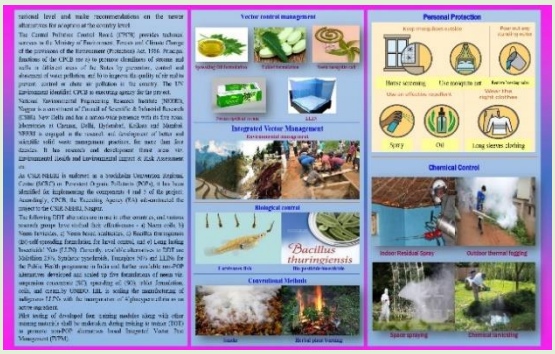
CSIR – National Environmental Engineering Research Institute, Nagpur

9th Training Programme Report

On

Five days offline Training Programme for Pilot testing of Modules and ToT (SPOs, VBD Consultants & Entomologists from Madhya Pradesh) to promote non-POPs alternatives to DDT based on Integrated Vector Pest Management

Venue: ***Hotel Amer Palace, MP Nagar, Bhopal***
Date: 30/05/2022 to 03/06/2022
Time: 09:30 AM to 17:30 PM



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List of Abbreviations

BCC	Behaviour Change Communication
Bti	*Bacillus thuringiensis var. israelensis*
CCHF	Crimean-Congo Haemorrhagic Fever
CPCB	Central Pollution Control Board
CSIR	Council of Scientific & Industrial Research
DDT	Dichlorodiphenyltrichloroethane
EC	Emulsifiable Concentrate
FFS	Farmer Field School
GEF	Global Environment Facility
GoI	Government of India
HIL	Hindustan Insecticide Limited
ICMR	Indian Council of Medical Research
IEC	Information Education and Communication
IGRs	Insect Growth Regulators
IRS	Indoor Residual Spraying
IVM	Integrated Vector Management
IVPM	Integrated Vector and Pest Management
JE	Japanese Encephalitis
KFD	Kyasanur Forest Disease
LLINs	Long Lasting Insecticidal Nets
MoCF	Ministry of Chemicals and Fertilizers
MoEFCC	Ministry of Environment Forests and Climate Change
MoEFCC	Ministry of Environment, Forest and Climate Change
MoH&FW	Ministry of Health and Family Welfare
NEERI	National Environmental Engineering Research Institute
NIP	National Implementation Plan
NVBDCP	National Vector Borne Disease Control Programme
POPs	Persistent Organic Pollutants
RNA	Ribonucleic Acid
SC POPs	Stockholm Convention on Persistent Organic Pollutants
SIT	Sterile Insect Techniques
UNEP	United Nations Environment Programme
VBD	Vector-Borne Disease
WDP	Water Dispersible Powder
WHO	World Health Organization
WP	Wettable Powder
ZIKV	Zika Virus

1.0 Introduction

Stockholm Convention (SC) is an international treaty works for the protection of human health and environment from harmful Persistent Organic Pollutants (POPs). The Government of India (GoI) signed the Stockholm Convention on POPs and the Ministry of Environment, Forests and Climate Change (MoEFCC) was assigned as the National Focal Point. India has committed to fulfilling its obligations under the Convention, prepared its National Implementation Plan (NIP) and submitted it to the Secretariat of the Stockholm Convention on 21 April 2011. India assured in the NIP, that the development and promotion of non-POPs alternatives to DDT is one of the top priorities that require immediate action. Accordingly, the project entitled "**Development and promotion of non-POPs alternatives to DDT**" was jointly developed by United Nations Environment Programme (UNEP) and United Nations Industrial Development Organization (UNIDO). The project was approved by Global Environmental Facility (GEF) in April 2015 with two GEF implementing agencies *i.e.,* United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Programme (UNEP), which are responsible for supporting delivery of specific project components. Following are the major project components to be implemented under the project:

I. Legislation, policy framework and institutional capacity (UNEP)
II. Alternatives to vector control (UNIDO)
III. Promotion and propagation of new cultivars of Neem (UNIDO)
IV. Development and Promotion of Integrated Vector Pest Management (IVPM)
V. Monitoring and evaluation of results (UNIDO / UNEP)

For components I and IV, MoEFCC has nominated Central Pollution Control Board (CPCB) as a national Executing Agency to look after a partial execution of the project. As per the project document, the other part will be executed by the UNEP Law Division. The components of UNEP prescribe broadly Legislative framework and development, and pilot application of a set of Guidelines for Integrated Vector and Pest Management. UNIDO is working on the development of non-POPs alternatives to DDT viz. Long-Lasting Insecticidal Nets (LLIN), Neem based insecticides, *Bti* based pesticides under its two components.

