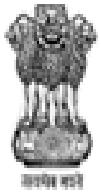


Government of India

OPERATIONAL GUIDELINES

FOR

URBAN VBDs SCHEME

(2016)

National Vector Borne Disease Control Programme

22 Sham Nath Marg

Delhi 110054

ACKNOWLEDGEMENTS

Urban Malaria constitutes about 10% of the total malaria in the country and Urban Malaria Scheme is presently functional in 132 towns in the country. The name has now been changed as Urban VBD Scheme as other vector borne disease namely Dengue, Chikungunya, Filaria and Japanese encephalitis are also being reported in these towns and to be tackled in terms of disease and vector management.

The Operational Guidelines for Urban VBDs Scheme (Previously UMS) has been developed under the able guidance of Dr. A.C.Dhariwal, Director, National Vector Borne Disease Control Programme (NVBDCP) in view of the National Framework for malaria elimination (2016-30). The final document is the result of several rounds of review and consultations with State Programme Officers, Biologists of Urban VBD Scheme, Regional Directors and officers of NVBDCP. The development of this document has been coordinated by Dr G. S. Sonal, Additional Director and HoD, Malaria Division NVBDCP with overall drafting and compilation done by Dr S. N. Sharma, Joint Director and Nodal Officer for Urban VBD Scheme at Dte. of NVBDCP. The contribution of Dr P. K. Srivastava, Joint Director and Dr Sukhvir Singh, Joint Director is also highly acknowledged.

The Directorate is thankful to Dr. Eva Maria Christophel, Regional Adviser Malaria WHO-SEARO, Dr Saurabh Jain, National Professional Officer, and Dr Nicole Simone Seguy, Team Leader Communicable Diseases, WHO Country Office for India for providing their support and encouragement in preparing this document. Hope that this document will serve as a field manual for undertaking Urban VBD activities for the control of malaria and other vector borne diseases under Urban VBD Scheme of the country.

CONTENTS

CHAPTER-1

INTRODUCTION

Malaria is endemic in India and active transmission has been reported form almost all area except those above 2000 meters sea level. Some areas have very low receptivity like the state of Kerala and North Bihar. Malaria in India is largely unstable and thereafter outbreaks do occur after an interval of several years depending on immunological, environmental and meteorological factors. In North Eastern region of the country malaria is stable and therefore its control has always been a serious challenge. Considering the recommendations of the Health Survey and Development Committee of Government of India, 1946 and also keeping in view the wide-spread adverse effect of malaria on the national health economy, industrial and agricultural growth in the country, the Planning Commission accorded highest priority to a nation-wide Malaria Control Programme. The remarkable success of the National Malaria Control Programme (NMCP) and the fact that malaria had been eradicated in certain countries paved the way for launching the National Malaria Eradication Programme (NMEP) in the country in 1958. In the plan of operations under NMEP all roofed structures in the rural areas received insecticidal coverage during attack phase except those in urban towns with population over 40,000.

In such areas, the residual insecticidal coverage was confined only to the houses in the peripheral belt to depth of 1 to 1.5 km. In the remaining areas of such towns and cities, anti-larval measures were recommended. The implementation of anti-larval operations was made the responsibility of local bodies. Many of the local bodies carrying out anti-larval operations earlier failed to continue the same due to paucity of funds. During that time malaria in urban areas was not considered as a major problem because the epidemics recoded earlier in Bombay, Delhi, Lucknow etc. could immediately be contained. The problem was noticed gradually when the implementation of control activities under NMEP brought down malaria incidence markedly by 1963-65 but at the same time increasing trend of malaria was observed in some town / cities.

This was mainly because *An. culicifacies* supplemented malaria transmission being maintained by *An. stephensi* in these pockets. *An. stephensi* breeds mainly in wells and cisterns which are man-made and of permanent and of permanent nature whereas *An. culicifacies* breeds in agricultural grassland mostly found in peri-urban areas. Secondly, the tremendous development activities specially construction activities aggregation of labour leading to mushrooming of slums which served as focal of dissemination of infection. During 1963-1968, infact malaria in urban areas surfaced as

a big problem in several states like Tamilnadu, Andhra Pradesh, Gujarat, Rajasthan, Maharashtra etc.

Major factors that contributed for increasing malaria problems in urban areas mainly included trans-migration of population, rapid urbanization, lack of adequate water disposal system in developing towns and habit of storing water for human use. It also led to spread of malaria from urban areas to the rural area that had already been cleared of malaria in early sixties as a consequence of successful implementation of National Malaria Eradication Programme, mainly because of frequent movement of people to big cities in search of employment who on their return carried malaria infection with them to their native villages resulting in focal outbreaks.

Urban malaria as a specific problem in India was first recognized in 1969 when an in-depth review of malaria situation in India was undertaken by Madhok Committee. This committee reviewed the problem and found that 10 urban areas in Andhra Pradesh and Tamilnadu contributed 11.2 percent of the total malaria cases in the two states during 1963. The committee felt that **if effective anti-larval measures were not undertaken in urban areas, the proliferation of malaria cases from urban to rural areas might spread in a bigger way in many states** and recommended central assistance adequately for tackling the problem.

Thus, the spread and increasing trends of malaria in urban areas necessitated the concerted efforts of malaria control in urban areas with a problem of mainly An. stephensi as a malaria vector The implementation of control measures under erstwhile 'NMEP' showed reducing malaria incidence in rural areas in the country till 1965, but at the same time increasing trend of malaria was observed in some towns/cities as a result of which, Madhok Committee (1969) reviewed the problem and found that 10 urban areas in Andhra Pradesh and Tamil Nadu contributed 11.2% of the total malaria cases in the two states during 1963. The Committee felt that if effective antilarval measures were not undertaken in urban areas, the proliferation of malaria cases from urban to rural areas might spread in a bigger way in many states and recommended central assistance adequately for tackling the programme.

Accordingly the **'Urban Malaria Scheme'** was approved during 1971 as 100% centrally sponsored scheme which from 1979-80 was changed to 50:50 sharing basis between centre and state governments. The UMS scheme was scaled up in phased manner by including 23 towns in 1971-72; 5 in 1972-73; 87 in 1977-78; 38 in 1978-79; 12 in 1979-80 and 17 in 1980-81 making a total towns of 182. Since states have the responsibility of providing human resource and infrastructure, the scheme could be implemented only in 131 towns for which GoI is supplying anti-larvals. The drugs are made available through states. At present Urban Malaria Scheme is protecting about 116 million

population from malaria and other mosquito borne diseases in 131 towns. Since, there is report for other vector borne disease namely dengue, Chikungunya, Lymphatic Filariasis and Japanese encephalitis from the towns under UMS, it has been envisages that Urban Malaria Scheme may be re-named as Urban VBD Scheme during XII Five year plan.

Objectives

The main objective of Urban VBD Scheme (earlier UMS) is to control malaria and other VBDs by reducing the vector population in the urban areas through recurrent anti-larval measures, since indoor residual insecticidal spray in general is not acceptable to the urban population.

The norms for establishment of Urban VBD Scheme (earlier UMS) are as follows:

i) The towns should have a minimum population of 40,000.
ii) The API should be 2 or above.
iii) The towns should promulgate and strictly implement the civic by-laws to prevent/eliminate domestic and peridomestic breeding places.

Control Strategy

The control measures recommended under Urban VBD Scheme (earlier UMS) are as below:

1. **Source reduction**

Environmental methods of controlling mosquito breeding including source reduction by filling ditches, pits, low lying areas, streamlining channelizing, desilting, deweeding, trimming of drains, water disposal and sanitation, emptying water containers once in a week and observing weekly Dry Day etc.

2. **Anti-larval methods**

Chemical

Recurrent anti-larval measures at weekly intervals with approved larvicides to control the vector mosquitoes are recommended. The following larvicides are used in the programme:

Mosquito Larvicidal Oil
Temephos 50% EC
Bacillus thurigensiasis israilensis (Bti) - WP / AS

Diflubenzuron 25% WP
Pyriproxifen 0.5% Granular

The use of Paris Green, Fenthion and Pyrethrum based emulsifiable oil is discontinued in UMS towns due to technical, logistic and financial constraints.

Biological control

Biological control of mosquito breeding through biological agents especially larvivorous fishes and biolarvicides.

3. Aerosol space spray

Space spraying of pyrethrum extract (2%) in 50 houses in and around every malaria positive cases to kill the infective mosquitoes.

4. Early Diagnosis and Complete Treatment :

Anti-parasitic measures through passive agencies like hospitals, dispensaries, clinics and private practitioners to reduce the reservoir of infection, by early case diagnosis and complete treatment.

Organisational Set-up

The Urban VBD Scheme (earlier UMS) has been Centrally sponsored State Programme and being operated mainly by the local Administrative Bodies under the active supervision of State Health Authorities. The Municipal Health Authorities in the towns were undertaking some sort of anti-larval measures before the initiation of Urban VBD Scheme (earlier UMS) and had same staff in this regard. Therefore, the infrastructures provided under Urban VBD Scheme (earlier UMS) by the state was attached to Municipal Authorities for better functioning of anti-larval operation.

The scheme is thus being implemented at the following levels:

1. Town Level – Biologist / Urban VBD Officer is the in-charge of Urban VBD scheme for its proper execution. He has been provided with adequate staff following a well planned staffing pattern. The Biologist should be made the drawing and disbursing officer for his staff.

2. **State Level**- Additional Director (VBDs), Joint Director (VBDs) or Deputy Director (VBDs) is the in-charge of this scheme at state level. He supervises the scheme and offers technical and Administrative guidelines for better execution of the scheme.

3. **Central Level**- Directorate of NVBDCP at central level monitors the urban malaria scheme and provides technical guidance needed for effective implementation of the scheme. It supplies the approved items as per norms directly to the urban malaria towns. The assessment of anti-malaria measures under taken by the scheme is also done by the Directorate of NVBDCP.

4. Occasional Field visits from superior levels are to be made for proper implementation of the scheme.

Staffing Pattern

The staffing pattern under Urban Malaria Scheme / Urban VBD Scheme has been approved on the basis of the areas of a town. The following pattern is being followed:

The anti-larval staff has been provided on the basis of the Municipal area of each town to be covered.

The Municipal area is divided into wards of 25.6 sq.km (10sq mile) each. Each ward is again divided into 2.66 sq.km. (one sq. mile) sector.

1. Staff for ward

Inspector	1
Insect Collector	1

2. Staff for one sector

Superior Field Worker	1
Field Workers	2
Field Workers	1 (for towns with inadequate drainage) 0.5 (for towns with adequate drainage)

3. Driver

One driver and one jeep with trailors can be provided for towns having upto 40 sectors.

Two drivers and two jeeps with trailors can be provided for towns having more than 40 sectors.

4. Biologist / Urban VBD Officer

One Biologist / Urban VBD Officer for a town to direct and supervise the anti-larval operations in the town is also allowed. Generally the staff pattern will be on the above basis. But minor variations and modifications may be made according to the need of the towns.

Surveillance Staff.

Surveillance activities for detection of malaria cases particularly in slum areas, labourer huts, construction sites and in villages within the urban limits are very essential for prompt treatment of malaria cases to ward off transmission of malaria to other areas. But under the approved pattern of staff, no provision of surveillance workers for detection of cases by house visits and technicians for examination of blood slides have been envisaged.

The Review Committee constituted on Urban Malaria Scheme (Now, Urban VBD Scheme) by the Ministry of Health, Govt. of India on 10th August, 1984 recommended the following staff under UMS.

i)	Surveillance Worker	- One per 20,000 people.
ii)	Technician	- One for one lakh people.

In case the blood smear collection by the

Surveillance workers become more than 50 slides per day, than for additional 50 slides or part thereof one more technician should be Provided.

The Expert Committee on Malaria-1995, has also recommended that case detection mechanism should be introduced in urban areas with immediate effect. They also approved one Surveillance Worker for every 20,000 people for active surveillance in slum areas.

Expert Committee further suggested one worker for strengthening passive surveillance/activating passive surveillance to be posted at each dispensary/public hospital with and OPD attendance of 200 cases per day. In the afternoon this OPD malaria worker can be assigned active case detection in the population adjoining the institute where he is posted.

Recommended Pattern for the Supply of Material & Equipments to Towns under Urban VBD Scheme (earlier UMS) :

Supply of different larvicides and the adulticide is made following set norms which are given below:

1. Mosquito Larvicidal Oil (MLO) 0.5 litre per capita.
2. Temephos 0.5 kilo litre per million population
3. Pyrethrum extract 2% One kilo litre per million population

The above norms are for all towns under UMS except the four Metropolitan cities (Bombay, Calcutta, Delhi and Chennai) where only limited quantities of above items are supplied. The norm for supply of logistics by the centre to these cities are as follows:

M.L.O.	700 kilo litres (Only to Delhi)
Temephos	500 litres.
Pyrethrum extract 2%	1400 litres.

