distance and effect of control will not reflect to the epidemiological data in that institution, were omitted.

The reports from dispensaries since January 1986 were kept at 3 statistic centers, Mnazi Mmoja, Magomeni and Temeke and the descriptions of the number of CSM and a total attendance in each month were transcribed by Mr. Nakara, medical recorders concerned and Dr. Tanaka to the prepared form. An example of completed form is shown in Table P-2.

It was found that so many monthly reports were not submitted to the statistic centre. In routine work, received records were added, ignoring unsubmitted report, and made a monthly district report. Then 3 district reports were added to make a monthly and yearly report as a whole of city (Table P-3). Analysis based on the monthly report from individual dispensaries will show the different results.

The lacking of dispensary records is requested to the medical recorder to fulfill as much as possible. Description of monthly records after June 1987 are also requested.

There were so many mistakes of simple calculation of addition in statistical tables from the dispensaries. And there were no checking function in the statistic centre or statistic unit of the council. To prevent these simple mistakes, the centres, City Council and malaria unit of MOH should be installed with mechanically driven adding machines with recording function. Calculation by a handy calculator also often makes the cause of mistakes.

Transcription of records from 44 appropriate dispensaries was completed at this time.

The original of all transcribed records is kept by Mr. Nakara, health Statistic Unit of City Hall, the whole photocopies are kept by Dr. Tanaka in Tokyo and photocopies of dispensary data in a district are kept by the district medical recorder concerned.

### 3.2 Detailed Evaluation

Microscopic examinations of the blood film will be performed in selected dispensaries as the detailed evaluation. Selection of dispensary and recording methods by a microscopist are as follows:

#### 3.2.1 Selection of Dispensary

The capability of microscopist for blood examination may be between 30 to 60 a day. A dispensary having about 30 CSM is of choice. Since aims by this evaluation are to determine the effect of control measures undertaken, at least, a dispensary will be selected corresponding to a control method. Attendance to that dispensary is preferably the representative of dwellers in the area concerned.

Candidate dispensaries in consideration are:

D04	Mbagala	for Larviciding
C11	Kimara	Indoor Spraying
B08	Vingunguti	Larviciding and Indoor Spraying
C10	Oysterbay	
	Police	ULV Spraying and larviciding
B10	Pugu	
	Kajungeni	Untreated area

If a better idea comes up, the final determination will be carefully made with flexibility but will not be changed when once the programme starts.

3.2.2 Record form of microscopic examination. The recording forms should be as simple as possible so that a microscopist can easily follow. Attached forms are examples.

Form EP1 is a record of results of individual suspected malaria patients. All suspected cases will be examined. For description of density of parasite Annex EP-1 should be referred.

Form EP2. Daily total will be described on this form together with the total number of attendance.

Form EP3. The report form to the Health Statistics Unit in City Hall. Monthly total of Form EP2.

#### 4. DETERMINATION OF CHOLINESTERASE LEVEL OF INDOOR SPRAYMEN

For indoor spraying in Dar es Salaam, 90 squads of 450 persons will be recruited for 45 days before each of 2 rainy seasons. Since 90 are the squad leader, 360 are indoor spraymen whose cholinesterase level in the blood will be examined once before spraying and once in 2 weeks while spraying is going on. The whole target persons will be divided into about fourths and they will be examined at 3 district hospitals and a clinical laboratory in the Dar es Salaam City hall where Lovibond Kits will be provided and used for examining the cholinesterase level in the blood.

In the laboratory, individual record of cholinesterase level should be made and kept, so that change of its level can be followed-up easily for the safety of individual indoor spraymen.

Those who are sensitive to organophosphorus compounds or whose cholinesterase level is reduced to the unfavourable level are not continuously requested to work for indoor spraying.

Table P-1

List of names and codes of Medical Facilities \* in Dares Salaam

Code no.	Name	Malaria Control Method**
Headquarters A		
x A01	City Hall Clinic (Staff), Sokoine Driv.	L
x A02	City Depot Clinic, Pugu Rd.	L
x A03	Muhimbili Medical Centre	L
x A04	Ocean Road Hospital	L
Ilala District B		
x B01	Mnazi Mmoja (Statistic Centre)	L
x B02	Ilala (Amani) Dist. Hospital, Uhuru St.	L
B03	Ukongu	L & L
B04	Tabata	L & L
B05	Railways, Gerezani	L
B06	Gerezani	L
B07	Kitunda	I
B08	Vingunguti, Kiwalani	I & L
B09	Kinyerezi	I
B10	Pugu Kajiungeni	U
B11	Kiwalani	I & L
B12	Buyuni	U
B13	Chanika	U
B14	Mvuti	U
B15	Msongola	U

X Statistics in the facility with mark x are not included for malaria control because of involvement of many attendance coming from the distance.

\* Names of dispensaries mostly. Others are the Hospital, District Hospital and Health Centre.

\*\* Marks of control measures.

L Larviciding  
 I Indoor spraying  
 S Space spraying (ULV)  
 U Untreated area

Table P-1. continued

Code no.	Name	Malaria Control Method**
Kinondoni District C		
x C01	Magomeni (Statistic Centre)	L
x C02	Mwananyamala Dist. Hospital	L
C03	Sinza Health Centre	L
C04	Mburahati	L
C05	Tandale	L
C06	Kunduchi	I
C07	Mbezi	I
C08	Kawe	L
C09	Mwenge	L
C10	Oysterbay Police	S & L
C11	Kimara	I
C12	Bunju	U
C13	Goba	U
C14	Nabwepande	U
C15	Kibama	U
C16	Mbweni	U
C17	Kwembe	U
C18	Boko	U
Temeke District D		
x D01	Temeke Dist. Hospital (Statistic C.)	L
x D02	Kigamboni Health Centre	I & L
D03	Rangi Tatu	I
D04	Mbagala	I
D05	Yambo Vituka	I
D06	Buyuni	U
D07	Tundwi Songani	U
D08	Chekeni Mwasonga	U
D09	Kimbiji	U
D10	Gomvu	U
D11	Gezaulole	U
D12	Mji Mwema	I
D13	Kibada	U
D14	Toangoma	U
D15	Chamazi	U
D16	Tambuka Reli	I
D17	Mwongozo	U



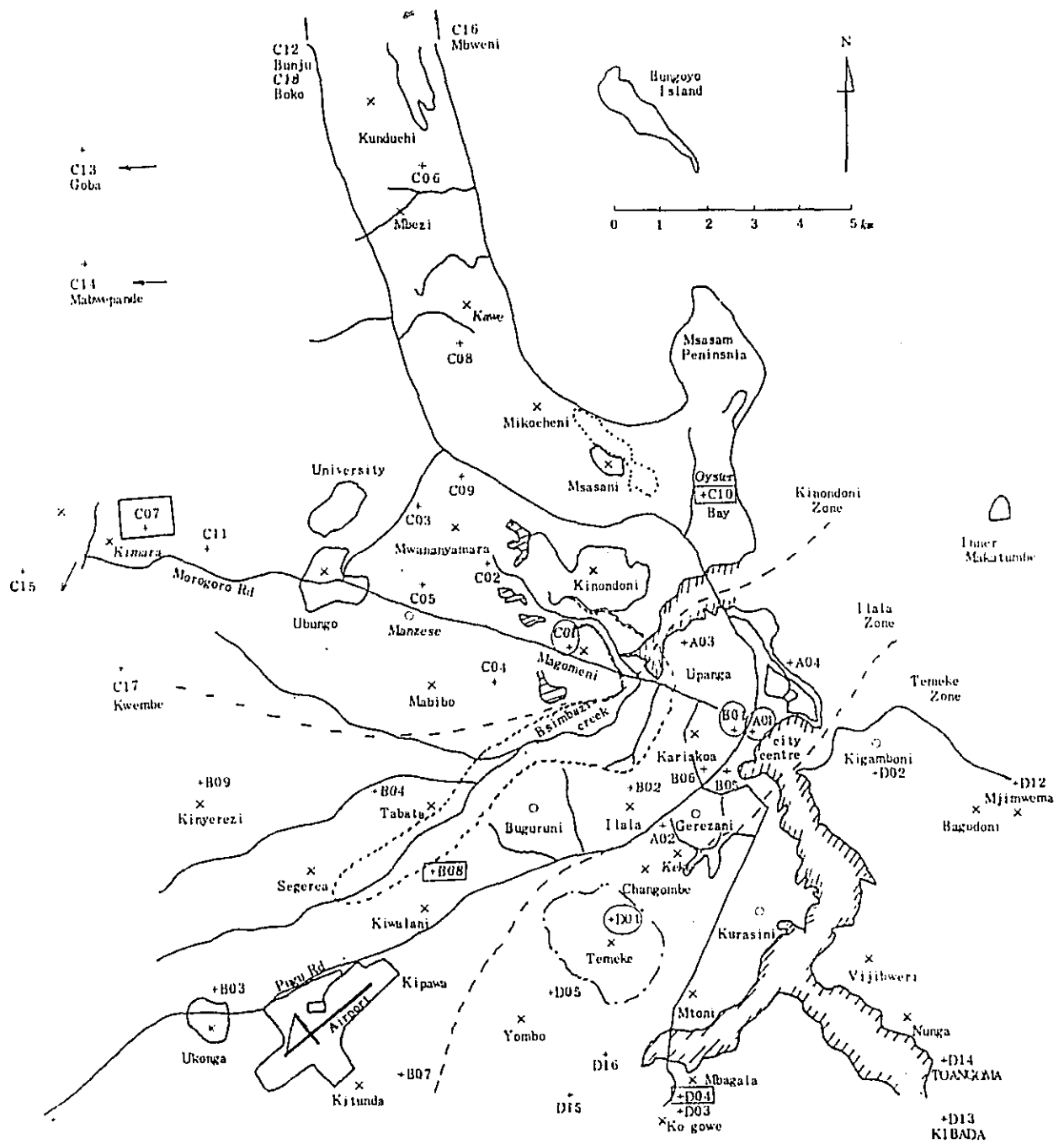


Fig P-1 Location of Medical Care Facilities

- Code no. detailed evaluation
- Code no. statistic centre in District

Table P-2 Monthly Record of Clinically Suspected Malaria Cases

Dispensary; Kinyerezi				Code no. B09 Larvicid. ✓Indoor Spr. ULV                    Untreated			
	1986		1987		1988		Remarks
	No.	%	No.	%	No.	%	
J A N	CSM Attend.	128 859	/	188 837	/	/	
E E B	CSM Attend.	97 728	/	90 571	/	/	
M A R	CSM Attend.	147 859	/	188 839	/	/	
A P R	CSM Attend.	94 775	/	268 1,452	/	/	
M A Y	CSM Attend.	/	/	101 993	/	/	
J U N	CSM Attend.	92 492	/	/	/	/	
J U L	CSM Attend.	NO DATA	/	/	/	/	
A U G	CSM Attend.	94 1,025	/	/	/	/	
S E P	CSM Attend.	74 463	/	/	/	/	
O C T	CSM Attend.	92 507	/	/	/	/	
N O V	CSM Attend.	90 539	/	/	/	/	
D E C	CSM Attend.	81 622	/	/	/	/	
T O T A L	CSM Attend.	/	/	/	/	/	