The Global Environment Facility (GEF) was established to tackle our planet's most pressing environmental problems. The GEF supports countries to build capacity for the implementation of the Stockholm Convention through introduction and demonstration of viable, cost-effective and sustainable alternatives to eliminate dependency on DDT and other POPs chemicals.

The United Nations Environment Programme (UNEP) is the voice for the environment and the primary driving force for international activities related to the sound management of chemicals in the United Nations system. The UNEP promotes chemical safety by providing policy advice, technical guidance and capacity building to the developing countries. UNEP Chemicals Branch has the leadership of the Global Alliance for the Development and Deployment of Alternatives to DDT. As such, UNEP is a well-placed partner with other organizations to phase out current use and avoid future practices of DDT use in India.

The Directorate of NCVBDC, central agency responsible for guidelines, policy for prevention and Control of vector-borne diseases in India has been implementing the Integrated Vector Pest Management (IVPM) strategy for effective management of vectors. It recommends Indoor Residual Spray (IRS) and Insecticide Treated Bed Nets (ITNs)/ Long lasting Insecticide Net (LLIN) for vector control in rural areas and anti-larval measures in urban areas.

IVPM is a tool for managing vector population to reduce or interrupt transmission of disease. IVPM is a way forward to improve cost-effectiveness, ecological soundness and sustainability of disease vector control. It emphasizes that the insecticides used in the programme must have negligible adverse human health effects, must be effective against the target species, must have minimal effect on non-target species and natural environment and their use must take into account the need to prevent the development of resistance. Key stakeholders involved in the project are the three Ministries viz. Ministry of Environment, Forests and Climate Change (MoEFCC), Ministry of Chemicals and Fertilizers (MoCF), and Ministry of Health and Family Welfare (MoH&FW) whose mandates and roles are given below:

The Ministry of Environment, Forests and Climate Change (MoEFCC) is the nodal ministry for planning, promoting and coordinating environmental programmes including the management of chemical disasters in India. The Ministry is mandated to protect the land, air and water systems and is responsible for the prevention and Control of pollution including hazardous substances. MoEFCC is the GEF and Stockholm Convention focal point in the country, which coordinates activities and cooperation between relevant stakeholders of the NIP.

The Ministry of Chemicals and Fertilizers (MoCF) is mandated to control the production and scaling up of alternatives to chemical pesticides. The Department of Chemicals and Petrochemicals of MoCF is entrusted with the responsibility of policy, planning, development and regulations of chemicals and petrochemicals. The public sector named HIL under the

MoCF is involved in the production, scaling up and setting up of the facility for industrial production of the alternatives, viz. production of synthetic pyrethroids, production of Long-Lasting Insecticidal Nets (LLINs), neem-based botanical pesticides and *Bti*-based biopesticides.

The MoH&FW mainly performs advisory role for matters related to public health including vector control programme in the country. The Ministry is responsible for the application, assessment and adoption of alternatives in public health activities; the State Health Departments coordinate and implement the project activities at the respective state level for the evaluation and assessment of newer alternatives to DDT in the field on the target pest; the National Centre for Vector Borne Disease Control (NCVBDC), National Institute of Malaria Research (NIMR) and the National Centre for Disease Control (NCDC) undertake activities at the national level and make recommendations on the newer alternatives for adoption at the country level.

The Central Pollution Control Board (CPCB) provides technical services to the Ministry of Environment, Forests and Climate Change of the provisions of the Environment (Protection) Act, 1986. Principal functions of the CPCB are a) to promote cleanliness of streams and wells in different areas of the States by prevention, Control and abatement of water pollution and b) to improve the quality of air and to prevent, Control or abate air pollution in the country. The United Nations Environment programme (UNEP) identified CPCB as executing agency for the project.

National Environmental Engineering Research Institute (NEERI), Nagpur is a constituent of Council of Scientific & Industrial Research (CSIR), New Delhi and has a nationwide presence with its five zonal laboratories at Chennai, Delhi, Hyderabad, Kolkata and Mumbai. NEERI is engaged in the research and development of better and scientific solid waste management practices, for more than four decades. It has research and development thrust areas viz. Environmental Health and Environmental Impact & Risk Assessment, etc. As CSIR-NEERI is endorsed as a Stockholm Convention Regional Centre (SCRC) on Persistent Organic Pollutants (POPs), it has been identified for implementing the components IV and V of the project. Accordingly, CPCB, the executing agency (EA) sub-contracted the project to the CSIR-NEERI, Nagpur.