Superior kerosene oil required for mixing Pyrethrum extract is to be procured by the States/UT's and Metropolitan cities at the rate of 20 kilo litres per one kilo litre of Pyrethrum Extract.

Pattern of Procurement

As per the present policy, the states are to procure the requisite larvicides /adulticides and other different items as decentralized items :

(However, for North Eastern States 100 per cent assistance is being given since December, 1994. So the centre is procuring most of the items for these states under UMS depending on the availability & requirement of such states).

Drugs

Drugs under Urban VBD Scheme are to be used supplied for NVBDCP programme implementation.

Proportion of Malaria Cases contributed by UMS Towns (1990-96) :

Year	Country	UMS Towns	% of total +ves	% of Pf
1990	2018783	216632	10.72	2.61
1991	2117460	213323	10.07	2.52
1992	2125826	195569	9.20	2.46
1993	2207431	221622	10.04	1.38
1994	2511453	228535	9.09	2.95
1995	2926197	236432	8.07	2.48
1996	2870082	247146	8.61	2.46

Recommendations of Expert Committee 1995

The Expert Committee identified 15 major cities including four Metropolitan cities as high risk areas. Besides these, the Expert Committee identified 14 other towns in the country where malaria situation is serious showing SPR 10% and above during any of the preceding three years. Some of the major cities as well as the metropolitan cities contribute very high number of malaria cases. It has been observed that the City of Madras contributed 45 to 74% of malaria cases in Tamil Nadu during the last ten years.

The high risk areas identified by the Expert Committee include the 29 cities/towns.

The Expert Committee also recommended that any other urban area with a population of 50,000 or more and SPR more than 5% or the ratio of clinical malaria case to fever cases more than one third as per hospital/dispensary statistics during the previous calendar year is to be identified as high risk areas.

Accelerated Action Recommended by the Expert Committee – 1995

The Committee has recommended that cases detection mechanism should be introduced in urban areas with immediate effect. This recommendation has been made in view of the fact that other agencies like hospitals, dispensaries and clinics do not report clinical malaria cases to the Urban Malaria Organisation. They also rarely get their clinical diagnosis confirmed by microscopy therefore, there is under-reporting of malaria cases from urban areas. Further a large number of towns in the country are not included in Urban Malaria Scheme. About these towns there is hardly any information.

CHAPTER – 2

STAFFING PATTERN AND DUTIES

Duties of different categories of staff provided under UMS

1. Biologist / Urban VBD Officer

Control Operation: He is complete in-charge of all the control operations and the appraisal of results of the area assigned to him. It is his first duty to acquaint himself with all the aspects of the work assigned to him. He should quickly familiarise himself with the area and by means of available data determine the epidemiology of malaria in his area. He should study the breeding habits of the mosquitoes, the known vectors with particular reference to *An.stephensi* and also keep in view of the breeding sources of *An.culicifacies*. He should have all the breeding sources both temporary and permanent charted and numbered. During rainy season, low lying areas get water logged and serve as prolific breeding places for both *An.stephensi* and *An.culicificies* hence these areas require particular attention during and after the rainy season.

He should ensure the proper implementation of programmes as approved by State Malariologist or State Programme Officer.

He will thoroughly familiarise himself with the technical details of day-to-day work. He should be familiar with the standing orders of the State Government regulating the service conditions of the State Government employees, their recruitment and account etc.

For the purpose of carrying out anti-larval operations, the town area will be divided into wards and sections. An areas of 2.54 sq.km. (one sq. mile) will constitute a sector and the area of 24.5 sq.km. (10 sq. miles) i.e. 10 sectors will comprise one ward. For a sector, one Superior Field Worker and 3 Field Workers are provided (2.5 field worker for areas with adequate drainage). For supervision of the work in the ward (10 sectors), one Inspector is provided. For cross-check, one Insect Collector per ward is provided.

The physical boundaries of each sector and the ward will be determined by the Biologist taking into account the local conditions in regard to the concentration of houses, accessibility by road, type of local terrain, the types of the breeding sources of mosquitoes in general and the vectors in particular.

It will be the endeavour of the Biologist / Urban VBD Officer to know all his men personally and inspire sufficient confidence in them as a leader to facilitate team work.

The Biologist / Urban VBD Officer will periodically scrutinise of daily record of work, diaries of inspectors and Surveillance Field Workers (SFWs).

Biologist / Urban VBD Officer will draw up a schedule of daily, weekly and monthly returns to be submitted by the subordinate staff and he should impress upon each subordinate that the returns and permanent records should be very carefully prepared and submitted on the dates after careful scrutiny.

The Biologist / Urban VBD Officer will make concurrent and consecutive supervision of the anti-larval operations as routine and also pay surprise visits periodically. He will spend at least 4 hours in the morning in the field. He will visit problem areas particularly and check the breeding place visited by his staff and satisfy himself that these have been properly treated. In the laboratory, he should identify all the anopheline larvae collected by the staff.

Focal space spray with Pyrethrum Extract and kerosene oil mixture will be carried out in and around 50 houses, where malaria positive case is detected.

He will establish Gambusia and Guppy hatcheries in the town and will ensure their proper maintenance. The fish from the hatcheries will be used for stocking wells, ponds, ornamental tanks etc. for biological control of mosquito larvae.

He will carry out W.H.O susceptibility tests against the vector species before and after the transmission season i.e. March-April and October-November every year. The results obtained will be forwarded to the State Malariologist or State Programme Officer and Directorate of NMEP (3 copies) in the W.H.O proformae soon after the studies are completed.

He will keep a close liaison with Municipal Health Officer of his area.

Administration

The headquarters of the Biologist / Urban VBD Officer will be fixed in the towns where he is to supervise the operations.

In each place, arrangements will have to be made for suitable office accommodation for the staff and the stores. The accommodation available with the local body and by the State if the programme is to be implemented by the local body and by the State if the programme is to be implemented by them. For hiring of the accommodation wherever it becomes necessary, the agreement for leasing the building will have to be approved by competent authority. The recognised procedure for hiring private building where government/local body accommodation is not available, should be followed. It is essential to make arrangements for proper storage of

larvicides/adulticide to be supplied to each town. Such storage accommodation should be ensured that the stocks are adequately protected from sun, rain, fire, pilferage and thefts. Wherever necessary, sub-depots will be established in each ward and stocked with larvicides in sufficient quantity to be used every week. These sub-depots may be in the accommodation that may be provided by local bodies in the zonal/ward's officers. The building for the office of the Biologist should have garage to house the jeep and trailer provided.

Recruitment of Staff

All recruitment of subordinate personnel is to be governed by approved procedure, modified, if possible, to suit the emergent nature of the programme, in each State/town. Some general indications are furnished in regard to the qualifications for each class of personnel.

Biologist / Urban VBD Officer should be a post graduate in Zoology with background of entomology. He should go under the training of Malaria Entomology or Malariology.

Inspectors should have undergone a course of training in Malariology either at the State Malaria Organisation, Regional Coordinating Organisation, Regional Office for Health & Family Welfare or at the National Institute of Communicable Diseases, where special facilities are provided.

Qualified Sanitary Inspectors having experience of Malaria/Filaria work should possess adequate educational qualifications, preferably those who have passed High School Examination. They should be able to record the day to day activities and compile and submit the returns required of them.

The service conditions, under which the different categories of men are recruited, should be made known to them.

Office Staff

In the Urban VBD Scheme, no provision exists under central assistance for the appointment of clerical staff. It is expected that such clerical establishment that may be needed for maintenance of records, attending to correspondence, accounts, stocks, preparation and submission of returns on due dates, will be provided by the State/local body.

An Accountant or UDC-cum Computer may be in over-all charge of office and accounts. The Store keeper will be responsible for the stocks and for correspondence. Although clerical assistance will be provided, Biologist will be responsible for all money transactions of the stores and the correspondence. He should, therefore, acquaint himself with the duties of each subordinate in the office and check the work of each as often as possible.

The programme of work of the field staff, viz. Inspector, Superior Field Workers, Insects Collectors and Field Workers should be readily available in the office.

All the stores supplied should be kept under safe custody.

Furniture and Stationery

It is usual to have a standard list of furniture for each office depending on its size. Arrangements should be made for the supply of the furniture required though the usual channels. The Biologist/ Urban VBD Officer should follow the rules of State Government for procurement of furnitures.

Necessary office equipment other than furniture like typewriter should be obtained through the State/local body.

All furniture supplied should be numbered and a classified list of such furniture should be entered in stock register separately kept for the purpose.

Stationery requirement of each office are usually fixed by a specific Government Order and supplied through a central stationery depot. The Biologist/ Urban VBD Officer should arrange to get his requirement through the head of the department when the office is freshly started and thereafter directly from the Central Stationery Office. Rules concerning purchase of extra stationery in each State should be followed. It should always be possible to get any additional requirement by special sanction.

Stores

It is very important to keep up-to-date accounts of all receipts and issue of stores. The Biologist/ Urban VBD Officer is responsible for all supplies made to him.

The established procedure for maintaining stock and issue registers will have to be followed. The pages of the stock register will all be numbered and certified on the first page and no page should be torn off.

All stores received should be personally checked by the Biologist/ Urban VBD Officer when in Headquarters, and if received during his absence the next senior officer who receivers the stores should be instructed to immediately bring the same to his notice on his return.

All stores received directly from the suppliers, form other units, or any other source in the first instance may be entered in red ink. The following details may also be noted in appropriate columns:

- Quantity received
- Values including sales tax, freight etc.
- Date of invoice from the firm or reference if supplies by other office, the source of any particular supply along with any other details required.

The stores should be physically checked at frequent intervals but physical verification should be done as per State Government rules and a certificate submitted to the next higher authority on the dates prescribed.

The Biologist/ Urban VBD Officer should follow the rules of State Government to write off, sell or auction or otherwise dispose off any articles from the stores.

In case of loss or damage or theft, the responsibility should be determined in each case and cost of properly lost should be recovered and credited to the treasury under the appropriate head. Where it can be proved that the loss or damage was not duo to negligence of those concerned, a recommendation for writing off the articles may be made.

Cases of short-receipts/damage during transit should be brought to the notice of concerned authorities immediately and steps for recovery of loss or damage promptly taken.

Worn out or unserviceable articles may be listed and after obtaining permission, sold by public auction. There is usually a prescribed procedure for disposition of such articles by auction and such procedures in force disposition of such articles by auction and such procedures in force in each state should be followed.

2. Malaria Inspector

The Malaria Inspector must know the technical details of mosquito control in general so that when he discovers a breeding place, he should know at once what measures are to be taken in dealing with it, whether to drain, oil or stock with fish. He should be able to identify the mosquitoes. If he does not understand the work what he is doing, the will increase the cost and reduce the efficiency of the campaign.

He will be responsible for the proper output of work of the staff working under him.

He will ensure that the equipment in his charge is in proper working condition and the necessary requirement of larvicides are proper and perfectly stored.

He will ensure proper dosage of oil or other larvicides is applied and no wastage or dishonesty in the use of the larvicides occur.

He will record the daily consumption of the larvicides received from the Superior Field Workers working under him.

He should spot out the undetected breeding places and inform without delay the Biologist/Anti-Malaria Officer as well as the Superior Field Workers working under him for including and numbering the same and getting these treated.

He will undertake daily concurrent and consecutive checking as per programme and report to the Biologist/ Urban VBD Officer the defects and deficiencies.

He will ensure that the Superior Field Workers and Field Workers do a full day's work and all breeding places are thoroughly treated. The Biologist/Urban VBD Officer will periodically scrutinize the daily record of work, diaries of Inspectors and Superior Field Workers. Pocket note-books will be maintained. The note books should be available for inspection in the field by the Inspecting Officers.

He will be held responsible if any breeding is found in his area.

He will get the map of the area prepared. The map will show sections and the daily work to be done. He will get minor leveling and filling work done in his area by the men provided in his area. He should ensure that the drains are clear of silt and vegetation so that larviciding is effective. It will be necessary to see that the cleaning of the drains and oiling proceed side by side. Unless this is done, larviciding will not be effective. He should take attendance in field both in the morning and in the evening. He should ensure that the equipment and stores are issued in the morning and the same are received back after proper cleaning in the evening.

He will fix up the responsibility for the loss of any equipment etc. and their parts, and will report to the Biologist/ Urban VBD Officer for recovery. He should find out the cause of such a loss and report in writing for realization or for writing off.

3. Insect Collector

One Insect Collector is provided for each ward (25.4 sq.km area). He is part of the Cross-check Organization and eyes and ears of the Biologist/ Urban VBD Officer. He should work directly under the directions of the Biologists.

Insect Collector is the key person for the collection of important data which help in the assessment of the anti-larval operations in a town.

He will thoroughly familiarize himself with the techniques of collection of mosquitoes, adults and larvae. He should be trained in entomological techniques.