CSM; Clinically Suspected Malaria. Attend; No. of attendants

Table P-3

HAMASHELAURI YA JIJI LA DAR ES SALAAM  
 TAKWIMU ZA MAGONJA YA KIMBUKIZA KWA MWAKA 1986.  
 JANUARI - DESIMBA

MAGONJA	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DES.	TOTAL JUMLA
MALARIA	161	211	147	324	310	430	371	352	623	776	797	311	4813
MELIJSLES	85	96	99	123	35	39	111	45	200	230	203	204	1470
DYSENTERY	25	12	13	43	34	22	83	43	149	127	103	93	747
G. ENTERITIS	70	93	121	90	215	201	416	216	272	158	135	186	2173
INF. HEPATITIS	1	3	3	4	3	4	2	4	4	-	6	2	35
CHOLERA	-	63	64	49	57	77	127	139	50	23	11	-	660



INSTRUCTION FOR DETERMINATION OF MALARIA PARASITE INTENSITY  
 ENUMERATION OF MALARIA PARASITES

Cited From WHO/MEM/2  
 December 1960

At times when malaria parasites are very numerous the simple code from one to four crosses is adequate. The following code has been suggested for a magnification 500x - 600x:

- + 1-10 parasites per 100 thick film fields
- ++ 11-100 parasites per 100 thick film fields
- +++ 1-10 parasites per One thick film field
- ++++ more than 10 parasites per One thick film field

A very approximate estimate of the actual parasite count per mm<sup>3</sup> from the numbers of parasites seen in a microscopic thick film field (magnification 500x - 600x) is shown below. Naturally this estimate varies within a wide range (factor 2 or 3) in relation to the thickness of the thick film:

1 - 10 parasites per 100 fields	5 - 50 parasites per mm <sup>3</sup>
11 - 100 parasites per 100 fields	55 - 500 parasites per mm <sup>3</sup>
1 - 10 parasites per one field	550 - 5000 parasites per mm <sup>3</sup>
11 - 100 parasites per one field	5500 - 50000 parasites per mm <sup>3</sup> and more

## Daily Record of Microscopic Examination of Malaria

Month, Year

Name of Dispensary:

Codeno.:

Malaria control method: Larviciding, Indoor spraying, ULV spraying, Untreated

1	2	3	4	5	6						
Day	No. attend.	No. CSM	No. +	No. P.f.	No. oth.M.	Day	No. attend.	No. CSM	No. +	No. P.f.	No. oth.M.
1						16					
2						17					
3						18					
4						19					
5						20					
6						21					
7						22					
8						23					
9						24					
10						25					
11						26					
12						27					
13						28					
14						29					
15						30					
						31					
						Total					

To be written by microscopist. Keep this form in the dispensary.

1. Write the initial of the day of week after day, like MTWTFSS.
2. No. of all attendance of the day including re-attendance.
3. No. of clinically suspected malaria (CSM) including patients for re-examination
4. No. of microscopically proven malaria.
5. No. of Plasmodium falciparum.
6. No. of other malaria species.

Double infections are added to column 4 and also 5.

## Monthly Report of Microscopic Examination of Malaria

Name of Dispensary:

Code no.:

Name of Microscopist:

Month, Year

Signature  
\_\_\_\_\_

The following items are the total of the previous month transcribed from figures in the total in the Daily Record (EP-2).

Two copies are written by microscopist. Keep one copy at the dispensary and send another to the Health Statistics Unit at City Hall.

1. No. of attendance :
2. No. of CSM :
3. No. of positives :
4. No. of Plasmodium falciparum :
5. No. of other malaria cases :

For use of epidemiologist. Do not write below.

- % CSM  $(100 \times (2)/(1))$  :
- % positive in CSM  $(100 \times (3)/(2))$  :
- Falciparum ratio %  $(100 \times (4)/(3))$  :

## TANGA

A group composed of Mr. J. H. Marijani, Dr. H. Tanaka and Dr. I. Miyagi made a site visit to Tanga from 30 August to 1 September 1987. On 31st August, they made courtesy calls to Tanga Regional Commissioner and Municipal Director, accompanied by Dr. H. A. S. Kasale. Then, with members of Municipal Council and M.O.H., they visited malaria infested areas, Sahare, Mwang'ombe and Mwakidila Village Dispensary.

On the following morning, a technical meeting was held in the presence of Dr. Mutabingwa and Dr. Willkis (England) of the Amani Medical Research Centre, NIMR, and Dr. A. Ndawi and Mr. R. G. N. Ntakumulenga of the Vector Control School, Tanga.

Following this meeting, a short managerial meeting was held in attendance of Tanga District Commissioner, City Mayor, Ag. Municipal Council, Director and a Member of Parliament for Tanga.

In the afternoon, technical members visited Muheza (Ubwari) field station of Amani Medical Research Centre, National Institute for Medical Research.

Main subjects studied, discussed or agreed are briefly as follows:-

### 1. Plan of Insecticiding Operation

#### 1.1 Present Advancement

A group of council members assisted by 2 officers and 5 assistants who were dispatched from MOH and staying at Tanga, are making a map of delimitation of areas by the different control activities, i.e. larviciding, domestic residual spraying and ULV spraying as shown on a map in Fig. T-1. A wide central part of city was determined as larviciding area where 9.9 ha of sprayable water surface are estimated as shown in Annex T-1.



Villages at peri-urban areas are selected as the indoor spraying area and sketch maps of each village were almost completed. As the total number of houses in these villages is less than the amount of available insecticides and manpower, the areas will be expanded mostly to the central directions.

ULV spraying will be conducted at Kisosora at the populated city centre and Raskazone Peninsular Areas.

The final stratification of areas by control method will be soon determined by the calculation of necessary amount of insecticides and manpower, according to the study report at Dar es Salaam which will be sent to Tanga as soon as possible.

1.2 Necessary calculations for spraying operation. When the report of DSM is made available, for delimitation of areas by difference of insecticiding methods, the following items should be calculated as necessary preparation for operation;

#### Larviciding

The maximum area of sprayable water surface :

9.9 ha (tentatively)

necessary amount of fenitrothion 50% EC:

356.4 l (tentatively)

Number of available manpower ?

#### Indoor Spraying

A total number of houses to be sprayed ?

Number of houses made of mud wall?

Number of houses of painted wall?

Necessary amount of fenitrothion 40 WP?

Necessary amount of fenitrothion 80 EC?

Number of available manpower:

75 persons in 15 squads for 45 days twice a year,

## ULV Spraying

A total area to cover with spraying?

Necessary amount of pyrethroid mixture solution?

Available manpower :

2 supervisors and 1 driver for 8 days in 4 weeks after rainy season twice a year.

## 2. Epidemiological Survey and Evaluation

The number of clinically suspected malaria (CSM) and % to the all outpatients (%CSM) at 6 governmental dispensaries in the programme area (or 7 in case, Mwakidila Dispensary will be involved) and Makorora Health Centre (HC) by month will be used as the common parameters in this area. As base-line data, monthly occurrence of CSM and %CSM will be studied in 1986 and 1987.

The ratio of true malaria among CSM will be examined by microscope observations. For this, a blood smear will be prepared at Makorora HC at one in every 10 suspected malaria cases.

## 3. Determination of Cholinesterase Level of Indoor Spraymen

For indoor spraying, 15 squads of 75 persons will be recruited for 45 days before each of the 2 rainy seasons. Since 15 are the squad leader, 60 are indoor sprayment whose cholinesterase level in the blood will be examined at Ngamiani Health Centre by the Lovibond kit which will be provided with other logistics. They are examined once before commencement of spraying and once in 2 weeks while spraying is going on.

## 4. Entomological Survey and Evaluation

### 4.1 Principles

For entomological evaluation

One untreated area is selected outside of the operation area and the

mosquitoes are collected by the following methods in both treated and untreated areas.

Indoor spray catch	:	20 houses in each area
Light trap	:	2 traps in each area
Dipping for larval collection	:	100 sites of the waters

The collection by each method will be conducted once a week in those areas. The regular evaluation of the control activities in entomological aspects is made by comparing the data in untreated area with those in treated area.

#### 4.2 Important Preparation

4.2.1 One untreated area is selected outside of the operation area as comparison and shown on the map.

4.2.2 At least one entomologist and 10 - 20 mosquito collectors are necessary in Tanga Municipal Council. In Dar es Salaam, Mr. Majala, Med. Entomologist, Ministry of Health, and Mr. Keto, Malaria Health Officer, City Council will belong exclusively to the entomological evaluation of this programme. They will also be good advisers and partners for the entomological evaluation team in Tanga.