2.0 Training Objectives

At the end of the training programme, the participants should be trained to:

- Describe the vectors and their role in Vector-Borne Diseases, the basic information about vector-borne diseases, how vector-borne diseases are transmitted, transmission cycle for respective vector-borne diseases and global distribution as well as the burden of the diseases in India.
- Define the vector, describe the morphological characteristics of adult and immature stages of mosquitoes and about the biology and ecology of vectors.
- Promotions and development of locally safe, effective, affordable and environmentally sound alternatives to DDT, Environment management methods for vector control: Biological control methods, Genetic control methods, Control of vectors by chemical, non-chemical methods, Natural and conventional vector control management strategies.
- Learn the role of Integrated Vector and Pest Management (IVPM), describe different control measures used to control vectors and pests, learn organization and management of IVM in different sectors including FFS and how IVM improves the awareness in the community through BCC.

3.0 Training Programme

This training programme was conducted for 05 days from 30/05/2022 to 03/06/2022, the total number of the training sessions was 05 and each session has 9-14 training parts. 45 participants from Madhya Pradesh were selected including SPOs, DMOs, State Entomologists and DVBDC participated in the training programme. Dr. L. J. Kanhekar, Project Consultant, coordinated all the training sessions. The training content covered from Training module-1: DDT and Vector-borne disease, Training module-2: Vector morphology and bionomics, Training module-3: Alternatives to DDT in vector control management, and Training module-4: Integrated vector and pest management developed by CSIR-NEERI under the project "Development and promotion of non-POPs alternatives to DDT."

4.0 Training programme- Inaugural Function

Inaugural function of the 9th offline training for Training of Trainers (ToTs-SPO/Entomologists, and VBD Consultants from Madhya Pradesh State) and pilot testing of modules to promote non-POPs alternatives based Integrated Vector and Pest Management was held on 30th May 2022, in Bhopal at Hotel Amer Palace, MP Nagar between 09:30 am to 10:00 am by Chemical and Hazardous Waste Management Division (CHWMD), CSIR-NEERI, Nagpur. **Dr. A. Ramesh Kumar** (Project Leader and Senior Scientist, CHWMD) gave a brief

regarding training and introduced **Dr. Santosh Jain** (Chief Guest), Addl. Director, DHS, Bhopal; **Dr. M. P. Patil,** Chief Scientist and Head, CHWMD, CSIR-NEERI; **Dr. P. T. Joshi,** Former Gujarat State Entomologist; **Dr. L. J. Kanhekar**, Project Consultant, CSIR-NEERI; **Dr. J. C. Paliwal,** Former State Entomologist, MP & Faculty Member; all the participant trainees and requested **Dr. M. P. Patil** to welcome the chief guest and participants and give their opening remarks on behalf of **Dr. A. N. Vaidya**, Director, CSIR-NEERI. **Dr. M. P. Patil** briefly introduced this training of trainers and pilot testing of modules to promote non-Persistent Organic Pollutants (PoPs) alternative to DDT. He also discussed the Stockholm Convention (SC)- International treaty that works for protection of human health and environment from harmful effects of PoPs and Government of India is a signatory to this convention. One of the top priorities identified under this convention is the project entitled 'Development & promotion of non-PoPs alternative to DDT', which is jointly developed by UNEP & UNIDO, other key stakeholders in this project are MoEF&CC, Ministry of Chemicals and Fertilizers, Ministry of Health and Family Welfare etc. There are five major components under this project which includes: 1) Legislation, policy framework and institutional capacity (UNEP); 2) Alternatives to vector control (UNIDO); 3) Promotion and propagation of new cultivars of Neem (UNIDO); 4) Development and Promotion of Integrated Vector Pest Management (IVPM) and 5) Monitoring and evaluation of results (UNIDO / UNEP). CSIR-NEERI working on components 4 & 5 of this project. CSIR-NEERI has developed four training modules and several training materials for pilot testing & capacity building of state vector control officials. CSIR-NEERI is required to conduct a total of 10 training programmes. So far, NEERI has completed 8 training programmes via online mode due to COVID-19 restrictions and this is 9th training programme in offline mode. In all the training programme CSIR-NEERI emphasised that it should be an interactive programme rather than conventional training programme. This interaction of the participants with a subject expert will help us to continuously improve the training modules which will be further used by the trainers for training various stakeholders dealing with control of VBDs in the country. He requested to participant trainees to forward valuable interaction with experts to further improve the training modules and welcomed all the guests and participant trainees.

Dr. P.T. Joshi, Former Gujarat State Entomologist and Guest of Honour addressed all the participant trainees and express his deep gratitude for being part of such a great learning programme. He also gave a brief introduction of this training programme and its importance for minimizing DDT reliance and malaria eradication & other vector borne diseases. As this is

pilot testing, feedback and suggestion from the participants will be vital to make these modules more informative. At the end, he thanked and gave best wishes to all the participants in this training programme.