He will obtain the necessary equipment which includes the following and should always carry with him while him while on work.

- A canvass hand bag.
- One mosquito suction tube.
- Two dozen test tubes.
- 100 gram Cotton wool.
- 2 pieces of cotton lint or flannel for covering the test tubes.
- One pocket watch.
- One flash light complete with cells.
- One mosquito forceps.
- One hand lens.
- Specimen tubes for collecting larvae.
- One dipper for collecting larvae.
- One larval collecting net.
- One well net.
- One enamel tray (photographic dish).
- One wide mouth pipette.
- 1 Bottle (500 ml.) chloroform.
- 1 viral formalin (10%).
- 1 pocket note-book.
-

All collection work of adults and larvae should be done between 6.00 A.M. and 12 noon. Identification, preservation of material and recording of data should be done in the afternoon. The area is to be divided into 12 sub-areas and two fixed catching stations established in each sub-area. Four catching stations are to be visited each day by him. He should have a set programme of work.

He should reach his place of work by 6.00 A.M. and start collection systematically. He should collect mosquitoes from the four fixed catching stations and then make random collection around the fixed catching stations, thereafter he should carry out search for mosquito breeding places.

The schedule of work of collection for one day will be 15 minutes in Fixed Catching Station-I; 15 minutes in random collection in houses around Station I, spending not less than 5 minutes in each areas.

In each checking station he will notify his arrival to the house owner and arrange to have a male member of the family with him during the period he stays there in the house.

Before starting the work in each station, he will start from one end and search every likely resting place of mosquitoes, dark corners, niches, cup-boards, under surface of

furnitures, the ceiling, hanging articles etc. he will collect about 4 to 5 mosquitoes in the suction tube and then transfer them into a test tube. He will not down the number of cattle sheds (CS), types of collection (fixed or random) the date on a slip of paper and insert the same in the test tube. The test tubes containing the mosquitoes should be wrapped in wet cotton lint or flannel to keep them cool.

Careful search for mosquito larvae will be made and all types of water collections, wells, peri-domestic breeding places and overhead tanks. He should see that the water collections have not been disturbed for at least five minutes before he takes samples every time. At least 5 dips with the dippers will be made. In case mosquito larvae and pupae are found, these will be collected in the specimen tubes or plastic containers. A slip of paper with number of such area, type of collection and date will be inserted in the tube.

The material collected on the same day should be identified on the same day. However, pupae may be kept to hatch and the adults be identified.

During the larval collections, a through geographical reconnaissance of the mosquitogenic potential of the area should be undertaken. The new breeding places spotted out will be notified to the Inspector and to the Biologist for recording and necessary action.

The action taken by the Inspector will immediately be reported to the Biologist / Urban VBD Officer.

The verification of the action will be direct responsibility of the Biologist/ Urban VBD Officer. The reasons for such lapses, in spite of active anti-larval measures will be investigated and the remedial action taken to prevent such recurrence will be recorded.

4. Driver

The Driver on taking charge of the jeep and trailer will take an inventory of all tools given to him.

He shall maintain the jeep and the trailer in a proper condition and see that the vehicles, tyres, the stepney and the trailer tyres are properly inflated in the morning and mobil oil and water are full.

He will get the jeep and trailor serviced at required time.

He should be able to rectify minor defects of the vehicles.

He will report for duty half an hour earlier than the schedule time of work. During this time he should check his vehicle every day.

The vehicle should not be driven rashly. The driver should take particular care in driving when the trailer is fixed to the jeep.

He should maintain a log look indicating places visited, name of the user, purpose, time, distance travelled, petrol/mobil oil received and get it duly signed by the officer using the vehicle.

5. Superior Field Worker

Success of the work will depend very largely on the ability and personal interest taken in the work by the Superior Field Worker of the larviciding squad. In his area, no mosquito larvae should reach the pupal state. He must go to all the areas within his jurisdiction at frequent intervals and verify that the work is being satisfactorily performed and that none of the places are missed.

Each Superior Field Worker will be in-charge of a section which is approximately 2.54 sq.km. (1 sq.mile) area and have 3 Field Workers (2.5 Workers in Town with adequate drainage e.g. Chandigarh), to work under him.

He should be thoroughly acquainted with sections allotted to him and the nature and purpose of work entrusted to him. He should remember that he is a very important link in the whole organization and success of anti-larval operations will largely depend on his efficiency and integrity.

He should carry a copy of the map of his section showing all the permanent and temporary breeding places and the limits of each day's work in the week. He should also keep an account of the larvicides used and given the same to the Inspector in-charge of the ward.

He will be personally responsible for the equipment supplied to him and will have to take proper care of it.

As far as possible, he will distribute the work of the Field-Workers in such a way that the responsibility of each one of them can be pinned and at the same time he should be able to see each one of them during the day from time to time, while on work, for example, he may divide his section into six sub-sections to be taken up on each day in a week. Each sub-sections may again be divided into two or three areas which would be the responsibility of the individual Field Workers/Beldars. At the end of the day's work, the equipment and stores will be carefully checked and returned to the Inspector. In case of any minor damage these will be repaired and kept ready for day's work. Arrangements should be made for the replacement of the loss. He should have sufficient spare parts and reserve equipment to carry out the work without interruption.

He will maintain a daily diary of the record of work done and present it to the visiting supervising officer.

He will punctually submit his daily/weekly/monthly reports to the Inspector in-charge.

6. Field Workers/beldars

The field workers will help the Superior Field Worker in collecting the material and equipment required for the day's work.

They will check that the equipment is in working condition and is not leaking.

They will treat the mosquito breeding places assigned to them with larvicides very thoroughly.

They will not allow any mosquito breeding upto advance stage i.e. pupal stage.

They will keep the drains and water collection free of vegetation.

They will obey the instructions of Superior Field Worker/Jamadars for all sorts of duties connected with anti-larval measures assigned to them.

CHAPTER – 3

ANTI-LARVAL OPERATIONS

Anti-larval operations are defined as measures used against the larvae of mosquito vector to restrict or eliminate their breeding.

Prior to the discovery of synthetic insecticides, the anti-larval operations were being undertaken for mosquito abatement as well as control of mosquito borne diseases. Notable achievements recorded in the history of anti-larval operations before 1950 have been the successful eradication of *An.gambiae* form Barzil and Upper Egypt and that of *An.sergenti* from the areas of Dakhla and Kharji (Upper-Egypt). There is no reason why, if the measures advocated hereafter are earnestly implemented, there should not bring in rich dividends, not only in terms of malaria control but also in control of other mosquito borne diseases and the mosquito nuisance.

Anti-larval measures can broadly be divided into:

1. Source Reduction.
2. Biological.
3. Chemical.

1. Source Reduction

The anti-larval operations which result in reduction or permanent elimination of mosquito breeding places are termed as source reduction methods. These measures may initially cost more, but need little or no maintenance, or repeated attention and therefore are economical in the long run. Some of the measures undertaking should not only solve the problem of malaria and other mosquito borne diseases in that area but also results in socio-economic and financial benefits to the citizens wherever these measures are undertaken. The lands reclaimed by clearing marshes can be utilized for agricultural and residential purposes. This will give a boost to the real estate prices and it proper publicity is given, it can become very popular with the counselor and the citizens.

Science and technology are shaping civilisation and altering living standard in all parts of the wolrd. There is consciousness among the citizens of today for taking measures for prevention of possible environmental health hazards in the areas being developed and wherever these are inevitable, people are ready to take steps for minimising or eliminating such source of health hazards. It is felt that in the planning or extension of the towns, particularly in malaria endemic regions, adequate consideration should be given to the effect of such projects on the incidence of the disease and measures should be incorporated in the plans that would avoid the formation of breeding sources

of mosquitoes and thus reduce the danger of spread of malaria transmission and other vector borne disease.

Source Reduction Methods can be divided into:

A. Elimination or reduction of breeding sites and it largely depends upon engineering methods.
B. Environmental manipulation

A. Elimination or reduction of breeding sites.

Following methods are used taking into consideration the types of the site and the resource available:-

Filling: Filling can be on a minor scale as in the case of elimination of borrow pits, ditches, small unused irrigation canals, abandoned well etc. in these no engineering skill is required and as such can be undertaken by the Field Worker engaged in routine activities for their filling up.

On a medium scale, river silt can be frequently used for filling. Old quarries and brick pits can be silted up very cheaply by diversion of small streams. Rivers or stream can be guided or braked by means of bamboo sticks or other obstructions so that they will deposit silt and automatically do the filling job. Very large areas can be filled by means of hydraulic process. Specially designed centrifugal pumps and dredger are used, which suck up silt from the bottom of the water way at high velocity through a pipeline and discharge it on to the area to be filled. The work is expensive and requires engineering skill.

The garbage from a city may sometimes be dumped to advantage into a place that needs filling. But it has the objectionable features of odour, and fly breeding nuisance, which have lead many to abandon this method of waste disposal. The current recommended practice is to cover the refuse daily with 60 cm. (2 ft.) of soil cover. It must mentioned that valuable compost can be made from garbage, refuse and night soil and it might be more economical to take earth as filler.

Drainage

Drainage is used in eliminating breeding sites by draining away the water collection or reducing vector breeding by channeling water to a few places which can be easily controlled. Construction of surface ditches, sub-soil drains, vertical drains, pumps and tide gates are some of the methods used in drainage. Type of ditch or drain, best suited for a particular situation will depend upon topography, source of water and soil properties. Further the availability of funds for the works will be an important factors. Drainage can be of the following types:

a. Drains

i. **Surface ditches:** Ditching is the most widely used method of drainage in source reduction programmes. The cost of construction is modest and benefits are considerable. Proper choice of side slopes and grades can reduce maintenance. However, regular maintenance is necessary to ensure adequate flow capacity. This also includes channel improvements, so that mosquito breeding pockets will not be created.

ii. Sub-soil drains: Well designed sub-soil drainage requires minimum maintenance and can function satisfactorily for many years. For large installation concrete pipes should be used whereas for smaller installations, concrete or clay pipes may be used. This method has the advantage of converting water logged area into suitable land for farming or other purposes.

iii. **Vertical drains**: Vertical drainage is economical and effective when water is held on the surface by an impervious stratum which is known to overlie on a pervious stratum. This drainage is simply boring a hole through the impervious layer so that water will drop to pervious layer and be taken off. When installing vertical drainage, local sanitary authorities must be consulted, regarding the danger of contaminating sub-surface water supplying wells.

b. Drainage in irrigation schemes

Source reduction measures required in irrigated areas are water management. This may be diversion of water, effective distribution system, drainage of access water or regulation in such a way that a dry day is kept once every week during irrigation. Such control of water has to be from the head gates to the field turn out.

c. Coastal Drainage

Drainage of coastal swamps and lagoons require care in design and construction of sea outlets.

d. Drainage by tide gates

The gates are used for drainage of salt marches along the sea. The gates are opened at low tide to allow water to flow out and closed at high tide to prevent sea water from flowing in. the construction of the gates is a specialized job and should include construction of ditches and dykes to control tidal water.

e. Drainage by pumps

When water accumulates in low lying areas and cannot be drained, it may be pumped out by installation of temporary diesel or electric pumps. It is important that in all water development project in the town under Urban Malaria Scheme, measures should be undertaken to reduce or prevent the creation of mosquito breeding sites and for this the Biologist/Anti-Malaria Officers should be associated at the planning and execution level.

B. Environmental Manipulation

The measures by which changes are effected in the natural conditions under which mosquitoes exit and making them unsuitable for mosquitoes to thrive either in larval or adult stages. Some of the examples are changing the salt contents of water, pollution of water, flooding, drying of irrigated land etc.

2. Biological Control

I. Larvivorous Fishes:

Only larvivorous fishes have been extensively used for control of mosquito breeding. Other biological control measures including the use of predatory insects, other arthropods and pathogens such as bacteria, fungi, protozoa and viruses have not, as yet , reached an operational stage for use against mosquito breeding under the programme. In recent years bio-larvicides (Bacteria are being used for large scale trials). Various fishes have been reported to be predating on mosquito larvae. But for efficient control the larvivorous fish should have the following characteristics:-

i) Must be small, surface feeder, able to live in waters and useless as food.
ii) Able to survive in the absence of mosquito larvae and able to escape their natural enemies.
iii) Easy to rear and able to breed in small water collections.
iv) Should be able to withstand a wide range of temperature and light intensity.
v) Should withstand handling and transportation.