4.2.3 Determine more than 20 houses for indoor spray catches, 2 light trap setting locations and more than 100 collection sites by dipping in each treated and untreated areas and show those sites on the map.

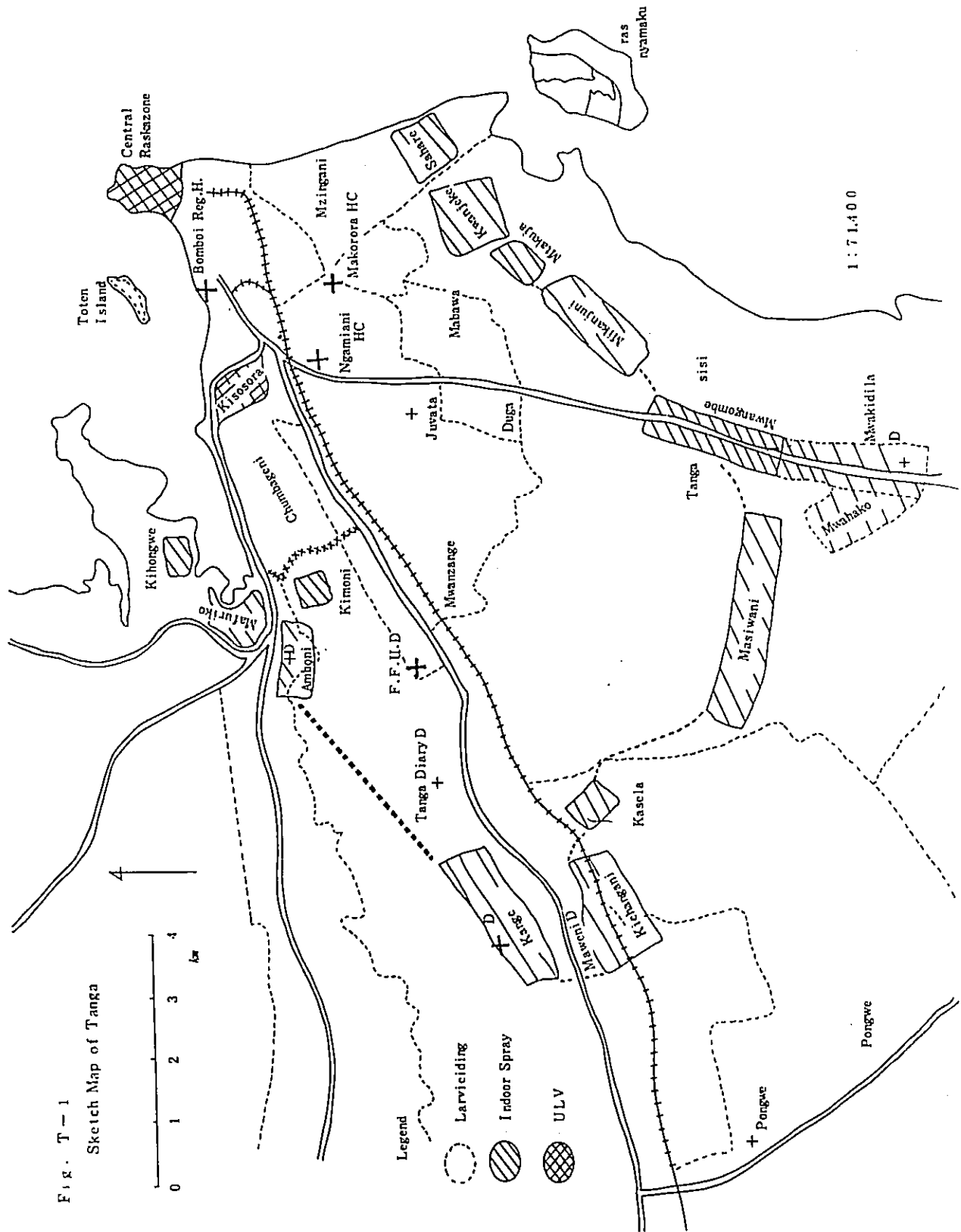
#### 5. Muheza Field Station

Members are impressed with its activity and learnt a lot. Trials of using insecticide impregnated bed nets, insecticide successibility test on Culex quinquefasciatus, use of CDC6 model of the battery operated light trap and data assessment by a computer using a prepared programme on dBASE are of importance to be applied to malaria control programme.

## 6. Malaria Control Organisation in Tanga

In Tanga, the malaria control committee was formed as seen in Annex T-1 and this was observed functioning by an appropriate secretarial arrangement made by Dr. H. A. S. Kasale. Core persons in this committee attended to the managerial meeting this time and actively participated in the discussions. The topics stressed by them were involvement of community participation. The other activities and preparations for control are seen in Annex T-1.

Fig. T-1  
Sketch Map of Tanga



URBAN MALARIA CONTROL PROGRAMME

TANGA MUNICIPALITY

Malaria is undoubtedly a major public health problem in Tanga Municipality. Efforts to control malaria have been there. However, they have always been frustrated due to lack of essential inputs, Vis finance, technical staff and an increase of mosquito breeding places. Furthermore the situation has been compounded by the resistance of mosquitos and malaria parasites to most of the traditional chemicals and drugs.

The proposed programme which seeks to reduce the present high level of malaria transmission to an extent that the disease becomes no longer a public health threat, will be carried with the help of Japanese Government. On behalf of Tanga Municipal Council and its Citizens I take the opportunity to thank the Japanese Government and we very much welcome the programme. The community is well aware of the programme and is anxiously waiting for it.

To ensure co-ordinated effective and smooth implementation of the programme the following have been planned.

(A) FORMATION OF MALARIA CONTROL COMMITTEE:

The committee will be formed with the following members to ensure sustained intersectoral collaboration.

- |                               |                 |
|-------------------------------|-----------------|
| (1) District Commissioner     | - Chairman      |
| (2) Municipal Director        | - Vice Chairman |
| (3) Medical Officer of Health | - Secretary     |
| (4) Municipal Health Officer  |                 |
| (5) Health Officer Malaria    |                 |
| (6) Municipal Engineer        | - Member        |
| (7) District Water Engineer   | - "             |
| (8) Agricultural Officer      | - "             |

- (9) Public Health Engineer - Member
- (10) District Party Secretary  
an Social Services - "
- (11) Manager of National Housing  
Corporation & Registrat of  
Building.
- (12) Regional Medical Officer
- (13) Community Development Officer
- (14) Municipal Education Officer

Functions of this Committee

- (1) Receive reports from the implementers and reviewing them in order to improve implementation.
- (2) Insure intersectoral co-operation.
- (3) Cordinating other agencies and mobilizing the Community for self-help participantion, Health education compaigns etc.

NB. The committee will hold its first meeting after party elections.

(B) STORAGE AND WORKSHOP FACILITIES

The council had already accepted to spend about 350,000 T.Sh to construct storage facilities. The sketch plans are ready, which will include one main office, one room for laboratory, car shelter, garage, one room for storage of spare parts, and another for chemicals. Clearing of the site have started and some procurement of materials have started. The construction is expected to be completed by October 1987.

(C) MAPPING OF THE AREAS OF OPERATION

Geographical reconuaissance to delimit potential breeding sites, and mapping have started and are nearing completion.

The maps will show periurban villages including houses, population and number of ponds and permanent swamps.

The estimation of surface areas with stagnant water i.e. permanent swamps, has already been done and is as follows:-

(1) New Nguvumali	- 240 sq metres
(2) Makorora H/Centre	- 1750 sq "
(3) Mng'amboni Railway and Government quarters	- 600 sq "
(4) Mabawa Police Line	- 15000 sq "
(5) Duga Maskini Camp	- 30000 sq "
(6) Majengo Martin Shamba area	- 1200 sq "
(7) Pangani Road Mwakidila (Tanga sisi)	- 50000 sq "
	<hr/>
TOTAL	98790 sq metres
	=====

(D) COLLECTION OF DATA AND REPORTING

As the present data collection system is inadequate we will try to strengthen the collection system as to help in monitoring the programme. We plan to start an urban Primary Health Care, we will rely mostly in the community health workers, workers in dispensaries and Health Centres. Basic Training on data collection and reporting will be done to those workers.

Dr. H.A.S. Kasale  
MEDICAL OFFICER OF HEALTH  
TANGA MUNICIPAL



TANCA Epidemiological Base-Line

1986	Ngaitani HC	Makorara HC	Pongwe RHC	Pande Disp.	Tongoni Disp.	Mabokwe- ni Disp.	Mwaki- dila Disp.	Kiso- sora Disp.	Mafu- riko Disp.
January		2067	178				500		
February							470		
March							390		
April							394		
May	1732						392		
June	4672						412		
July	5702	1649					410		
August	4812		180	2732		96	382		
September	1842	2600	160	301			392		
October	2064		200	291	2411	118			740
November	2941	2265	105		2302	107			
December	3216	2191	332			83	3749		646
	27061	10770	1156	3324	4713	404			1386

1987									
January	2794	2266	371		1687	112		266	690
February	2115	1500	200		1645	101		268	523
March	2179	2331	170		1489	108	442	830	308
April	2674	1098	79		1426	155	365	936	
May	4766	818	150		1328	192	393	830	262
June		890	269		2066		408	793	334
July	2371	643	305		2433		390	650	446
August		2500			1266		377		534
September									
October									
November									
December									
	16899	12046	1544		13440	668	2375	4573	3097

## ZANZIBAR

Mr. J. H. Marijani of Malaria Services Unit of Ministry of Health (MOH), Tanzania and Dr. H. Tanaka, a short-term expert of JICA visited Zanzibar Malaria Control Program (ZMCP) in the period from 17 to 19 September, 1987 in responding to the invitation from Ministry of Health, Zanzibar.