Dr. Himanshu Jayswar, Deputy Director (NVBDCP & SPO), DHS, MP welcomed all the participant trainees from MP State and gave an introduction about this training of trainers (ToT) & pilot testing of modules to promote non-POPs alternatives based on Integrated Vector Pest Management. This training programme should be an interactive programme rather than conventional training programme. This interaction of the participants with a subject expert will help to improve the training modules which will be further used by the trainers for training various stakeholders dealing with control of VBDs not in the State but also across the country. He thanked CSIR-NEERI team for organising such an important training programme and conveyed best wishes to all the participant trainees for this training programme.

Dr. Santosh Jain (Chief Guest), Addl. Director, DHS, Bhopal, has inaugurated this training programme by releasing the training modules to promote non-POPs alternatives based on IVPM. He welcomed all the participant trainees (DMOs/Consultants/ Entomologists) from Madhya Pradesh State. He also welcomed all the subject experts and CSIR-NEERI team to organised an important training programme. He also discussed about DDT used for Vector Borne Disease control and its long-term harmful effects on environment as well as on human. It is very important to start looking for alternatives to DDT.

Exhibit-1: Release of training modules

As this is pilot testing, feedback and suggestion from the all the trainees will be vital. Because this training will let the DMOs/SPO/ VBD consultants/ Entomologists to work in the field, what difficulties and challenges they will face, based on inputs & comments provided by them

will help to finalize the modules and release these modules for the greater benefit not only confined to State but across the country as well (**Exhibit-1**). At the end, he congratulates and wishes to all the participants for the success of the training programme.

Before proceeding to vote of thanks, **Dr. A. Ramesh Kumar** (Project Leader and Senior Scientist, CHWMD) on behalf of CSIR-NEERI has expressed his gratitude and presented a memento to the chief guest and other dignitaries. **Dr. L. J. Kanhekar** proposed the vote of thanks at the end of the Inaugural function and expected cooperation during the training period.

Exhibit-2.- Inaugural Session

5.0 Training sessions

The total training sessions were 5 including field visit, each session covered 9-14 parts and each part was conducted for approximately 30-40 minutes, the time was managed depending on a questionary discussion at end of the session. Every session from 30th May 2022 to 3rd June 2022 was conducted from 09.30 AM to 05.30 PM and on 2nd June 2022 field visit has been made from 08.00 AM to 01.00 PM

5.1 Training session-1 (Day -1: Monday - 30/05/2022)

Training part - 1: Introduction to Modules 1 to 4

Dr. L. J. Kanhekar introduced the training modules 1-4 with specific titles to each module and their content in detail. He informed that training modules were made available to all the participants and same in form of booklets also, PPT on each module, IEC materials, awareness brochures and FAQ. He deliberated the focus of CSIR-NEERI to develop these training modules for pilot testing of these training modules (1-4). Under the training programme on Integrated Vector and Pest Management (IVPM) module No. 1 is dedicated to Vector-Borne

Diseases and non-insect borne diseases, module 2 is dedicated to vector morphology and bionomics, module 3 is dedicated to alternatives to DDT in vector control management and module 4 is dedicated to integrated vector & pest management. He requested to all the participants to provide suggestions/ comments and on how to make these training modules more usable/ effective.

Facsimile of Training Modules 1 to 4

Training part - 2: Introduction to DDT and its use in vector control

Dr. A. Ramesh Kumar briefly explained this GEF funded project 'Development & promotion of non-PoPs alternative to DDT' & its five components and the role of CSIR-NEERI in implementing two of the five components. During his training session the contents covered an introduction regarding Stockholm convention on PoPs, what is DDT, its structure; physicochemical and its current production status and usage in vector control management (Technical grade DDT 50 % for use in India and DDT 75% for export purposes mostly African countries). Why DDT needs phase-out; Monitoring study of DDT concentration in Human milk; WHO action plan for the reduction of dependence on DDT in disease vector control; Overview of Stakeholders; Current scenario of DDT production and use in India, State-wise consumption of DDT (2019-2020); Development and promotion of non-PoPs alternatives to DDT and alternatives to chemical pesticides in vector control were discussed.