Indian Larvivorous Fishes

The following fishes are known for their larvivorous activity

Centops nobiles	Eastern India
Macropodus cupaus	Malabar & Coromandal, Bombay, Kerala
Ophicephalus punctus	Delhi
Nuria danrica	Delhi
Barbus phutired	Delhi, W. Bengal
*Panchax pan*chax	Madras, Bombay, Calcutta

Therapon	Brackish water habitats
Polycanthus	Brackish water habitats

Anabas testidinius	Bombay, Calcutta.
Badies badis	Calcutta
Lebias dispar	Sindh. Kachchh
Ambassis nama	W. Bengal
Colisa fasiata	W. Bengal
Notopterus notopterus	W. Bengal
Rosbora daniconisus	W. Bengal
Laubucca atpar	W. Bengal
Ambasis ranga	Uttar Pradesh, Delhi, Western India, Pakistan

Some of the other Indian fishes which prey upon mosquito larvae are:-

Chela laubucca, Chela untrahi, Chela argentea, Salmostoma dacaila Salmostoma phulo, Barilius bendelisis, Danio aeqauippinatus, Danio (Branchidanio) rerio, Esomus danricus, Amdlypharyngodon mola, Aspidoparia morar, Crossocheilus latius, Pantius phuntino, Puntius sophore (Syn P.stigma), Puntius ticto, Carassius autatus, Orgzias melastigma, Aplocheilus panchaz, Aplocheilus lineolatus, Horaichtnys setnai, Chanda nama, Chanda ranga, Etrophus suratensis, Etroplus maculates and Tilapia mossambica.

Among all larvivorous fishes studied so far only *Gambusia affinis* and *Poecilia reticulata* (the Guppy) are found most valuable in the programme. Gambusia is more efficient species. Centralized stock of the fish can be easily established and maintained on negligible cost. In warm polluted or very small water accumulations where Gambusia may not be able to thrive *Poecilia reticulata* may be introduced. This is effective both against anopheline and culicine larvae.

Gambusia affinis

Habitat

It is a very hardly fish and can survive in all types of water bodies but does not tolerate very high organic pollution. The optimum temperature is 24° C to 34° C but can survive even at freezing temperatures. The most suitable pH of water is between 6.5 and 9.9.

Size and Longevity

The maximum size attained by a male is 4.5 cm and by a male is 4.5 cm and by a female is 5.2 cm to 6.8 cm. its life span is approximately 4±1 years.

Breeding Habit

The female matures in about 3 to 6 months and by this time it attains a size of about 3 cm. Each ovary contains approximately 120 eggs. Young ones are released in a brood of 25-30 at a time. The young females have two gestations per seasons. The older group may have one to six generations per season.

A full grown fish may produce up to 300 off springs. It is estimated that a single female produces between 900 and 1200 off springs during life span.

Breeding Season

Reported to breed throughout the year at monthly interval after maturity, specially in tropical countries. However, the season and the frequency of breeding differs from one climatic zone to another. In temperate climate it lasts from May to September and in warmer climate form April to November.

Larvivorous Efficiency

i) It is highly efficient larvivorous fish.
ii) A single full grown fish eats about 100 to 300 mosquito larvae per day.
iii) It is a surface feeder.
iv) It negotiates to the margins of the water container, pond or other ground water collections. But if there is dense vegetation at the margins of the water body it becomes difficult for the fish to negotiate and eat larvae.

Advantages

i) It is small and inedible
ii) It is hardy fish and tolerated salinity
iii) It can withstand transportation and does not require specialized equipment or container.
iv) It survives in new places (water bodies) and multiplies easily. After release when it becomes well established in a water body, the fish can survive in good numbers for years and does not require constant care.

Disadvantages

i) Highly carnivorous, eats the eggs of almost all fishes in the water body.
ii) Eats away young ones of any fish which are very small. However it does not kill the fingerlings of edible fishes if they are big enough and thus is can coexist with them.

iii) In case of scarcity of food they prey on their young ones and thus the fish population is self limiting.
iv) The fish is preyed upon by big carnivorous fishes and does not get established in ponds where these predators are present.
v) It may fail to give results if the habitat is i. cold, ii. Too heavily infested with plants, iii. Too extensive or iv. Too temporary to allow the fishes to achieve sufficient densities required for effective control.

Poecilia reticulata (GUPPY)

(Formerly Lebistes reticulata)

This is an exotic fish introduced in 1910. It is now widely distributed in India and is considered to be one of the important larvivorous fishes for use in field operations as a biological control agent.

Habitat

It is a very hardy fish and survives in all types of water bodies. It tolerates high degree of eater pollution with organic matter than Gambusia. The optimum temperature range is form 24˚ C to 34˚ C. it can survive in water with pH ranging from 6.5 to 9.0.

Size and Longevity

The male when matures is 1.8 cm. ling and female is 2.5 cm. long. The fish is generally slightly smaller than *Gambusia affinis*. The Guppy lives for 4±1 years.

Breeding Habitat

The male when matures is 1.8 cm. long and female is 2.5 cm. long. The fish takes about 90 days to mature. Each ovary has 100 to 160 eggs. The female gives birth to young ones in brood of 5 to 7 at a time. About 50 to 200 young ones are released by the female every four weeks.

Breeding Season

Reported to breed throughout the year at about weeks interval after maturity. However breeding season will depend on climatic conditions. In tropics it may be from April to November.

Larvivorous Efficiency

i) A single fish eats about 80 to 100 mosquito larvae in 24 hours. Therefore it is comparatively less efficient than *Gambusia affinis*.
ii) It is a surface feeder.
iii) Negotiates margins of ponds more easily.
iv) It is highly carnivorous and parents or older brood may eat up their own young ones. Therefore, a fair amount of weeds are required in the water so that young ones can hide and survive.

Advantages

i) It is a hardy fish, tolerates handling and transportation very well.
ii) Does not require specialized equipment for transportation.
iii) Survives and reproduces when introduced into new water bodies. Once well established, it can be found in the habitat even after many years.

Disadvantages

i) Highly carnivorous, eats even its own young ones.
ii) It is preyed upon by big carnivorous fishes although it can coexist with herbivorous fishes.

Establishment and Maintaining Fish Hatcheries

Natural water collection can also be used as hatcheries after these are cleared of big fishes that may be existing there. In cases such water bodies are not available, it is advisable to establish an artificial hatchery as described below:

It is suggested that an artificial concrete pond generally 10 to 12 meter long and 3 to 5 meters wide should be prepared. The depth of the pond should be prepared. The depth of the pond should be from t to 1.5 meters to permit the fish to seek protection from heat and cold. There should be arrangements for constant aeration of water. This can be done by installing a low capacity fountain which only slightly disturbs the surface of water. Fountain should cover only a small area of the tank. There should be growth of natural aquatic vegetation.

Natural water collection can also be used as hatcheries after these are cleared of big fishes that be exiting there.

Following points may be kept in view, while establishing the hatcheries for the rapid reproduction of the fish.

Salinity of water is important. It should not exceed 20 grams per liter. These fishes may survive salinity up to 52 gms. per litre. But it cannot reproduce at this salinity.

Hatchery should not be subjected to strong water current and should be protected from heavy rains and floods.

Fish should be artificially fed, if there are not enough larvae or other natural foods. Blood clots and powdered meat are used for feeding the fish in hatcheries. Waste flour (Atta) accumulating in flour mills obtainable at very cheap rates is an excellent food for Gambusia.

Chlorination of water beyond the tolerance margin of presence of insecticides will prove lethal to fish.

Dissemination and Transportation

Within towns or state, fishes can be transported in polythene bags, parts of which are filled with water prior to sealing. Simple containers of different sizes with water chilled by adding ice can be used for transportation over long distance.

Use of Fish

Fishes should be used in ornamental water, pools, tanks, ponds, wells, rice fields, or in open mosquito breeding sites. In deep wells or saline wells, fish should be introduced frequently. In open mosquito breeding sites or rice fields, they need to be protected from pesticides applied to crops. When used in rice fields, at the time of draining of the fields the water is allowed to pass through pits where the fish is trapped and conserved. The fish is again released when fields are inundated. The fish can be introduced at the rate of 10 per linear meter of water area. If the larval density is high, more fishes up to 20 can be released.

Limitations In the use of Fish for Mosquito Control

Under the programme, the fish which is used widely is Gambusia hence the limitations in use of this fish has been discussed. Following factors may reduce the efficiency of the Gambusia fish.

i) Gambusia does not reproduce in shallow wells where water is regularly drawn.
ii) It cannot live long enough to reproduce where there is insufficient light and oxygen.
iii) Rain and flood may wash away Gambusia.

Although experience has shown that the decrease in anopheline breeding is striking wherever fish is used, yet it must be pointed out that the use of fish cannot be recommended as the sole anti-larval method. The areas where Gambusia has been introduced should be checked periodically about the mortality, and as and when necessary these should be restocked. Any complacency that might come as a

result of Gambusia introduction, might upset the whole programme of mosquito control.

II. Use of Bio-Larvicides

Bacillus thuringiensis and B. sphaericus have been introduced in selected areas of some UMS towns on a pilot scale. These bio-larvicides are more bio-environmental friendly than chemical larvicides. The efficacy of formulations of these biolarvicides sometimes differ from formulations to formulation and even in the same formulation from batch to batch. Although proposed to propagate in the water body, frequent application are still required to maintain adequate anti-larval action. These are available in powder form and recommend dosages are:

C. sphaericus : Make suspension of 5% by mixing 500 grams in 10 litres of water. This ready to use suspension can be sprayed @ 20ml. per square meter in wells and @ 1 mitre per 50 linear or 200 litres per hectar in the drains, pools or river beds. The frequency of the application is three weekly.

B. theuringiensis : the ready to use suspension of 2.5 % is prepared by mixing 250 gram in 10 litres of water and used at similar dosage to that of B. sphaericus. This can be applied at the interval of 2 weeks.

These bio-larvicides are not recommended for use in potable water collection.

3. Chemical Control

The larviciding programme involves the following:

i) Mapping and classification of all actual and potential breeding places, temporary and permanent.
ii) Numbering of the breeding places and preparation of maps.
iii) Determining the larvicide, the formulation and the equipment to be used for the breeding places.
iv) Fixing the dosage and frequency of the application.
v) Fixing the concurrent and consecutive supervision pattern and cross check.
vi) Collection of the entomological data regarding the susceptibility levels to the larvicides and data collection in connection with the cross check work.
vii)

The chemincal anti-larval measures in wide use under urban malaria scheme includes both old and newer larvicides. Oil and Paris-green were the standard compounds. Aviation Gasoline Lead Free had also been used. Paris green is presently not under use and among oil Mosquito Larvicidal Oil (MLO) is widely of the organo-phosphorus group are being used at present. The details about the chemicals currently being used under programme are described.

Mosquito Larvicidal Oil (MLO)

This oil was and continues to remain the classic larvicide. The oil not only suffocates but also poisons the mosquito larvae. Its action on larvae has been described as:

a) Causing suffocation by producing a surface film which cuts off their supply of air.
b) Blocking of respiratory tubes by particles of oil.
c) Being soluble in water, toxic action of oil vapour has direct effect.
d) Reduction of surface tension, making it difficult for the larvae to remain at the surface and thus causing them to be drowned.

The oiled breeding sources tend to deter the adults from depositing their eggs. Oil kills algae so that food supply of larvae is reduced. Supervision of treatment of breeding places when oil is used, is easy by indications left on the grass and algae burnt by oil and oily marks on the stone and edges of the pools.

Specifications of the oil

The specification of the Mosquito Larvicidal Oil as laid down by the Indian Standard Institute in IS : 588- 1963 may strictly be followed.

Pre- requisite for obtaining maximum results

M.L.O does not easily penetrate a barrier of grass hence to make it thoroughly effective, all vegetation and debris must be removed. It is essential to prepare the surface before application of oil. It should be ensured that the film covers the entire surface of the water collection and that the water remains undisturbed for at least 30 minutes although the stability of film according to specification is two hours.

Dosages of application

Usual does of application is 69-100 litre per 4,404 square meter (15-20 gallons per acre) of water surface or 175 to 225 litres per hectare or 1 litr per 50 linear metres of the edge of a stream or drain. Application of oil is repeated ar weekly intervals.

Methods of application

1. Application by knapsack sprayers

Under the scheme knapsack sprayers are used for MLO. The sprayers is worked with one hand while the other holds the lance with nozzle. The nozzle delivers the cone spray of about 18 inches (0.45m) in diameter four feet in front of it. Oil used in the sprayer should be filtered into the sprayer through a sieve and after each day's

work, it should be washed out by pouring a litre or so of kerosene oil into the container and blowing it through the nozzle.

2. Mop and bucket method

A long stick with a bundle of a piece of sack tied at one end may be used to distribute oil over small pools. Ordinary sweepers broom dip into oil may be brushed around the edges of the standing pools on grass. But this is a crude method and should be strictly avoided in UMS towns.

4. Use of oil with saw dust among vegetation

Oil may be mixed with saw dust and thrown in the manner of sowing grains. This method has been advocated for use among vegetation. The mixture is prepared by mixing 200 litres of oil with 2.5 to 3 time by its volume of saw dust. This is sufficient for one hectare of area. Care is taken to allow the mixture to stand for 24 hours before use.