At courtesy call accompanied by Dr. J. A. Muchi, the Director, Zanzibar Malaria Control Program (ZMCP) to Mr. Kassim Maalim Suleiman, Principal Secretary, attended by Ministry top officials and WR. Dr. Kobello, PS expressed cordial welcome and Dr. Tanaka appreciated with honour and pleasure his invitation.

Among technical and managerial discussions, topics raised by PS were the possibility of Japanese assistance to Zanzibar for malaria control since USAID support is terminated in September 1987 with possible extension until April 1988. What he stressed to MOH, DSM was the inclusion of Zanzibar to the on-going Japanese assistance for Malaria control to Tanzania and he wished the understanding of Japan International Cooperation Agency (JICA).

### Itinerary

<u>DATE</u>	<u>EVENT</u>
September 17, 1987	- courtesy calls. Discussions on organization and control operation
September 18, 1987	- Observation of residual spray operations at Donge Mchangain area and Kikwajuni in Kaskazini District of Unguja Island.
September 19, 1987	- Observation of spray machines, laboratory facilities and mosquito breeding sites in the city. Discussion on entomological and epidemiological parameters for evaluation.

## 1. Organization and Management

The Zanzibar Malaria Control Programme (ZMCP) started in 1982. The amended loan agreement in 1985 included US\$7.4 million from USAID, with the financial commitment of Government of Zanzibar for US\$4.6 million and with a consultant from WHO. The total amount of loan, however, reached about US\$11 million upto now.

ZMCP in Zanzibar city consist of 11 main personnel and other workers in 3 sections headed by the Director, Juma A. Muchi, a Medical Doctor as shown in the list (List Z-1). Under this headquarters, an island chief is assigned at each of Unguja and Pemba offices. Officials are also distributed at levels of Region, District and Branch (Fig. Z-1). The relationships among ZMCP and other sectors in MOH are shown in Fig. Z-2. Coordination among other Ministries and recommendations to ZMCP are made by the Malaria Control Committee at national level.

For processing necessary materials, the headquarters (HDQ) prepares the list of materials, with brand name, model and type to be purchased from designated developed countries, and sends it to USAID in Dar es Salaam. Materials are purchased by AID, DSM and sent to ZMCP. When AID wishes to change the model of some requested materials, this change is informed to ZMCP for agreement, leaving room for further dialogues.

In the discussions on the relationship of Malaria Control with Primary Health Care (PHC), possession of the strong HDQ in a 3 storey building with several rooms and several laboratory rooms, stuffed well, and holding a vertical organization with the decreased number at descending levels are not the way to going back to the old health system, but an unavoidable organization for malaria control to make plans to be given to the PHC sector, and to monitor and evaluate the on-going activities for their improvement.

By the experience of Dr. Tanaka, the same size or much bigger headquarters are maintained by nearly the same concept in other countries such as Honduras and Burma, where malaria control has been conducted fairly well.

## 2. Control Operation

The methods and operations of insecticiding are nearly the same as in DWM. A whole area in 2 main islands with 550,000 population is under mosquito control. Indoor residual spray with DDT is given all houses except in Zanzibar city, 2 times in a year before each rainy season. In the city, mosquito larvae are killed by DDT for reduction of mosquito density. Pyrethrum ULV spray is combined with larviciding in only a limited area due to the expensive operation.

The average sprayable area in a house is 205 m<sup>2</sup>. One sprayman can cover 10 houses in a working time for 3 to 4 hours a day. A half of the necessary number of spraymen is recruited at the target village.

The hidden resting place of mosquitoes in a house discovered at Zanzibar is a narrow space under extending roof at a junction of two roofs at right angle directions. For spraying in this space, a long extension tube is needed after the nozzle apparatus of Hudson pump.

On Pemba, malathion was once sprayed but replaced with DDT since An. gambiae was not regarded to be resistant to DDT so much by the detailed examinations. Residual spraying with malathion was expensive for the cost of insecticide and operation. It was not appreciated either by dwellers for its bad smell.

## 3. Entomological Survey and Evaluation

Susceptibility tests of adult mosquitoes to DDT have been conducted from time to time at the appointed villages. The sites where mosquitoes are completely susceptible are very small in number and they are mostly partially or fairly resistant to DDT.

Residual effects of DDT on sprayed wall are often examined by bio-assay method or cup method. For this, Aedes aegypti is used in place of Anopheles because of difficulty of rearing a number of anopheline mosquitoes.

Many entomological parameters have been used in this programme. Reliability and disadvantage of methods used are as follows:

a. Whole night catch or human bite catch

This is most reliable and easy to do.

b. Pyrethrum spray catch

The number of mosquitoes is always small even if it is performed properly. By the loose structure of house, mosquitoes may escape from many slits or space other than window or door before knock down. The reliability is doubtful. Disturbance of dwellers in the house by collection at early morning is another disadvantage.

c. Light trap

CDC4 light trap operated by dry cells was used. This attracted more culicines than anopheline mosquitoes in limited trials. Therefore, this is not used in this programme.

d. Hand collection

Hand collection of mosquitoes resting on the wall is a simple and reliable method. Again, the disturbance of residents was a big problem.

e. Window trap

In most occasions, the number of mosquitoes collected was small in number, possibly because of access of mosquitoes through space and slits of the wall other than windows. Although this is important method for research purposes, it can not be used as a routine evaluation method.

f. Sporozoite index and Parous rate

These are important as operational researches but are not used daily works for its complicated technical procedures.

g. Dipping method for larval density

This is a simple reliable method. It was learnt by the members that Japan produces different sizes of qualified dippers which are easily available in most Southeastern Asian countries.

4. Parasitology and Epidemiological Evaluation

Blood films are examined at laboratories in HDQ for Mass Blood Survey (MBS). Microscopic examinations will be decentralized gradually. Other examinations are made in laboratories in cooperative hospitals for passive case detection (PCD). Parameters use are two, i.e., MBS and PCD mentioned above.

a. Mass Blood Survey (MBS)

Mass Blood Survey is a kind of active case detection (ACD). Indicator villages were determined and blood samples are taken from 400 dwellers in a village where the maximum population is 2,000. All villages are visited in the same month every year, so that seasonal fluctuation would be minimized.

In 1985, 11,110 and 4,484 slides were examined on Unguja and Pemba Islands, respectively. The MBS was 29.6% on Unguja and 32.8% on Pemba whereas the MBS was higher than 70% at the start of programme.

b. Passive Case Detection (PCD)

Passive case detections are conducted in main hospitals, district hospitals and cottage hospitals. A total of 128,763 patients were examined in 1985, and % positives varied from 0.7 to 6.5 by the villages. (Details are not clear to us. Why PCD was so low % although MBS was as high as about 30% ?).

5. Comments of Dr. Tanaka to DSM Programme after visit to Zanzibar

- a. Malaria Services unit, MOH is preferably strengthened.

Additional staffs expected are:

Director: Medical Doctor

Parasitologist and Epidemiological Evaluator (BS or MSc level)

Two administrative officials.

- b. Budget allocations are more enhanced and confirmed at levels of MOH and DSM council.

- c. Microscopic blood examinations are started at possible earliest occasion for the base-line data.

- d. Introduction of MBS as an epidemiological parameter in Zanzibar is planned to this programme in Dar es Salaam.

List Z-1

MALARIA CONTROL PROJECT, ZANZIBAR

KEY PERSONNEL AT THE HEADQUARTERS

<u>NAME</u>	<u>POST</u>
1. Dr. Juma Muchi	Director
	<u>Administration</u>
1. Mr. Shaaban Seif	Chief Administrator
2. Mr. Saalim Dadi Maalim	Chief of Supplies
3. Mr. Madawa Maalim Kinoo	Transport Officer
4. Mr. Sheha Ali Juma	Store keeper
	<u>Operations</u>
1. Mr. Juma Rajab	Operations Officer
2. Mr. Mbarouk Said Issa	Assistant Operations Officer
	<u>Laboratory/Epidemiology</u>
1. Mr. Hamad Juma Haji	Chief Parasitologist/Entomologist
2. Mr. Sultan Mohammed Issa	Assistant Parasitologist/Entomologist
3. Mr. Hassan Mussa Hassan	Chief Microscopist
4. Mr. Nassor Said Nassor	Chief Entomological Assistant
5. Mrs. Lucy Henry Shaaban	Chief Entomological Assistant