5. Use of oil on running water from small rocks streams

Swabs made of cotton waste soaked in crude oil and wrung out before use, are weighted down with a brick or stone or pegged into the ground. After about a week the swabs may be soaked and used again. These are useful for dealing with small rock springs, and by there use, running water is more economically oiled than by a machine.

4. Automatic oiling b use of drip cans

Drip can is used in either of the following ways:

(a) A nail be knocked through the bottom of the receptacle, and a piece of wool is wrapped around the head of the nail. By pulling the latter the flow may be regulated or
(b) A tap may be fitted to the receptacle or
(c) A thick lamp wick may be stuffed into a hole near the bottom of the receptacle.

For a water surface 30 cm. wide, 10-20 drops of oil per minute are to be used.
Ordinary tin container filled with oil weighed with a few stones and with a small hole in top and bottom has been found effective in slow running water:

Disadvantages of drip cans

Constant attention is necessary for efficient service as these may get clogged, be washed away by floods or be stolen. Also is placed in the center of a stream or drain, the oil is apt to be carried down in the middle of it, as a result margins are not properly treated.

5. Oil booms

Oil booms are used for destruction of mosquito larvae in moving water and for check or larval drift (larvae being carried down from the stream). Booms are placed on alternative sites at varying intervals. Types of booms employed depends on the depth of the channel, the velocity of the current and the amount of water present at different times.

A. Oil booms for small drains and irrigation channel

Booms made of split bamboo are placed across the whole width of the channel and fixed to vertical stakes, the lower edge of the boom being several inches above the bed. Chaff soaked in oil is thrown on the surface of the water immediately above the boom, so that the larvae trapped by the matter are destroyed by the oil exuding from the chaff.

B. Boom for canal 1.5 meter or more wide and fluctuating depth

Boom consists of three section each made of split bamboo in the form of a chick which can be rolled up when required. When water is low only the central section is used, whilst when the canal is full, all the three sections are brought into use being rolled up from the bottom to the desired height. Boom supported by wooden stakes driven into the bed of the canal and bhoosa(chaff) soaked into oil is thrown on to the water above boom.

C. Boom for Large drain with slight curves

Mosquito larvae are not uniformly distributed when the drain has slight curves in its course. Short booms projecting only a few feet from the banks are placed at the spots where mosquito breeding is detected. Oil soaked bhoosa is thrown on the water above each boom.

In all the above situations a single rope is stretched across from the bank to bank so that the objects floating down are held up and do not damage the boom. The boom can not be used where the boats are piled. Oil booms need someone on constant duty to prevent people from tampering with it.

Advantages of using oil

(i) It kills eggs, larvae and pupae of mosquitoes.
(ii) It kills culicine as well as anopheline larvae.
(iii) It is easily obtainable.
(iv) It is easy to see if a water collection is treated or not.
(v) No elaborate apparatus is required for its application.
(vi) Its use, though requiring supervision does not involve the amount of supervision as does for instance for organophosphorous larvicides and biolaricides.

Disadvantages of using oil

(i) Does not easily penetrate barrier of grass.
(ii) Film is broken up by winds and it may be carried to one side of the sheet of water.
(iii) Showers of rain wash away oil. Reapplication is needed.
(iv) Transportation is difficult as oil is heavy.
(v) May kill fish and render them unfit for human consumption.
(vi) Renders waters unfit for drinking.
(vii) Likely to be stolen by unscrupulous employees.

Pyrethrum Extract

It is perhaps the oldest effective insecticide that has been used in several countries. Its safety for use is unparallel and has been used as anti-helminthic and also introduced in urban water supply with not toxic hazards to the consumer. Pyrethrum is a contact poison. The active ingredients are pyrethrins. It may be formulated as a solution, immulsion, dust or granules. Pyrethrum extract is the extract of commercial pyrethrum flowers (Chrysanthemum cineraraefolium Linn.) in amineral oul with or without a minute quantity of added anti-oxidant but without a synergist. It is a clear transparent liquid free from sediment, suspended matter or other extraneous impurity, greenish in colour and possesses the characteristic odour of pyrethrum flowers.

Specification

The product should be as per ISI specification i.e. IS: 1051-1980.

Dosage of Application

The dosage of 0.1% pyrethrum kerosene mixture is 15 ml per 30 cubic metre space in a Pucca room and double the quantity in a Kutcha room.

Method of Application

Under the urban malaria scheme, pyrethrum extract 2% and kerosene oil are supplied primarily for carrying out focal space spray. Pyrethrum extract and kerosene oil (to be used in the ratio of 1 part pyrethrum extract 2% and 19 parts kerosene oil) spray has to be used as focal space spray to be carried out in and around 50 houses of a malaria positive case immediately after detection. It is emphasized that pyrethrum extract and kerosene oil supplied under Urban Malaria Scheme should not be used for the abatement of culicine mosquitoes.

Organo Phosphorous Larvicides

Organophosphorus larvicides have been recommended by the World Health Organisation as mosquito larvicide. Temephos has been recommended for use in potable water at the rate of 1 p.p.m. and has extremely low mammalian toxicity. The details of temephos and methodology for their use is given below:

Temephos

Temephos is an organophosphorus compound. Temephos has very low mammalian toxicity. The product acts as a contact poison and has a prolonged residual effect. If used in the recommended doses it is not toxic to fish and other aquatic life.

The product should be as per ISI specification i.e. IS:8498/1977.

Formulation

- Measure 2.5 ml. of temephos (50% emulsion concentrate in small leak proof or plastic bottles. For this purpose either 10 ml. measuring cylinder or 5 ml injection syringe may be used. About 5-10 such leak proof bottles should be carried to the field.
- Fill hand compression sprayer with 10 litres of potable water.
- One bottle containing 2.5 ml. of temephos should be poured into the sprayer filled earlier with 10 litres of water.
- Close the pump and shake sell. This would give the ready-to-spray emulsion of 0.0125% temephos which must be used on the same day otherwise it would break up and lose its efficacy.

Equipment

Mop and can method is not recommended for temephos application. Hand compression sprayers are ideal for temephos spraying. The discharge rate of hand

compression sprayer should be between 900 and 1,200 ml. per minute at pressure 0.7 kg./sq.cm (10lbs/sq/inch).

Dosage

By using hand compression sprayer, 175-225 litres of ready-to-use spray is applied over one hectare of water surface or one litre for 50 lenear metres (15-20 gallons/acre or one gallon/250 linear yards). For treatment of containers acting as breeding sources, the ready to use spray (0.0125% temephos) may be poured into containers at a dosage of 20 ml. per sq. meter wate surface. For septic tanks calculated quantity of ready to use spray should be poured into half a bucketful of water and flushed into the tank through seat of the latrine.

Frequency

The frequency of application in the above dosage is once in a week. The frequency of application may have to be decreased or increased on the preliminary observations in Index Breeding places depending upon the residual effect of the larvicide.

CHAPTER - 4

PROCEDURAL GUIDELINES FOR ANTI-LARVAL MEASURES

Pre-Treatment Measures

A through geographical reconnaissance survey of mosquitogenic condition should be made in the locality and a map prepared.

The list of breeding places such as potable water sources, agricultural fields, grass, fields, ornamental tanks, fish ponds, coconut husk resting ponds, weptic taks etc., where MLO cannot be used should be prepared sections and sector-wise.

Before the actual treatment of breeding sources with larvicides specific breeding sources should be marked distinctly for respective larvicidal treatment. Potable water sources breeding places to be treated with larvicies may also be earmarked and accordingly the larvicides should be distributed judiciously, subject to the budget allotment.

Though temephos has been proved to possess prolonged residual effect at higher dosage, the dosage is brought down so that the frequency of application of this larvicide will coincide with that of MLO. By this method the daily schedule already drawn and executed for MLO treatment will not be disrupted by introducing the new larvicides.

Maps already prepared for MLO will be utilized for the new larvicides also. The breeding sources to be treated with temephos and other larvicies shall be distinctly marked in the maps. The breeding sources which are hitherto untreated such as septic tanks, potable water sources etc. shall be charted in the map and a new serial number given to them.

The base-line data on larval and adult densities from fixed and random places should be collected for the areas brought under the larvicides before commencement of the use of these compounds.

Susceptibility Tests

The susceptibility levels of the vector mosquito towards temephos larvicide shall determined by the standard WHO technique before commencement of the trial. Pyrethrum has however, not yet been reported to precipitate resistance in insects of public health importance and therefore susceptibility tests should be made only, if warrated.

Formation of spray teams

No new squads or special squads will be formed for spraying different larvicides as the areas under anti-larval measures remains the same in the UMS area. The spray teams already in existence for MLO treatment will be utilized to spray the larvicides. The existing pattern of five day or six day week schedule, whichever be the case shall continue to be followed. It is advantageous if each spray team is provided with additional sprayer, one each for different larvicides.

If there is dearth of additional sprayers, the sprayers used for MLO can be utilized for temephos or others. When the larvicide is changed, care should be taken that the sprayer is completely emptied and thoroughly cleaned before using if for a different larvicide.

The sprayer can directly be used for MLO, temephos and consecutively. Unless the day area of on larvicide is completely covered, switch over to other larvicide should not be taken up. In the breakdown of MLO supplies all the breeding places under MLO area shall be treated with the other larvicides and the vice-versa (with precautions).

Training

The staff should be trained in the proper use of the larvicides, precautions to be observed, the formulation, dosage of application and in the maintenance of equipment. Training regarding the method of supervision and cross-check shall also be given.

Post Spray Data

The entomological data such as larval and adult densities, blood preference, biting rate, etc. be collected for all the larvicide-areas. The aquatic and adult densities for a particular area should be determined. The timing of larval checking should coincide with the last day of the larviciding interval. For example, the Wednesday area shall be checked for the presence of larvae on every Tuesday. The presence of III and IV instar larvae of the vector and their pupae when found, should be recorded and reasons for such failure of larviciding be investigated.

The susceptibility tests for the larval stages of vector mosquito shall be carried out once in six months.

CHAPTER-5

PRECAUTIONS FOR HANDLING AND STORAGE OF ORGANOPHOSPHORUS COMPOUNDS

Among the organo-phosphorous larvicides possesses relatively higher oral and dermal toxicity to mammals. Liquid concentrates and emulsion concentrates of most insecticides are classified as hazardous and should only be handled by specially trained personnel.

The organo-phosphorus (O>P) compounds are cholinesterase inhibitors and usual precautions for handling these O.P. compounds should be observed. Prolonged or repeated contact with the skin should be avoided. Any concentrate coming into contact with the skin should be thoroughly washed off immediately with liberal use of soap and water.

Soiled/ contaminated clothing should be removed immediately and boiled with a liberal quantity of soap. The staff engaged in actual spray operation should wear goggles, gloves, overalls and gauze-mask.

Exposure to sunlight and high temperature increase the rate of chemical breakdown, hence it should be stored in cool, shady and dry places.

It should be stored away from food, foodstuffs, children and animals and kept preferably in enclosed and locked location.

Ensure containers are properly labeled.

Empty containers should be destroyed so that they are not used for storing food materials for other household purposes.

Always keep spray equipment clean and free from leakage causing accidental contamination of skin and clothing.

Avoid application of larvicide directly to fruits, vegetables, domestic animals, forage crops and other edible products. One should be careful in applying the larvicide in drinking water for men or animals.

The spray men should not stand against wind while spraying. Never inhale the vapours from the emulsion concentrate.

ANTIDOTE

Ensure that the larvicide is used in strict conformity with the precautions mentioned. In case or insecticidal poisoning, contact the physician immediately.

Antidote for organo-phosphorus compound is **Atropine.** Tablets of this compound should be kept available with supervisory staff as a measure of first-aid. Two tablets each of 0.5 mg may be administered. This may be repeated in case of necessity. Injection of 1-4 mg may be given and 2 mg injection may be repeated at 10-15 minutes intervals depending on the severity of the case.

CHAPTER-6

PROVISIONS OF BY-LAWS

For management of domestic and extra-domestic mosquito breeding places, adoption and enforcement of by-laws for use under Urban Malaria Scheme are framed as under:

"CONTROL OF MALARIA AND OTHER VECTOR BORNE DISEASES"

DRAFT PROVISIONS SUGGESTED FOR ADOPTION UNDER APPROPRIATE SECTION/ RULE PREVAILING IN THE STATES.

Application of this Provision

1. The State Government/ local authority constituted under any Act by notification may enforce the following provisions to the whole or any part of the State/local authority area.

2. **(I)** If the provisions have been extended, no person or local authority shall, after such extensions.

    a. have, keep, or maintain within such area any collection of standing or flowing water in which mosquitoes breed or are likely to breed, or

    b. cause, permit, or prefer any water within such area to form a collection in which mosquitoes breed or are likely to breed, unless such collection has been so treated as effectively to prevent such breeding.