Fig Z-1

MALARIA PROGRAM ORGANIZATION, ZANZIBAR

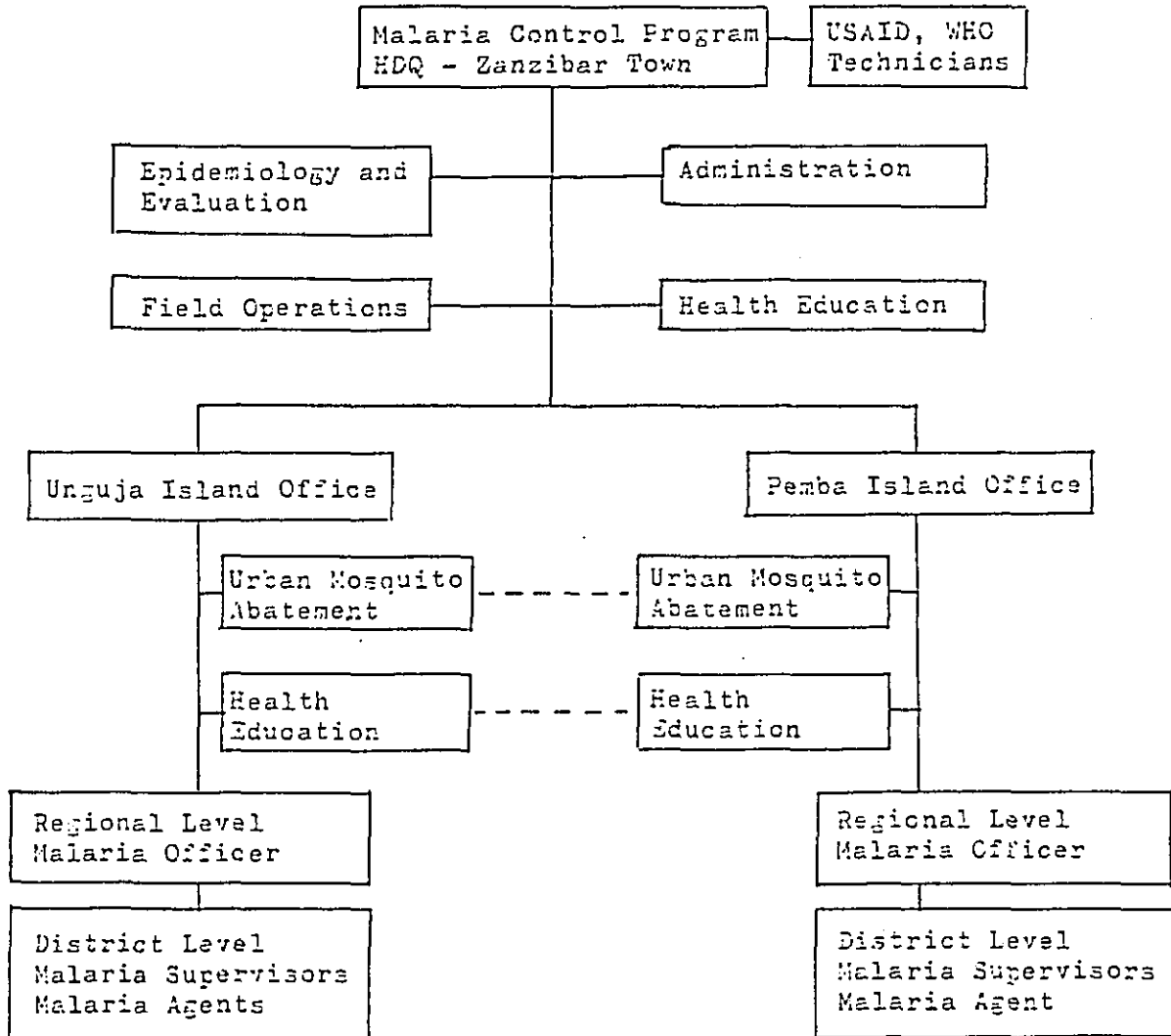
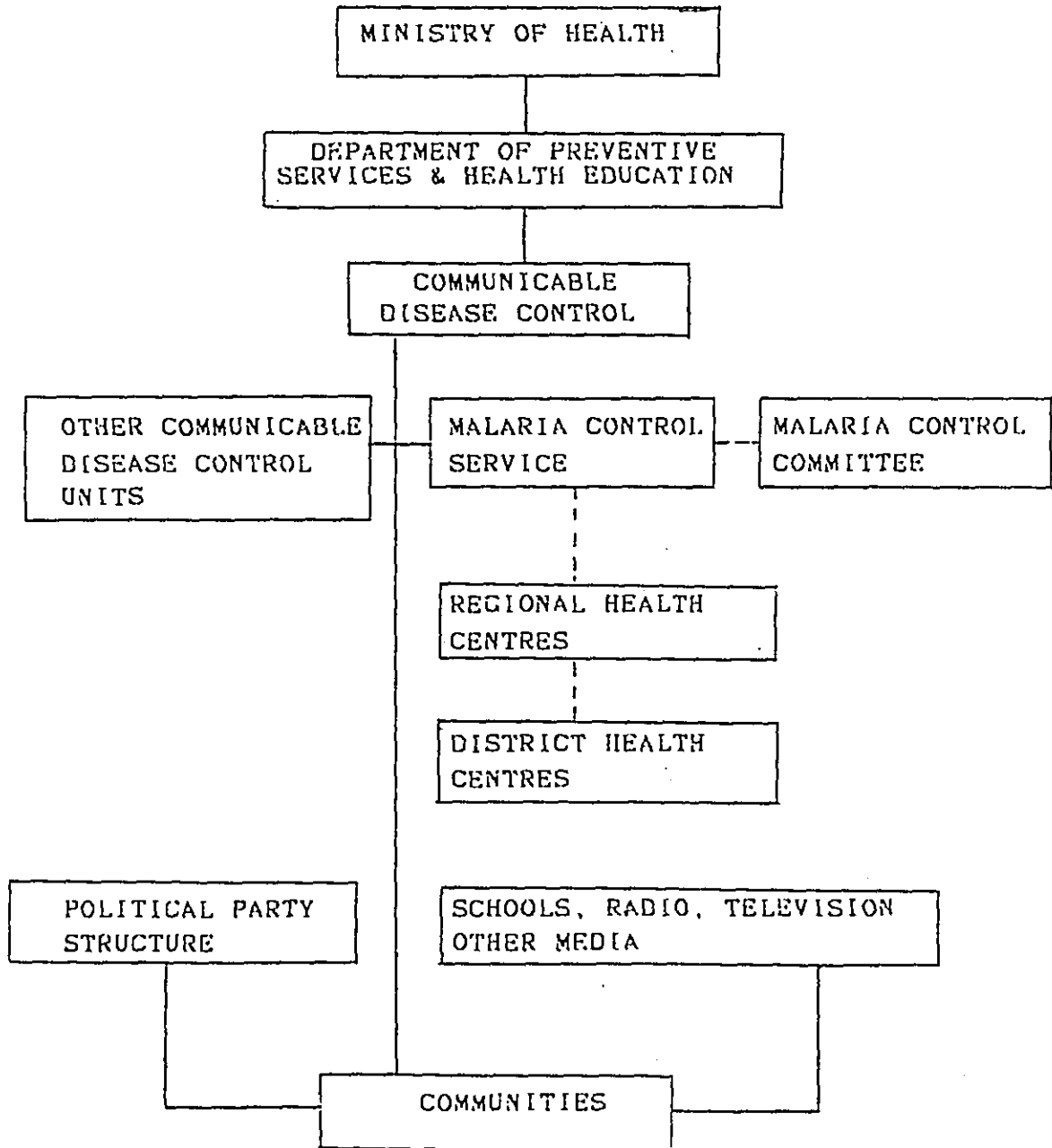


Fig 2-2

MALARIA ORGANISATION - ZANZIBAR MALARIA SERVICE



**REVISED PLAN OF OPERATION**  
**URBAN MALARIA CONTROL IN DAR ES SALAAM**  
**TANZANIA**

**AUGUST 1988**

This document is the description of revised parts of the plan of operation compiled in September, 1987. While the operation started and was being implemented, procedures of operation was reviewed by the members concerned in Dar es Salaam, Mhimbili Medical Centre and MOH in Tanzania and by Japanese collaborators. The report is the results of revisions by joint works of the persons whose names are listed below.

Dr. J. Orwa, M.D. Malaria Project Manager, DSM  
Mr. A.D. Mawi, Health Engineer, Mosquito Control Unit, DSM  
Mr. A.R. Majala, MSc. Entomologist, Malaria Service Unit, MOH  
Dr. M.J. Mponzoya, Health Director, DSM  
Dr. C.M. Kihamia, M.D., Sen. Lect. in Parasitology, Mhimbili M.C.  
Dr. J.N. Minjas, PhD., Sen. Lect. in Entomology, Mhimbili M.C.  
Mr. A.J. Keto, Mosquito Control Unit, DSM  
Assoc. Prof. K. Makiya, JICA expert  
Prof. H. Tanaka, JICA expert

ATTENTION: The contents of this revised plan of operation as well as the previous one in 1987 can be modified upon agreement among authorized persons in both countries. However, when anybody including voluntary service persons who notices the danger of the people in Tanzania is privileged to stop or suppress the implementation of written plan. No expansion or increase of control areas or activities are allowed to unauthorized persons without permission.

- 1 Offices and organization
- 2 ULV spray
- 3 Revised stratification of areas
- 4 Cholinesterase measurement
- 5 Indicator areas
- 6 Epidemiological evaluation
- 7 Entomological evaluation

## 1. Offices and organization

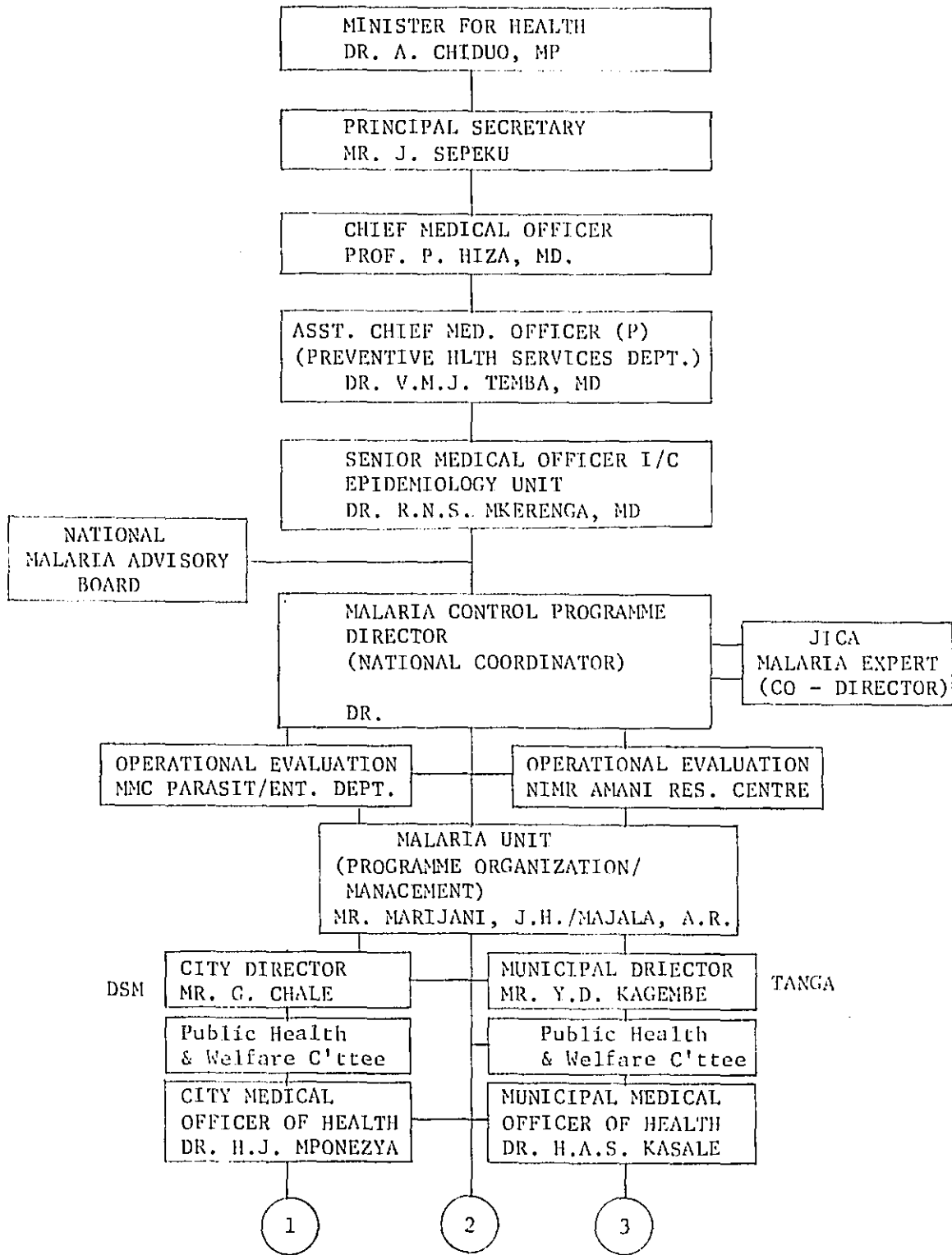
As the centre of executing malaria control, offices of the mosquito control unit of Dar es Salaam City Council (DSM) located at Kisutu, DSM are used. Since operation of ULV spray started and techniques of indoor spray are taught on the yard around offices, this mosquito control unit has gained the popularity among citizens and is now commonly called as the Malaria Station.

Most of the central management, operational planning, preparation of all activities, such as ULV spray, larviciding, indoor spray, epidemiological and entomological evaluations are conducted at this site.

Organization for urban malaria control in Tanzania was formulated at early stage and revised and improved many times. As in Fig. 1, the organogram involves comprehensively all personnel concerned in the levels of the Ministry of Health, DSM City Council and in the Malaria Station. Dr. Mkerenga was recently assigned to the malaria control programme director as a role of national coordinator temporarily in parallel with his present assignment.

As day by day execution of malaria control activities, individual terms of references were studied and clarified. Based on this study, responsibility of all jobs is distributed to the most appropriate personnel irrespective of their original institutions and a conventional executing organization was figured out so that roles, and responsibility of each person to the control activities in DSM is clearly identified in the total schemes (Fig. 2).

Fig. 1 TANZANIA MALARIA CONTROL PROGRAM ORGANIZATION CHART



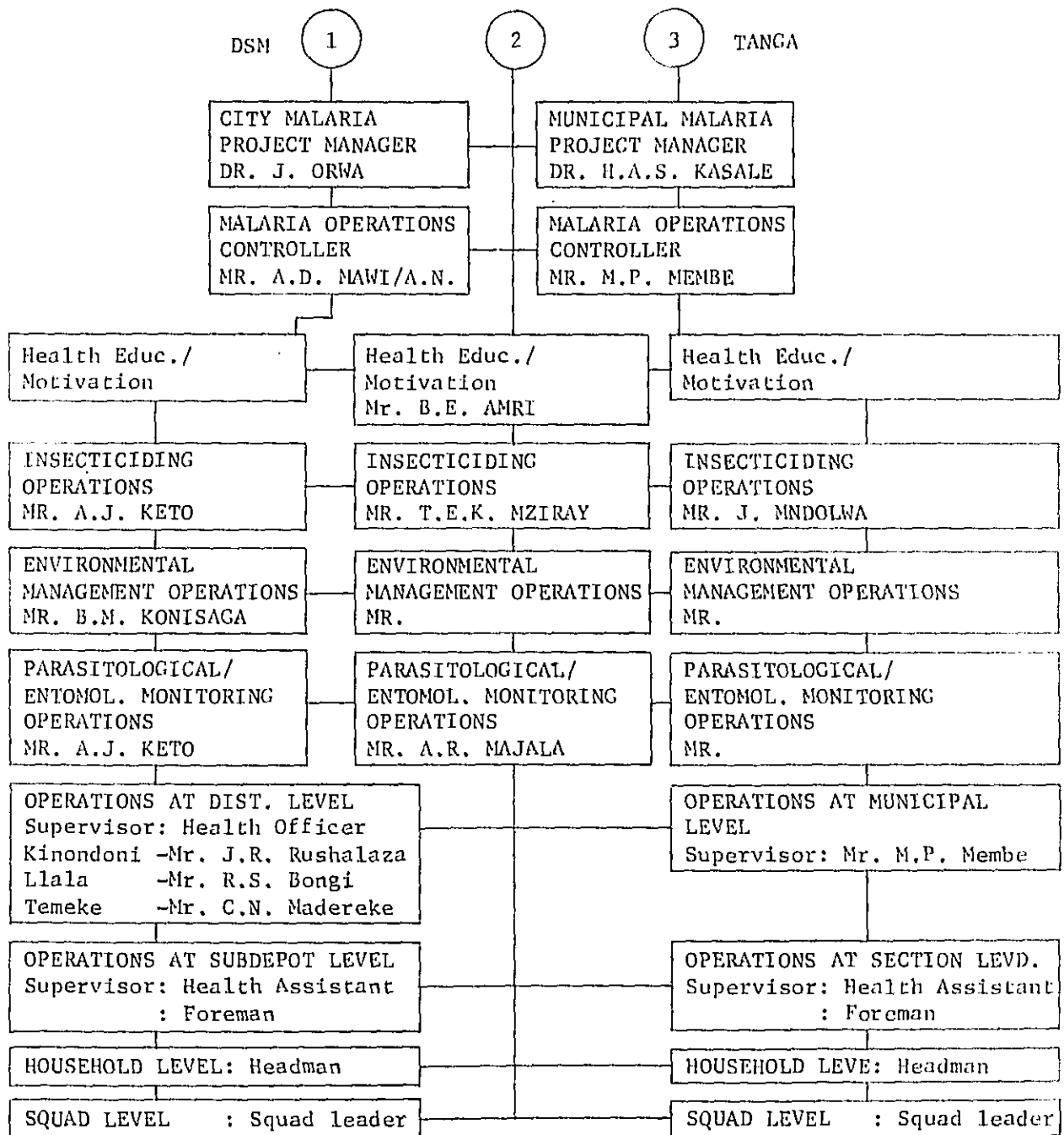


Fig. 2 Executing organization of the main personnel for malaria control  
in Dar es Salaam

Malaria Project Manager	Dr. J. Orwa, M.D. (DSM)
Man Power Management	Dr. K.R.S. Mkerenga (Mal. Con. Director, MOH) Dr. M.J. Mponezya, M.D. (H. Director, DSM)
Authorized collaborators (JICA experts)	Ass. Prof. K. Makiya, PhD. Dr. T. Ikemoto, PhD., Lecturer Prof. H. Tanaka, M.D., DMS
Planning of control operations	Dr. Orwa (DSM) Mr. A.D. Mawi (DSM) Mr. J.H. Marijani (Malaria Unit, MOH)
Control operations (DSM)	Mr. A.J. Keto
Larviciding <input type="checkbox"/>	Mr. R.S. Bonigi
Indoor spray <input type="checkbox"/>	Mr. C.N. Madereke
ULV spray	Mr. J. Rushalaza Dr. Orwa Mr. Mawi
Cholinesterase measurement (DSM)	
Chief	Mr. Christopher Dawson Bembi, M. Tech. Mr. Denis Paulo Manyenga, M. Tech. Mr. Ilanda Bulala, M. Tech.
Epidemiological evaluation	
Simple evaluation; CSM statistics from dispensaries	
Detailed evaluation; Blood examinations	
Consultant	Dr. C.M. Kihamia, M.D. (Muhimbili MC)
Chief	Mr. Christopher Dawson Bembi (Med. Tech. DSM) Med. Techs in DSM City Council Miss Mayumi Yamatoki (Med. Tech. JOCV, MMC) A new member (Med. Tech. JOCV, DSM)
Entomological evaluation	
Consultant	Dr. J.N. Minjas, PhD. (Muhimbili MC)
Chief	Mr. A.R. Majala (Malaria Unit, MOH) Mr. A.J. Keto (DSM)
Management of storage and logistics	Dr. M.J. Mponezya (DSM) Dr. K.R.S. Mkerenga, M.D. (MOH) Mr. J.H. Marijani (Malaria Unit, MOH)
Training of control operators	Dr. Orwa, Mr. Keto, Mr. Mawi
Technical collaborations for preventing intoxication	Mr. H. Takenaka (Sumitomo Corporation, DSM) Mr. T.L. Naivasha (Wellcome Limited, DSM) Members of Sumitomo Chemicals from Japan



## 2. ULV spray

According to the original monthly schedule, ULV spraying was initiated on 18 July (mon) by the schedule to work 6 evenings a week. In this first week, following 6 villages were covered.

July 18 (mon)	Oyster Bay
19 (tue)	Magomeni
20 (wed)	Kariakoo
21 (thu)	Ilala
22 (fri)	Chang'ombe
23 (sat)	Wailes

This schedule was reviewed on 26 July (tue) and decided to modify the schedule as in Table 1 due to heavy work load and doubtful efficacy as an operation of malaria control at selected areas. The main part of modifications was that two areas, Oyster bay and Magomeni, were selected as operational sites with intensive evaluation and that the other 4 sites will be given spray operation only at least frequency.