(II) The natural presence of mosquito larvae, in any stagnant or flowing water shall be evidence that mosquitoes are breeding in such water.

Treatment of Mosquito Breeding Places:

3. **(I)** The Health Officer may, by notice in writing, require the owner or the occupier of any place containing any collection of standing or flowing Water in which mosquitoes breed or likely to breed, within such time as may be specidied in the notice, not being less than 24 hours, to take such measures with respect to the same, or to treat the same by such physical, chemical or biological method, being measures or a method, as the Health Officer may consider suitable in the circumstances.

(II) If a notice under sub-section (1) is served on the occupier, he shall in the absence of a contract expressed or replied, to the country, be entitled to recover from the owner the reasonable expenses incurred by him in taking the measures of adopting the method of treatment, specified in the notice and may deduct the amount of such expenses from the rent which is then or which may thereafter be, due from him to the owner.

Heath Officer Power in Case of Default

4. If the person on whom a notice is served under provision 3 fails or refuses to take the measures, or adopt the method of treatment, specified in such notice within the time specified therein, the Health Officer may himself take such measures or adopt such treatment, specified in such notice within the time specified therin, and recover the cost of doing so from the owner or occupier of the property, as the case may be, in the same manner as if it were a property tax.

Protection of Anti-mosquito Works

5. Where, with the object of preventing breeding of mosquitoes in any land or building, the Government or any local authority or the occupier at the instance of the Government or local authority, (have constituted any works) in such land or building, the owner for the time being as well as the occupier for the time of such land or building shall prevent its being used in any manner which causes, or is likely to causes, the deterioration of such works, or which impairs, or is likely to impair the inefficiency.

Prohibition of interference with such works

6. **(I)** No person shall, without consent of the Health Officer, interfere with, injure, destroy, or render useless, any work executed or any material or thing placed in under or upon any land or building, by or the orders of the Health Officer with object of preventing the breeding of mosquitoes therein.

(II) If the provisions of sub-section (1) are contravened by any person, the Health Officer may re-execute the work or replace the materials or things, as the case may be, and the cost of doing so shall be recovered from such person in the same manner as if it were a property tax.

Section in respect of House-hold Cans and other Containers

7. The owner or occupier of any house, building, or shed or land shall not therein keep any bottle, vessel, can or any other container, broken or unbroken, in such manner that is likely to collect and retain water which may breed mosquitoes.

8. All borrow pits required to be dug in the course of construction and repair of construction and repair of roads, railways, etc. shall be so cut as to ensure that water does not remain stagnant in them. Where possible and practicable the borrow pits shall be left clean, free from dead organic matter and extra expenditure not exceeding 1 percent of the earth work in any project may be incurred to achieve this. The bed level of borrow pits shall be so graded and profiled that water will drain off by drainage channels connecting one pit with the other till the nearest natural drainage nullah is met with. No person shall create any isolated borrow pit which is likely to cause accumulation of water which may breed mosquitoes.

9. In case of any dispute or difference of opinion in the execution of any anti-mosquito scheme or in its operation or any work under these provisions in which the jurisdiction of the Government of India, or any other State is involved, the matter shall be referred to the Government of India for final say in the matter.

Powers of Health Staff to enter and inspect the premises

10. For the purpose of enforcing the provisions, the Health Officer or any of his subordinate not below the rank of Health or Sanitary Inspector may, at all reasonable times, after giving such notice in writing as may appear to him reasonable, enter and inspect any land or building within his jurisdiction and the occupier on the owner as the case may be, of such land or building shall give all facilities necessary for such entry and inspection, and supply all such informations as may be required of him for purpose aforesaid.

CHAPTER - 7

Urban VBDs Scheme and NUHM

Directorate NVBDCP deals with six vector borne diseases namely, Malaria, Lymphatic Filariasis, Kala-Azar, Dengue/Chikungunya and Japanese Encephalitis. Out of these six diseases Kala-azar and Lymphatic Filariasis are targeted for elimination by 2015. Malaria, Dengue/Chikungunya and Japanese Encephalitis are outbreak prone diseases. The control and containment of these diseases require intense efforts and resources.

Apart from malaria, other vector borne diseases like dengue, chikungunya, JE, filariasis and kala-azar are also increasingly becoming frequent in urban areas. Integrated control strategies are needed by meeting the requirement of additional staff and matching budgetary provision.

It is proposed to enhance the capacity of exiting 133 urban cities inclusive of 2 new towns to manage all VBDs prevalent in the urban areas. The vector control measures will focus to deal with all VBDs and special emphasis would be given for implementation of health impact assessment (HIA) component in all major developmental projects through enforcing appropriate legislature measures. The key lessons learnt during XI plan period and current challenges with respect to urban areas have already been outlined in the overall malaria component. Based on it the objectives, strategies and activities have been proposed under XII Plan for UMS (Urban VBDs).

Objectives:

1.Prevention of malaria mortality and reduction of morbidity in identified urban areas.
2.Effective management and control of other VBDs

Targets:

1.To improve vector surveillance and elimination of breeding at the source
2.To bring down cases of malaria and other VBDs in urban areas

Strategy:

(i) Detection and management of malaria cases and other VBDs
(ii) Integrated Vector Management
(iii) Capacity building and BCC
(iv) Intersectional coordination

Activities:

(i) **Diagnosis and case management:**

- Diagnostic and treatment facilities will be strengthened by establishing malaria clinics @ 1 clinic per 20000 population with special focus to urban slums.
- Involvement of other sectors /private providers for diagnosis, treatment and reporting
- Sentinel sites will be equipped with necessary diagnostic kits for diagnosis of VBDs

(ii**) Integrated Vector Management** by

- Larval control through Source reduction, Chemical larviciding and use of larvivorous fish and minor engineering
- Space spray during the outbreaks /epidemic
- LLINs in targeted vulnerable population of identified wards/burroughs under Municipal Corporations of mega cities.

(iii) Capacity building and BCC

- Training of personals involved in anti-malaria activities in urban areas including engineers and town planners
- Focused BCC
- Advocacy workshops for NGOs/ CBOs/ FBOs/ stakeholders for their involvement in VBD control activities
- Social mobilization through inter-sectoral collaboration.

(iv) Inter-sectoral coordination

- Adoption of Model civic bye-laws for prevention and control of vector breeding
- Health Impact Assessment (HIA) of Developmental projects

National Urban Health Mission (NUHM) :

- Approved on May 1, 2013 as a sub-mission of the National Health Mission (NHM) to strengthen the primary health care system in cities & towns
- **Target Population:** 29.95 Crore urban population (Census 2011)
  - 942 cities/ towns with population above 50,000 (29.69 Crore)

- 64 District Headquarter towns with population between 30,000 – 50,000 (0.26 Crore)

- **Special focus on**:
  - People living in listed, unlisted slums and other low income neighborhoods
  - All other vulnerable population such as homeless, rag-pickers, street children, rickshaw pullers, and other temporary migrants

Core Strategies :

- **Strengthening of Infrastructure**
  - Creation of new facilities
  - Rationalization and strengthening of the existing urban primary health structures (UFWCs, UHPs, Urban RCH Centres, Dispensaries)
- **Augmentation of HR**
  - Deployment of Medical Officers and Paramedical Staff at U-PHCs and U-CHCs
  - Engagement of ANMs
- **Community Participation**
  - Mahila Arogya Samitis (MAS) and ASHAs in slum areas
- **Urban Local Bodies (ULBs)**
  - Involvement of ULBs in planning, implementation and monitoring of the program
- **Inter and Intra Sectoral Coordination**
  - Convergence with all National Health Programs and other Ministries (Drinking Water, Sanitation, Housing, WCD etc)
- **Capacity building of stakeholders**
  - ULBs/ Medical and Paramedical staff/ASHA, MAS
- **Use of ICT**

- For better service delivery, improved surveillance and monitoring

NUHM: Service Delivery Mechanism :

- Urban-CHC
  - 30-50 bedded hospital in cities with more than 500,000 population
  - FRU level care
- Urban-PHC
  - For every 50,000 urban population
  - Comprehensive primary healthcare service
- Outreach Sessions
  - For every 10,000 slum and vulnerable population each ANM catchment area – weakly sessions
  - Para-medical level care for RCH, Immunization, Disease Control Programs
- Mahila Arogya Samiti
  - For every 50 – 100 households in slums and among vulnerable communities
  - BCC & Health Promotion

Dealing with Urban VBDs :

Sr. No.	Services	Health facility	Activity	Responsibility	Norm
	DIAGNOSIS AND TREATMENT				
1.	Outreach service at Community level (slum clusters)	ASHA / LW / CHW	Slide collection, testing using RDKs, DDT . counseling for practices for vector control and protection	Health Worker	@ 1 ASHA for 2000 slum population
2.	First Point of Service Delivery	U-PHC :	Diagnosis and treatment, referral of terminally ill cases	ANM	@ 4 ANM per U-PHC having 50,000 pop.

3.	**First Point of Referral**	**U-CHC**	**VBD detection centre / Case Management of terminally ill cases, hospitalization**	**MO / Technician / Health Inspector**	**@ 1 U-CHC for 5-UPHCs, i.e. 2.5 lakhs population**
4.	**Second Point of Referral**	**Hospital**	**Sentinel site / Hospital**	**Physician / Lab. services**	**State Resource**
	VECTOR CONTROL				
5.	**Planning and control for VBDs**	**Urban VBD Officer with one Entomologist and 3 insect collectors**	**Vector Monitoring, Anti-larval Operations & Vector Control.**	**FWs / SFWs**	**one squad of 1 SFW and 3 FW per square mile area**

CHAPTER – 8

PARAMETERS FOR ASSESSMENT

Entomological Parameters

Adult Collection

Mosquito collections should be carried out daily form fixed and random catching stations. The catching stations should be fixed in every day-area (area fixed for each day's work in six-day programme) under anti-larval operations. The random collection should be made from different houses on each turn while the fixed catching station shall in no case be changed. The adult collection shall be from 6.30 A.M to 10.30 A.M. for six days in a week. Average 15 minutes in each house (fixed/random) should be devoted during collection.

In each day – area, there should be 3-5 fixed catching station depending on mosquitogenic problem. The stations should be fixed close to breeding places. Each catching station should be visited once a week. If a fixed station is found locked/refused on a particular visit, the next neighbouring house should be used for mosquito collection.

In the laboratory, all the mosquitoes should be grouped into two i.e. culicines and anophelines. The species *An. stephensi, An. culicifacies, Culex quinquefasiatus and Aedes aegypti* should be recorded separately after proper identification. The recording should be maintained in a register.

Adult Mosquito Density: PMD (Per Man hour Density) PRD (Per Room Density)

A. Per Man Hour Density

Method

This index is calculated for each vector species and total anophelines. Index is calculated from the daytime hand collection made by the Insect Collectors. Aspirators tube flash light technique is commonly used for collecting the mosquitoes.

$$\text{Per Man Density} = \frac{\text{No. Mosquitoes (male \& female) collected}}{\text{No. of Insect Collector x Time spent in search in hour}}$$

Significance

This parameter is useful to know:

a) Mosquito fauna of the area

b) Seasonal prevalence of mosquitoes and vectors

c) Resting habits, both in-doors and out-doors

d) Impact of vector control measures.

Larval Collection

To determine the effectiveness of anti-larval operations, pre and post collection of larvae is the absolute need. The Superior Field Worker should attempt to take 5-10 dips with the help of ladle (an enamel dipper about 9 cm in diameter) dips from each breeding place. Each Superior Field Worker should check conveniently 25-30 breeding places in this day's area.

The pre and post-larval collections (average of 5-10 dips) should be recorded in proper proforma.

Larval density

(i) Method

Larval collection is done with the help of standard ladle, net well net etc. The common approach is to work out per dip density of larvae. Commonly a minimum of four dips is applied in each breeding places at different points and number of larvae an average per dip is determined.

(ii) Significance

a) An auxiliary method of detection of vector prevalence in time and space.

b) This parameter is used in understanding mosquito breeding habits.

c) This indicator is used in assessing the antilarval measures in urban areas.

Entomological indictors for dengue vector :

House index : % Houses & their premises positive for Immatures (More than 10 % High less than 1% Low Risk).

Container Index : % Water Holding Containers positive for Imatures

Breteau Index : No. of Positive containers per 100 houses (100 houses ideal; More than 50% High Risk; Less than 5% Low Risk).

Cross-checking of Breeding Places

The records for the presence of fourth instar larvae and purpae in breeding places, the work of Superior Field Worker and the work of Field Worker are to be cross-checked. The cross-checking should function under the direct control of officer in-charge. A Malaria Inspector and Insect Collector should constitute a team. Cross-checking of breeding places should be planned in such a way that as many breeding places as possible be treated either on the day of checking or within 4-5 days. The proper recording of the finding should be maintained in a suitable form.

Parasitological Parameters

Under UMS, malaria incidence is the main parasitological parameter, the information required to assess the impact of anti-larval measures directly or indirectly on malaria incidence may please is the key index of assessment of UMS, the officer in-charge of UMS and the District Malaria Officer should have mutual coordination in collection and maintenance of the proper information.

Maintenance of Anti-larval Records

All day-to-day collection of adult mosquitoes and larvae as well as consumption and balance of larvicides should be properly maintained in the register. At the month end, all the information should be summed up separately item-wise and should be made available to State Malariologist or the State Programme Officer and the Director, NMEP, Delhi, on standard prescribed forms.

CHAPER – 9

Health Impact Assessment

Health Impact Assessment (HIA) is defined as "a combination of procedures, methods, and tools by which a policy, program, or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population."

HIA is intended to produce a set of evidence-based recommendations to inform decision-making . HIA seeks to maximise the positive health impacts and minimise the negative health impacts of proposed policies, programs or projects.

HIA is a practical approach used to judge the potential health effects of a policy, programme or project on a population, particularly on vulnerable or disadvantaged groups. Recommendations are produced for decision-makers and stakeholders, with the aim of maximising the proposal's positive health effects and minimising its negative health effects.

The environmental factors such as terrain features (plain, desert, hilly and forests), ecology, climatic features, rainfall, humidity influence the presence of vector mosquitoes helping thereby in the transmission of a particular disease. The developmental project namely irrigation, dam, hydro-electrical projects, jhoom cultivation (deforestation) lead to direct health impact on the population in that area in terms of vector borne diseases.

Under the National Vector Borne Disease Control Programme, insecticides and larvicides are being used which are registered with Central Insecticide Board based on the toxicity data to ensure safe standard of human safety. However, Environmental Code of Practises (ECoP) envisaged under the orbit of the programme implementation. But, there is need for health impact assessment of the spraymen handling insecticides and irrational use of fogging operations in the municipal corporations on the spraymen and community.

The procedures of HIA are similar to those used in other forms of impact assessment, such as environmental impact assessment or social impact assessment. HIA is usually described as following the steps listed, though many practitioners break these into sub-steps or label them differently:

1. *Screening* - determining if an HIA is warranted/required
2. *Scoping* - determining which impacts will be considered and the plan for the HIA
3. *Identification and assessment of impacts* - determining the magnitude, nature, extent and likelihood of potential health impacts, using a variety of different methods and types of information
4. *Decision-making and recommendations* - making explicit the trade-offs to be made in decision-making and formulating evidence-informed recommendations

5. *Evaluation, monitoring and follow-up* - process and impact evaluation of the HIA and the monitoring and management of health impacts

The main objective of HIA is to apply existing knowledge and evidence about health impacts, to specific social and community contexts, to develop evidence-based recommendations that inform decision-making in order to protect and improve community health and wellbeing. Because of financial and time constraints, HIAs do not generally involve new research or the generation of original scientific knowledge. However, the findings of HIAs, especially where these have been monitored and evaluated over time, can be used to inform other HIAs in contexts that are similar. An HIA's recommendations may focus on both design and operational aspects of a proposal.

HIA has also been identified as a mechanism by which potential health inequalities can be identified and redressed prior to the implementation of proposed policy, program or project .

A number of manuals and guidelines for HIA's use have been developed

Determinants of health

The proposition that policies, programs and projects have the potential to change the determinants of health underpins HIA's use. Changes to health determinants then leads to changes in health outcomes or the health status of individuals and communities. The determinants of health are largely environmental and social, so that there are many overlaps with environmental impact assessment and social impact assessment.

Levels of HIA

Three forms of HIA exist:

- Desk-based HIA, which takes 2–6 weeks for one assessor to complete and provides a broad overview of potential health impacts;
- Rapid HIA, which takes approximately 12 weeks for one assessor to complete and provides more detailed information on potential health impacts; and
- Comprehensive HIA, which takes approximately 6 months for one assessor and provides a in-depth assessment of potential health impacts.

It has been suggested that HIAs can be prospective (done before a proposal is implemented), concurrent (done while the proposal is being implemented) or retrospective (done after a proposal has been implemented) . This remains controversial, however, with a number of HIA practitioners suggesting that concurrent HIA is better regarded as a monitoring activity and that retrospective HIA is more akin to evaluation with a health focus, rather than being assessment per se. Prospective HIA

is preferred as it allows the maximum practical opportunity to influence decision-making and subsequent health impacts.

HIA practitioners

HIA practitioners can be found in the private and public sectors, but are relatively few in number. There are no universally accepted competency frameworks or certification processes. It is suggested that a lead practitioner should have extensive education and training in a health related field, experience of participating in HIAs, and have attended an HIA training course. It has been suggested and widely accepted that merely having a medical or health degree should not be regarded as an indication of competency.

Why use HIA?

Values

HIA is based on four values that link the HIA to the policy environment in which it is being undertaken.

1. **Democracy –** allowing people to participate in the development and implementation of policies, programmes or projects that may impact on their lives.
2. **Equity –** HIA assesses the distribution of impacts from a proposal on the whole population, with a particular reference to how the proposal will affect vulnerable people (in terms of age, gender, ethnic background and socio-economic status).
3. **Sustainable development –** that both short and long term impacts are considered, along with the obvious, and less obvious impacts.
4. **Ethical use of evidence –** the best available quantitative and qualitative evidence must be identified and used in the assessment. A wide variety of evidence should be collected using the best possible methods.

HIA and policy making

In this section we investigate how HIA contributes to policy making.

HIA can be a valuable tool for helping to develop policy and assisting decision-makers. The usefulness and need of HIA within policy and decision making is clear, HIA:

- is used in projects, programmes and policies
- assists policy development
- brings policies and people together
- involves the public
- provides information for decision makers
- addresses many policy making requirements
- recognises that other factors influence policy apart from HIA.
- is a proactive process that improves positive outcomes and decreases negative outcomes

- can provide what policy makers need

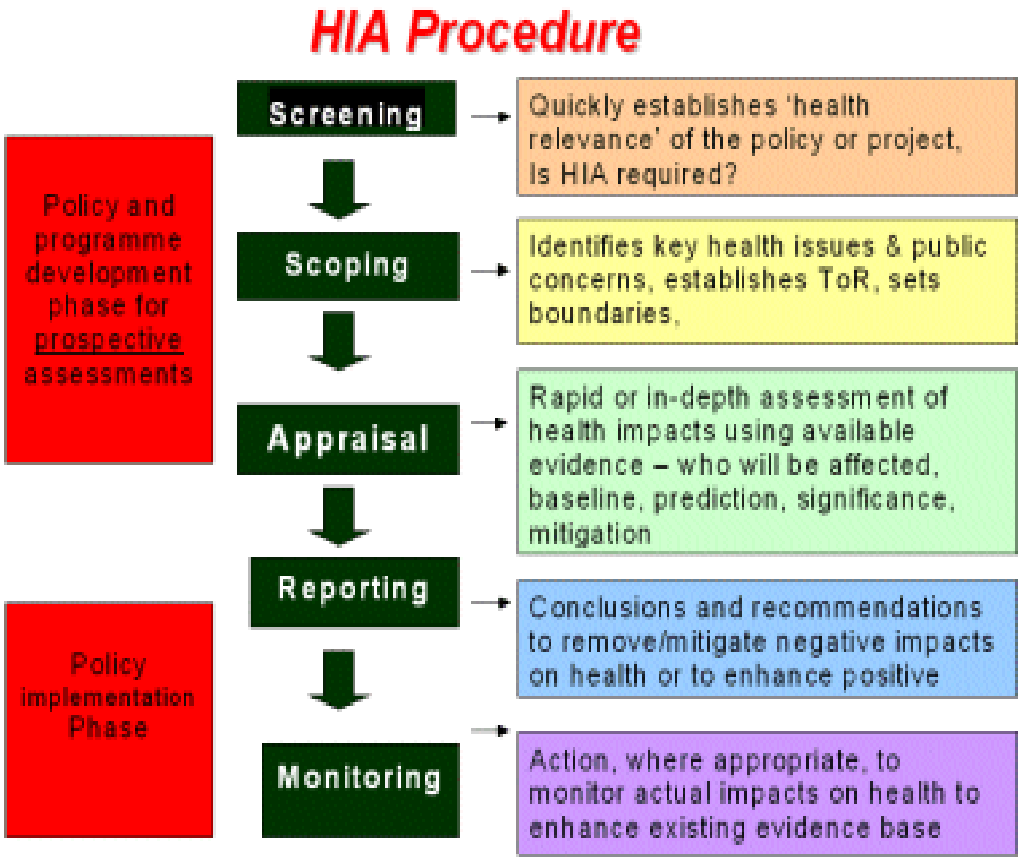
Suggestions for how an HIA practitioner might interact with the policy process and policy makers, a description of the different stages in policy making, plus some key steps for HIA practitioners, are also provided.

Tools and methods

How to undertake an HIA

This section will draw on a number of case studies to briefly describe the theory and practice of carrying out an HIA. Many HIA guidance documents have been produced, from all regions of the world and we encourage you to use these for detailed work. While there is no single agreed method for undertaking HIA, a general pattern has emerged amongst methods and there is much overlap between them.

Guidance documents often break HIA into four, five or six stages. Despite the differing number of stages, it is important to note that there are no significant differences between the methods. Also, the theoretical stages often overlap and intermingle, and a clean separation is not often obvious in practice. The stages are:



Using evidence within HIA

One of the key values of HIA is the ethical use of evidence.
A wide variety of evidence should be collected and assessed, using appropriate and effective methods. This will provide the basis for evidence-based recommendations that can be provided to decision-makers, who can then make decisions about accepting, rejecting, or amending the proposal in the knowledge that they have the best available evidence before them.

HIA considers several types of evidence. It goes beyond published reviews and grey literature to include the knowledge of stakeholders who are involved in or affected by a proposal. Where evidence of the quality and quantity demanded by decision-makers is not available, a note of this is made within the HIA.

CHAPTER 10 : MALARIA ELIMINATION STRATEGY

The overall objectives of the malaria elimination programme are rapid reduction of transmission in areas with high malaria incidence; interruption of malaria transmission in low transmission areas; and prevention of re-establishment of malaria in areas where transmission has been interrupted. Under Urban VBD Scheme, the towns are to be stratified into category 1, 2 & 3 based on API and SPR at the ward, circle and section level. Most of the towns / Metro cities under Urban VBD Scheme are showing less than 1 API. However, high incidence is being reported from the slum clusters, labour camps and migratory population. Based on the local situation and line listing of the cases, appropriate area specific tool is to be applied.

Programme phasing under Urban VBD Scheme :

Malaria elimination in India will be carried out in a phased manner because the various States/UTs have different levels of malaria burden. While some low burden states are in a position to plan action for malaria elimination right now, the high burden States will need to reduce the malaria burden first before proceeding towards elimination. Therefore, States and UTs have been categorized into phases, based on their API as primary criterion with due consideration given to ABER and SPR as secondary criteria. Similarly, Towns under urban VBD scheme need to be categorized as given in table below :

Classification of Towns under Urban VBD Scheme for malaria elimination

Category	Definition
Category 0 *Prevention of re- establishment phase*	Urban VBD Towns with zero indigenous cases of malaria
Category 1 *Elimination phase*	Urban VBD Towns with API less than one, and all the Wards/Circles reporting API < 1
Category 2 *Pre-elimination phase*	Urban VBD Towns with API < 1, but some of the Wards/Circles reporting API ≥ 1
Category 3 *Intensified control phase*	Urban VBD Towns with API ≥ 1

The broad strategies of the malaria elimination framework are:

- Early diagnosis and radical treatment
- Case-based surveillance and rapid response
- Integrated vector management (IVM)
  - Indoor residual spray (IRS)
  - Long-lasting insecticidal nets (LLINs) / Insecticide treated bed nets (ITNs)
  - Larval source management (LSM)
- Epidemic preparedness and early response
- Monitoring and evaluation
- Advocacy, coordination and partnerships

- Behaviour change communication and community mobilization
- Programme planning and management

The specific objectives and key interventions recommended for each category of states/UTs are detailed below and the same is applicable for towns under VBD Scheme as well.