After ULV spray in July, only two area are taken into consideration for its implementation.

Table 1. Time schedule of ULV spray and entomological evaluation in Dar es Salaam

Date	Oyster Bay	Magomeni	Larviciding & ULV operation only
Jul. 25 (M)	SPR-catch, Larvicid, ULV operation	-----	-----
26 (T)	-----	-----	-----
27 (W)	H-landing, L-trap (1)	-----	Kariakoo
28 (T)	SPR-catch	H-landing, L-trap (0)	Ilala
29 (F)	H-landing, L-trap (2)	SPR-catch, Larvicid, ULV operation	-----
30 (S)	SPR-catch	H-landing, L-trap (1)	-----
31 (S)	-----	SPR-catch	-----
Aug. 1 (M)	H-landing, L-trap (0)	-----	-----
2 (T)	SPR-catch, Larvicid, ULV operation	H-landing, L-trap (2)	-----
3 (W)	H-landing, L-trap (1)	SPR-catch	Chang'ombe & Wailes
4 (T)	SPR-catch	H-landing, L-trap (0)	-----
5 (F)	H-landing, L-trap (2)	SPR-catch, Larvicid, ULV operation	-----
6 (S)	SPR-catch	H-landing, L-trap (1)	-----
7 (S)	-----	SPR-catch	-----
8 (M)	H-landing, L-trap (0)	-----	-----
9 (T)	SPR-catch, Larvicid, ULV operation	H-landing, L-trap (2)	-----
10 (W)	H-landing, L-trap (1)	SPR-catch	Kariakoo
11 (T)	SPR-catch	H-landing, L-trap (0)	Ilala
12 (F)	H-landing, L-trap (2)	SPR-catch, Larvicid, ULV operation	-----
13 (S)	SPR-catch	H-landing, L-trap (1)	-----
14 (S)	-----	SPR-catch	-----
15 (M)	-----	H-landing, L-trap (2)	-----
16 (T)	-----	SPR-catch	Chang'ombe & Wailes

SPR-catch : Spray catch

Larvicid : Larviciding

H-landing : Human landing catch

L-trap : Light trap

(0) Pre-operation survey

(1) Post-operation survey 1

(2) Post-operation survey 2

### 3. Revised stratification of areas by difference of control measures

In the previous report, villages were stratified by the difference of control measures. After planning in 1987, areas were further studied for applicability of each control method and for accessibility of vehicles.

The areas for ULV spray were changed as in Chapter 2. Some parts of villages scheduled to give indoor spray were found to be difficult for accessibility of trucks and changed to larviciding. Some villages to be larviciding alone were found to apply the indoor spray.

By these modifications, stratification of villages was completely revised and shown in Table 2 and Fig. 2. Villages are classified to the area of larviciding (L), indoor spray (I), ULV spray (U) and these combinations. When a part of a village is given indoor spray and the rest part of the same village is under larviciding, the village is marked with "l and i", which is different from "L and I", by which all areas in a village are covered with both indoor spray and larviciding.

In the previous schedule, about 50,000 houses were scheduled to cover with indoor spray, and by the above mentioned modification of spray areas, there is a possibility of increasing the number of houses to be covered. The increase of number of houses, however, is not welcomed at the first exercise of indoor spray by the new members and the reduced number is more preferable.

Control measures to be given to each village are listed up in details in Fig. 2. And further modifications may be necessary while the first round of indoor spray is being implemented.

By these big changes of stratification of areas, selection of appropriate villages for entomological and epidemiological evaluations had to be re-considered. Villages for these purposes were selected again and the villages of revised designation are presented in Fig. 2.

This revised stratification of areas is illustrated in Fig. C-1 for simple visual understanding.

Table 2  
Stratification of areas by difference of control measures (I)

Locality	Operation				Evaluation	
	Larvi- ciding	Indoor spray	ULV	Un- treated	*Entomo- logical	Epidemio- logical
Kinondoni Zone						
Kawe	l	i				
Mikocheni	l	i				
Msasani Town	l	i				
Msasani Peninsula	L					
Oyster Bay	L		U		EN	EP
Kinondoni	L				EN	
Mwananyamala	L					
Manzese	l	i				
Magomeni	L		U		EN	
Mabibo	l	i				
Kunduchi		I				
Mbezi		l				
Kimara		I			EN	EP
Ubungo	l	i				
Dunju				x		
Goba				x		
Mabwepande				x		
Kibamba				x	EN	
Mbweni				x		
Kwembe				x		
Boko				x		

l and i; Larviciding at a part of village and indoor spraying at the rest part.

\*; Collection at 5 sites simultaneously by 1) Spray catch  
2) Human landing  
3) Light trap

Stratification of areas by difference of control measures (II)

Locality	Operation				Evaluation	
	Larvi- ciding	Indoor spray	ULV	Un- treated	*Entomo- logical	Epidemio- logical
Ilala zone						
Upanga	L				EN	
City Centre	L					
Kariakoo	L					
Gerezani	L				EN	EP
Ilala	L					
Buguruni	l	i				
Kiwalani	L	I				
Kipawa	L	I				
Ukongu	L	I				
Tabata	l	i				
Kinyerezi		I			EN	
Segerea		I				
Guruka kwa lala		I				
Kitunda		I				
Pugu Kajiungeni				x	EN	EP
Buyuni				x		
Chanike				x		
Mvuti				x		
Msongola				x		

l and i; Larviciding at a part of village and indoor spraying at the rest part.

\*; Collection at 5 sites simultaneously by 1) Spray catch  
2) Human landing  
3) Light trap

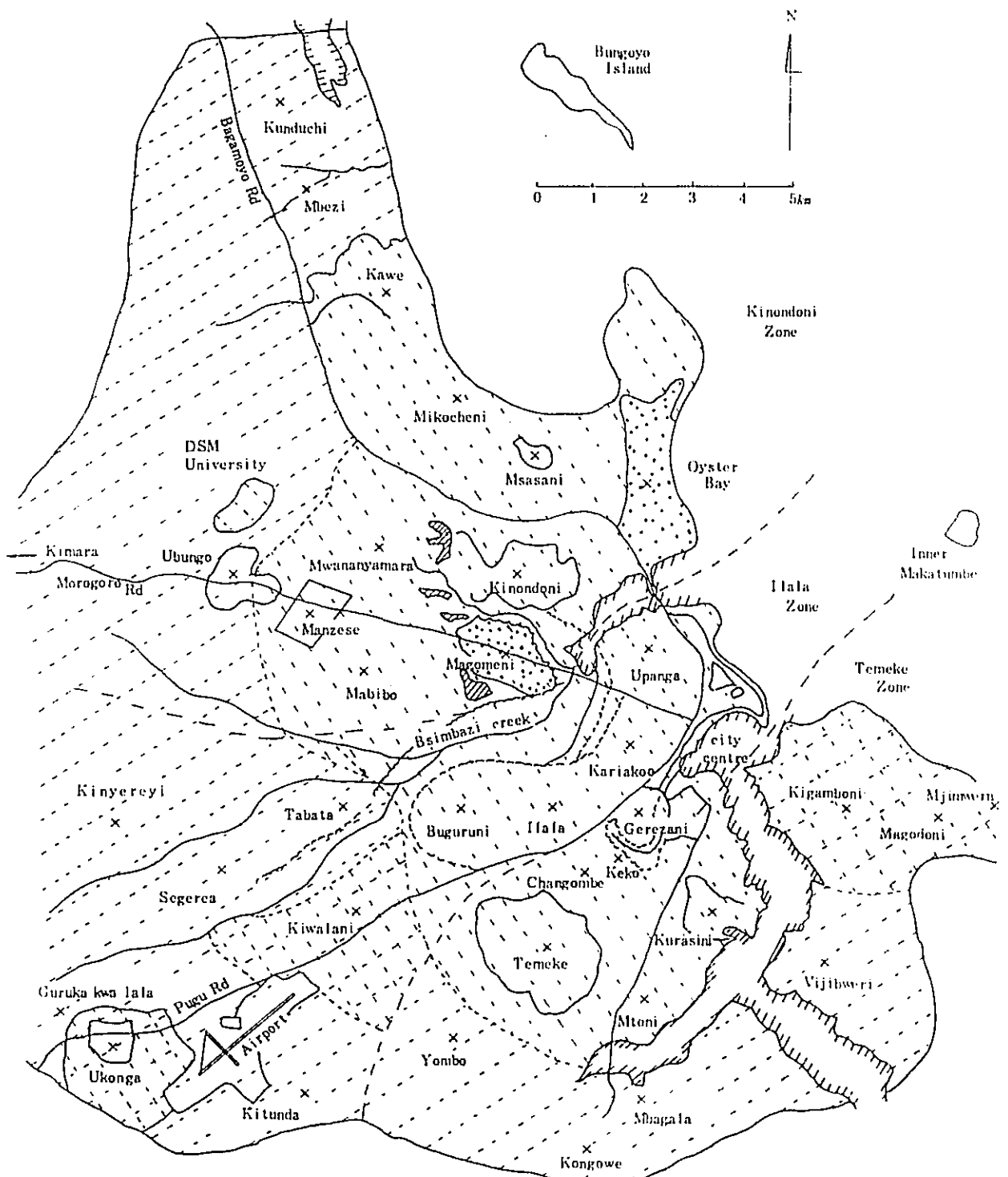
Stratification of areas by difference of control measures (III)

Locality	Operation				Evaluation	
	Larvi- ciding	Indoor spray	ULV	Un- treated	*Entomo- logical	Epidemio- logical
Temeke Zone						
Magogoni	l	I			EN	
Kigamboni	L	I			EN	EP
Keko	l	i				
Chang'ombe	l	i				
Temeke	l	i				
Kurasini	l	i				
Mtoni	l	i				
Vijibweni		I				
Mbagala	l	i				
Kongowe		I			EN	EP
Yombo	l	i				
Buyuni				x		
Tundwi Songani				x		
Chekeni Mwasonga				x		
Kimbiji				x		
Gomvu				x		
Gezaulole				x		
Kibada				x		
Toangoma				x		
Chamazi				x		
Mwongoro				x		

l and i; Larviciding at a part of village and indoor spraying at the rest part.

\*; Collection at 5 sites simultaneously by 1) Spray catch  
2) Human landing  
3) Light trap

Fig. C-1



DELIMITATION OF INDOOR SPRAYING, LARVICIDING AND ULV SPRAY

- Indoor spraying
  - Both indoor spraying & larviciding
  - Larviciding
- ULV operation

#### 4. Measurement of cholinesterase level of spraymen

For spraying organophosphorous compound like fenitrothion, monitoring of the cholinesterase level of spraymen is of unavoidably essential to prevent their intoxication. Therefore, the Government of Japan provided kits for determining cholinesterase level (Lovibond, England). The problem with this kit is a rack of 0.01 ml micro pipet for taking blood and it was solved locally.

Those whose cholinesterase level was below 75% of normal person were not employed. More than 300 spraymen were examined and 30 persons were not contractetd because of its low level.

Usually, candidates for the sprayman are examined with their cholinesterase level before employment like in the procedures undertaken here. As routine procedures, spraymen will be examined once in 2 weeks while spray is going on. However, when newly recruited persons start operation, the cholinesterase level is preferably examined once a week at the early phase.

#### 5. Indicator area

There were opinions that entomological and epidemiological evaluations should be performed widely in the whole area evenly. On the other hands, some like to establish indicator areas where intensive evaluations would be performed. By the reasons, that by the latter method, effect of control operations and activities will be more clearly indicated, it was agreed to select indicator areas by the difference of control measures and even distribution in 3 administrative zones in DSM. Those areas were carefully selected and are shown in Table 2 and in chapters 6 and 7.



## 6. Epidemiological Evaluation

In the plan of operation worked out in September 1987, two methods of epidemiological evaluations were proposed, i.e., simple evaluation and detailed evaluation.

### 6.1 Simple Evaluation

For the simple evaluation, collection of statistics of cases of clinically suspected malaria at dispensaries was planned. Actually, the data in the period from January 1986 to May 1987 were collected and tabulated. Those data after May 1987 have been succeedingly collected and kept by Dr. Orwa and his members, and will be analysed soon. This simple evaluation will be continued as it was described at chapter 3.1 in the former document in 1987.

### 6.2 Detailed Evaluation

Detailed evaluation will be performed by microscopical blood examination. In the old document in 1987, it was intended to examine sample cases of attendants to dispensaries at indicator areas of different control measures.

The plan is changed and children at grades 1 to 3 at primary schools in the 6 indicator areas will be examined monthly. Names of school, the number of children and the control measures given to each indicator area are as follows;

Name of Primary School	Locality *(Zone)	No. of Children at Pl, 2, 3	Control Measures
Oysterbay	Oyster Bay, (K)	800	Larviciding + ULV
Kisarawe	Gerezani, (I)	500	Larviciding
Kongowe	Kongowe, (T)	400	Indoor spray
Kimara	Kimara, (K)	600	Indoor spray
Kigamboni	Kigamboni, (T)	400	Larvicid. + Indoor sp.
Pugu Kajiungeni	P. Kajiungeni,(I)	300	Untreated
Total		3000	

\* Zone, K; Kinondoni I; Ilala T; Temeke

### 6.3 Organization execution

The blood collection will be performed monthly by a team of 3 medical technicians headed by Mr. Christopher as in the list of executing organization and medical technologists of JOCV.

Blood samples will be examined at medical laboratories in the DSM City Hall for the time being, and the new laboratory facilities will be installed at Kisutu Malaria Station in near future to be used specific to malaria case detection. The children found positive for malaria will be treated with chloroquine.

The parameter to be used for the transmission of malaria will be the prevalence of children in each month at the indicator area, and individual children will not be monitored for simplicity. Since detected malaria cases are treated every month, the prevalence can be regarded as nearly equal to the incidence.

The whole epidemiological evaluation will be performed under Dr. Orwa with consultation of Dr. Kihamia, Parasitologist at Muhimbili Medical Centre. Observed data including crude descriptions will be reproduced by photocopies. The original will be kept at Malaria Station and copies will be sent to Dr. Kihamia and a JICA expert for analysis.

Medical technologists newly recruited with less experience in malaria detection, especially those coming from Japan will be trained by Dr. Kihamia and his associates.

### 7. Entomological evaluation

For assessment of control activities against vector mosquitoes, 3 methods were determined in the operation plan in September 1987 (Chapter 2.1).

In addition, human landing catches were adopted this time by agreement among members of both countries for the reason of WHO-recommendation. These 4 methods of mosquito collections determined are listed below.

- 1) spray catches (by 0.1% pyrethrum),
- 2) light trap catches (by CDC6 battery type),
- 3) human landing catches (by aspirator),
- 4) larval collections in waters (by hand dippers).

The relation between sites of these entomological evaluation and epidemiological evaluations is shown in the table of stratification by different control measures (Table 2).

### 7.1 Evaluation areas

The following table shows areas of evaluation decided by the discussion between Tanzanian and Japanese members concerned in July 1988.

Locality of entomological evaluation	Control measures at locality
Kinondoni Zone	
Oyster Bay	Larviciding + ULV spray
Kinondoni	Larviciding
Magomeni	Larviciding + ULV spray
Kimara	Indoor spray
Kibamba	Untreated
Ilala Zone	
Upanga	Larviciding
Gerezani	Larviciding
Kinyerezi	Indoor spray
Pugu Kajiungeni	Untreated
Temeke Zone	
Magogonii	Larviciding + Indoor spray
Kigamboni	Larviciding + Indoor spray
Kongowe	Indoor spray

### 7.2 Evaluation by adult mosquito catches

Among the above-mentioned 4 methods of entomological evaluations, 3 methods of adult mosquito catches (spray, light trap, and human landing

catches) are carried out weekly at 5 designated houses in each area whole the year round.

Light trap and human catches are continued during whole night from 18:00 in the evening to 06:00 in the next morning. By human landing method, catch size can be expressed in terms of mosquito number per man per night.

Spray catch is started by the same personnel immediately after finishing the above methods. It is required to move furnitures and other obstacles from the wall side so that all the fallen mosquitoes can be collected firmly on white sheet.

### 7.3 Evaluation by larval catches

Larval catches should be performed at as many water sites as possible by dipping with the same size of hand dippers. After reviewing the on-going dipping method, a standardized method should be established in consideration with quantitative survey of mosquito larval density. For example, 1) mean larval density per dip can be obtained by calculation of  $[\text{total number of larvae collected}]/[\text{total number of dips}]$ , or 2) larval density can be compared with the number of larvae collected for 10 minutes.

### 7.4 Organization

In order to implement the above-mentioned entomological evaluation, adult and larval mosquito collections will be performed by a team dispatched by Mr. Keto, and identification of collected mosquito specimens by personnel headed by Mr. Majala and Mr. Keto.

The whole entomological evaluation will be performed under Mr. Majala with consultation of Dr. Minjas, medical entomologist at Mhinbili Medical Centre.

Obtained data including crude descriptions will be reproduced by photocopies. The original will be kept at Kisutu Malaria Station and copies must be sent to Dr. Minjas and JICA expert(s) for analysis.

A memorandum to  
Dr. Orwa from Dr. Tanaka  
on 9 August 1988

A memorandum to Dr. Orwa from Dr. Tanaka on 9 August 1988

A following is my suggestion based on the desk plan and please take the principles written below in your consideration. Although the names of persons are written below for your easy understanding, you have freedom to modify or improve by nominating available man-power in other ways.

At present, you have 3 technicians, Mr. Christopher, Mr. Denis and Mr. Ilanda. Works for epidemiological evaluation and cholinesterase can not be performed by one group. Two groups, one for epidemiological evaluation and the other for cholinesterase are necessary.

The epidemiological evaluation is a continuous work whole the year round. The test of cholinesterase is an unstable work. A group of 6 to 8 persons has to work 8 days at maximum later 4 days in 2 months twice a year.

1) Epidemiological evaluation group

You have to organize a stable group composed of technicians and microscopists.

You have 5.5 working days in a week and possibly about 22 days in a month if you consider national holidays. In a month, 3,000 children at 6 schools will be covered. The technicians have to spend 6 days to visit 6 primary schools for blood sampling and keep another 6 days for treatment of positives and data processing.

On remaining 10 days, 3,000 specimens are examined microscopically, i.e., 300 specimens a day. For this you may need 5 microscopists. Possibly, you may need Mr. Christopher, Mr. Ilanda and 3 more persons of medical technicians or microscopists.

Epidemiological survey should have done at least one year before to collect base-line data. Therefore, the survey group should be formed and the blood examinations should be started as soon as possible.

2) 'Cholinesterase group

The examination of cholinesterase is very important and preconditional for spraying organophosphorous compounds.

For this, if you wish to use 3 kits simultaneously, you may need at least 6 persons or preferably 8 persons. Please follow the recommendations and plans from instructors of the test kits. The examinations should be performed to all spraymen weekly at the first round of indoor spray in September and October. From the next round, the test may be conducted once in 2 weeks.

The personnels working for epidemiology can not be used for this examination and establishment of another group consisted of medical technicians and assistant technicians is necessary.

If you assign Mr. Denis for the chief of this work, you may need 5 to 6 personnels more. Can you ask help of medical technicians or assistant technicians to 3 health centers, medical laboratories and hospitals for this purpose? Can you assign 2 more assistant technicians under Mr. Denis? It is wise to do this test by a few stable personnel and temporary assistants since working days are not much in a year.

In the period of months without indoor spray, permanent personnels in choloinesterase team should work for epidemiological evaluation as assistants to the epidemiology team.

JICA