3.1 Category 3 (Intensified control phase: States/UTs with API ≥ 1)

Table 3.1 Specific objectives and key interventions of Category 3 states/UTs

Specific objectives	Key interventions
• Achieve universal coverage with malaria preventive and curative services • Establish an efficient system to reduce ongoing transmission of malaria • Reduce malaria-specific morbidity and mortality • Contain and prevent possible outbreaks of malaria, particularly among non-immune high-risk mobile and migrant population groups • Emphasize reducing malaria morbidity and mortality in high transmission pockets such as tribal, hilly, forested and conflict affected areas	• Massive scaling up of existing disease management and preventive approaches and tools, aimed at a significant reduction in the prevalence and incidence of malaria as well as associated deaths • Screening of all fever cases suspected for malaria • Classification of areas as per local malaria epidemiology and grading of areas as per risk of malaria transmission followed by implementation of tailored interventions • Strengthening of intersectoral collaboration • Special interventions for high-risk groups such as tribal populations and populations residing in conflict affected or hard-to-reach areas • One-stop centres or mobile clinics on fixed days in tribal or conflict affected areas to provide malaria diagnosis and treatment, and increasing community awareness with the involvement of other agencies and service providers as required • Timely referral and treatment of severe malaria cases to reduce malaria-related mortality • Strengthening all district and sub-district hospitals in malaria endemic areas as per Indian Public Health Standards with facilities for management of severe malaria cases • Establishment of a robust supply chain management system • Maintenance of an optimum level of surveillance using appropriate diagnostic measures • Equipping all health institutions (primary health care level and above), especially in high-risk areas, with microscopy facilities and RDTs for emergency use and injectable artemisinin derivatives for treatment of severe malaria

3.2 Category 2 (Pre-elimination phase: States/UTs with API < 1, but some of their districts reporting API ≥ 1)

The states/UTs in pre-elimination phase are those close to entering the elimination phase. Therefore, malaria elimination interventions will be introduced with particular focus on setting up

an elimination surveillance system and initiating elimination phase activities in those districts where the API has been reduced to less than 1 case per 1000 population at risk per year. The planning of elimination measures will be based on epidemiological investigation and classification of each malaria case and focus.

3.3 Category 1 (Elimination phase: States/UTs with API < 1, and all their districts reporting API < 1)

Table 3.2 Specific objectives and key interventions of Category 1 states/UTs

Specific objectives	Key interventions

• Interrupt transmission of malaria
• Immediately notify each detected case
• Detect any possible continuation of malaria transmission
• Determine the underlying causes of residual transmission
• Forecast and prevent any unusual situations related to malaria; ensure epidemic preparedness and respond in a timely and efficient manner to outbreak situations
• Prevent re-establishment of local transmission of malaria
• Ascertain elimination of malaria
	• All efforts will be directed at interrupting local transmission in all active foci of malaria.
	• Mandatory notification of each case of malaria from the private sector, other organized government sectors or any other health facility
	• Adequate case-based surveillance and complete case management established and fully functional across the entire country to handle each case of malaria
	• Investigation and classification of all foci of malaria
	• A strict total coverage of all active foci by effective vector control measures
	• Early detection and treatment of all cases of malaria by means of ACD and/or PCD to prevent onward transmission
	• State and national level malaria elimination database established and made operational
	• Implementation of interventions for effective screening, management and prevention of malaria among mobile and migrant populations
	• Establishment of an effective epidemic forecasting and response system
	• Ensuring rigorous quality assurance of all medicines and diagnostics
	• Setting up a national-level reference laboratory to serve following two functions:
	  • All positive and a fixed percentage of negative slides will be referred to this laboratory for confirmation of diagnosis and cross-checking. After elimination has been achieved in each State/UT, 100% of cases will be notified to this laboratory for confirmation of diagnosis. The laboratory will be notified immediately on all positive cases of malaria by each state/UT through either SMS, e-mail or telephone with information on name, gender, address (village and district), date and type of testing and type of parasite for each positive case of malaria so that a national level database can be maintained.
	  • Training of master trainers and accreditation/certification of microscopists as per Indian Public Health Standards shall also

Specific objectives	Key interventions
	be undertaken at this laboratory. • During investigation of foci, all suspected cases of malaria are to be screened for malaria. These could include household members, neighbours, schoolchildren, workplace colleagues and relatives. • Surveillance of special groups, migrant populations or populations residing in the vicinity of industrial areas are also to be covered under surveillance operations

3.4 Category 0 (Prevention of re-establishment phase)

The probability of malaria becoming re-established in a malaria free area varies with the level of receptivity and vulnerability of the area. If either of these factors is zero, the probability of malaria becoming re-established is zero even if the other factor has a high value. When importation of malaria due to the arrival of migrants from a malarious area coincides with increase in receptivity because of halted vector control measures or development activities in an area for example, re-establishment of malaria transmission is possible. In the absence of appropriate action, the area is likely to become malarious again.

When any area, whether a state/UT or a district within a state/UT, has achieved malaria elimination, the specific objectives will be as follows:

- Detect any re-introduced case of malaria;
- Notify immediately all detected cases of malaria;
- Determine the underlying causes of resumed local transmission;
- Apply rapid curative and preventive measures;
- Prevent re-introduction and possible re-establishment of malaria transmission; and
- Maintain malaria-free status in these areas.

These goals will be achieved by proactively identifying all individuals who carry the malarial parasites and treating them so that onward transmission of infection is stopped. This will be supplemented by targeted and tailored mosquito control measures to reduce vector density and minimize vector-human contact.

CHAPTER 11 : ADULTICIDES / LARVICIDES USED

Larvicide formulations and dosages

S.No.	Name of larvicide	Commercial formulation	Preparation of ready to spray formulation	Dosage			Frequency of application	Equipment required	Remarks
				1 square meter	50 Linear meter	Per Heactare			
1	MLO	100% petroleum project product	As it is	20 c.c.	1 Litre	200 Litres	Weekly	Knapsack/Hand compression Sprayer	To be applied along the shore of water body
2	Temephos (Abate)	50% EC	2.5 c.c. in 10 Litres of potable water	20 c.c.	1 Litre	200 Litres	-do-	Knapsack/Hand compression Sprayer	Can be applied in clean water
3	Bacillus thuringiensis var israelensis WP	Wettable Powder	5 Kg in 200 litres of Water	-	-	5 Kg.	Fortnightly	Knapsack/Hand compression Sprayer	For both clean and non-potable polluted water
4	Bacillus thuringiensis var israelensis 12 Aqueous Suspension (12AS)	Aqueous Suspension	1 litre in 200 Litres of water	-	-	1 Litres	Weekly	Knapsack/Hand compression Sprayer	Clean Water
			2 litre in 200 Litres of water			2 Litres			Polluted Water
5	Diflubenzuron 25% WP	25% Wettable Powder	100 gms in 100 Litres of water	-	-	25 gm a.i	Weekly	Knapsack/Hand compression Sprayer	Clean Water
			200 gms in 100 Litres of water			50 gm a.i			Polluted Water
6	Pyriproxyfen	0.5% Granular	Ready-to-use	-	-	2 kg.	3 Weekly	Granular Applicator / Hand Broadcast	Clean Water
						4 kg.			Polluted Water

Indoor Space Spray

S.No	Name of Insecticide	Commercial formulation	Preparation of formulation	Equipment required	Remarks
1	Pyrethrum Extract	2.0% extract	1:19 i.e.1 part of 2% Pyrethrum Extract in 19 parts of Kerosene (50 ml in 1 litres K.Oil)	Pressurised Spray machine or fogging machine	Used for Indoor Space Spray
2	Cyphenothrin	5% EC	0.5 mg a.i per sq.mt.(20 ml in 1 litres K.Oil)		

Outdoor Fogging

S.No	Name of Insecticide	Commercial formulation	Preparation of formulation	Equipment required	Remarks
1	Malathion	Technical Malathion	1:19 i.e.1 part of Malathion Tech in 19 parts of Diesel (50 ml in 1 litres diesel)	Shoulder mounted Fogging machine or Vehicle mounted thermal Fogging machine	Used for Outdoor Thermal Fogging
2	Cyphenothrin	5% EC	3.5 g a.i per hactare (7 ml in 1 litres diesel)		

Annexure - I

Year wise Urban VBD - Malaria Reports -2014

S. No.	State	Population	B/S Exam.	Malaria cases total	PF
1	Andhra Pradesh	12058237	466704	2993	85
2	Gujarat	11643614	1724245	7969	1090
3	Haryana	6012001	298397	529	11
4	Jammu & Kashmir	613000	1688	13	1
5	Jharkhand	916609	39035	1565	338
6	Karnataka	3328728	660049	160	7
7	Madhya Pradesh	12008237	225805	644	52
8	Maharashtra	20583471	1792273	8197	460
9	Manipur	270000	157	2	0
10	Nagaland	197277	23639	217	146
11	Orisha	410346	27480	1833	1303
12	Punjab	975215	1776713	423	11
13	Rajasthan	4532979	1914216	2073	62
14	Tamil Nadu	6397746	4436433	21217	591
15	Tripura	409700	845	0	0
16	Uttar Pradesh	5544280	915176	9316	53
17	West Bengal	5437379	195767	8254	355
18	Chadigarh	1080000	45019	114	0
19	Delhi	15785520	168683	98	0
	Total	**108204339**	**14712324**	**65617**	**4565**

Annexure – II

Urban VBD - Malaria Reports 2015

S. No.	State	Population	BSC (Exam.)	Malaria cases total	PF
1	Andhra Pradesh	11079798	346606	1820	84
2	Gujarat	11735755	1781254	3739	584
3	Haryana	4456474	341902	286	8
4	Jammu & Kashmir	625568	27134	33	4
5	Jharkhand	1577439	38806	1311	460
6	Karnataka	3395303	96611	38	10
7	Madhya Pradesh	5405768	697773	2838	354
8	Maharashtra	23175294	2158436	7641	432
9	Manipur	270000	177	1	0
10	Nagaland	200758	29893	260	148
11	Orissa	200000	1740	21	18
12	Punjab	6240478	355602	97	1
13	Rajasthan	10086298	1170965	835	44
14	Tamil Nadu	2703811	64748	154	58
15	Tripura	409700	8275	2	21
16	Uttar Pradesh	36852448	82034	428	11
17	West Bengal	45080544	216769	9049	416
18	Chadigarh	1123983	20698	150	1
19	Delhi	16753000	186659	54	0
	Total	**181372419**	**7626082**	**28757**	**2654**

Annexure – III

Urban VBD Fomats :

STATE :

TOWN :

URBAN VBD I
PROFORMA :

National Vector Borne Disease Control Programme

POPULATION :

Monthly Epidemiological Report under Urban VBD Scheme for the Month 2015

AREA : ..... (in sq. km)

VBD Situation	During the month under report	Progressive
1. Blood Smears collected.....		
2. Blood Smears Examined.....		
3. No. of B. S. Found positive.....		
4. No. of P.F. / Mixed.....		
5. No. of Dengue case.....		
6. No. of Chikunguniya case.....		
7. Death if any due to Malaria.....		
8. No. given radical treatment		
9. Total Positive during the corresponding period of the last year		
10. No. of P.F./ Mixed during the corresponding period of the last year		
11. Any Other VBDs		

Biologist,

Urban Malaria Scheme

STATE-WISE STAFF POSITION UNDER URBAN VBD SCHEME Proforma - II

Name of Town : Population :

Sr. No.	Designation of post	Position of staff			Training status		Remarks
		No. Sanct.	No. in Position	Vacancy	No. trained	No. Untrained	
1	Biologist / Urban VBD Officer						
2	Urban VBD Inspector						
3	Insect Collector.						
4	Superior Field Worker						
5	Field Worker						
6	Driver						
7	Total						

Urban VBD - Dengue Vector Survey Report Month 2015

Sr.NO	Urban VBD Town	House Surveyed	Breeding found in Houses	Container Surveyed	Breeding found in Container	HI	CI	BI

MONTHLY REPORT OF SPACE SPRAY CARRIED OUT DURING THE MONTH OF ..... YEAR:- 2015							
Sr. No.	Name of the Ward / Area	WEEK	No. of House given space spray		Quantity of Material used		
			House	Room	Pyrethrum Ext. 2% in lit.	K., Oil/diesel	Others
1							
2							
3							
4							
5							

PROFORMA :

National Vector Borne Disease Control Programme

Monthly Report on cross checking work carried out for Mosquito breeding during the Month of - under Urban VBD Scheme by Biologist Supervisor & SFWS.

Ward/ Sector	No. of Mosquito Breeding Sources checked.	No.of found treated with MLO. BTI & other	No. of + ve dips applied	No. found with Mosquito breeding									Type of breeding sources where more breeding was detected	Timelag between reporting of breeding places & treatment
				Culex			Anopheles			Aedes				
				No. with Larval stage		pupae	No. with Larval stage		pupae	No. with Larval stage		pupae		
				I to III	IV		I to III	IV		I to III	IV			
2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Urban VBD Scheme Stock Position of Larvicides for the Month of ..... year

Sr. No.	Description	MLO in liter	Diflubenzuron	Temephos in liter	Pyrethrum Extract in Liter	Petrol in liter	Diesel in liter	Bti (AS)	Bti (wp)	SP (WP)	Any other
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	Opening Balance										
2	Received during the Month.										
3	**Progressive Total**										
4	Other Issued										
5	Consumed during the Month										
6	**Balance at the End of the Month**										