Training part - 3: Entomological and epidemiological situation in Madhya Pradesh

Dr. Satyendra Pandey, State Consultant Entomologist presented entomological and epidemiological situation in Madhya Pradesh with vector control measures and use of DDT. State of Madhya Pradesh has achieved API Below 1 (one) in all the districts during the year 2021, only 3181 Malaria positive cases reported. State has achieved continuous decreases in malaria cases since the year 2015 to 2021 and qualified under Category 1 in the year 2021 as per NFME 2016-2030 while state included under category 3 during 2015. GoI awarded to MP for their achievement under Malaria Elimination activities on the occasion of World Malaria Day (25th April 2021) at Delhi. Madhya Pradesh continuously conducted vector control activities as per NCVBDC, GoI Guidelines including LLIN distribution, IRS, Anti larval activities, biological control methods, Indoor Space Sprays, fogging operations and other activities as per the need of the areas. IRS activities planned and conducted during the year 2021 in 22 districts from which 19 districts with Alphacypermethrin 5% WP (about 9.43 MT used) and only 3 districts with DDT 50% WP (about 6.20 MT used).The entomological studies carried out and the prevalence of *An. culicifacies, An. fluviatilis, An. stephensi Aedes aegypti, Cx. tritaeniorhynchus* and *Cx. quinquefasciatus* vector mosquitoes were noted from Madhya Pradesh for VBDs viz. Malaria, Dengue, Chikungunya, Zika, Japanese Encephalitis and Filaria.

Training part - 4: Introduction to vector borne diseases: Malaria

Dr. L. J. Kanhekar has deliberated this training session, a brief introduction about the vector borne disease: Malaria and its impact. Causative agents of Malaria: *Plasmodium* Parasite (*P.*

falciparum, P. vivax, P. ovale, P. malariae) & its life cycle: Asexual & Sexual cycle; transmission of malaria; Vectors: Female *Anopheles* Mosquitoes (globally more than 70 vectors recorded out of which 9 in India (6- primary & 3- secondary vectors); Host: Human; Current status according to National Strategic Plan: Malaria elimination mode supported by organisation like NCVBDC, NCDC, NIMR etc., as per National framework for malaria elimination cases has been gradually decreasing from 2006 to 2020 approx. 70% decline, Global disease burden and burden in India. He deliberated regarding WHO documentation on Malaria elimination framework for Urban areas.

Training part - 5: Morphology and Bionomics of Vector Mosquitoes

Dr. J. C. Paliwal, Former State Entomologist MP has deliberated in this training part, Introduction to mosquito vectors: *Anopheles, Culex, Aedes* and *Mansonia* spp.; Classification of mosquitos; Morphological characters of mosquitoes. He gave a brief lecture on vectors of malaria: *Anopheles* mosquito (*Anopheles culicifacies, An. stephensi, An. fluviatilis, An. minimus, An. dirus (baimai), An. epiroticus*); Morphological characters, classification (egg, larva, pupa and adult), vector biology (life cycle of vector mosquitoes) and ecology (Distribution, breeding places etc.); Vectors of lymphatic filariasis (LF) and Japanese Encephalitis (JE): Introduction on *Culex* spp. Most important vector of LF and arboviral disease such as JE, Culex vector; External morphology- Adult, egg, larvae, pupa; Vector of Brugian filariasis transmitted by *Mansonia* Mosquito & its external morphology (egg, larva, pupa, adult); Vector biology and ecology; Vectors of Dengue, Chikungunya, and Zika: Introduction; External morphology of vector; Vector biology and ecology: two medically important species *viz. Aedes aegypti* & *Ae. albopictus*; Introduction to bionomics of vector mosquitoes (feeding, resting, biting habits, breeding, distribution, site of transmission (intra, peri, extra, domiciliary sites), gonotrophic cycle, insecticide resistance; Eco-Epidemiological aspects: - Entomological factors (Vector density, frequency of biting man, longevity) & Environmental factors (Temperature, Relative humidity, Rainfall).

Training part-6: Introduction to vector borne diseases: Japanese Encephalitis

Dr. P.T. Joshi deliberated on learning objectives of training module-1, a brief explanation about the introduction of Japanese Encephalitis, Causative agents: a virus (Flavivirus); J.E. vectors in India: *Culex tritaeniorhyncus, Cx. vishnui* etc.); Signs & symptoms (According to WHO, a headache, high fever, tremors, nausea, vomiting); Key players in JE transmission: Environment, Vector-Agent, Host (amplifying): primarily animal (Pig), Host carrier: birds & human incidentally; Transmission Cycle of J.E. Virus (Natural transmission, horizontal &

vertical transmission); Epidemiology: Epidemic patterns & Endemic patterns; Burden in India (JE endemic states, JE cases & deaths) and global disease burden; Prevention & Control were also discussed.

Training part - 7: Morphology and Bionomics of Flea and Flies

Dr. J. C. Paliwal, Former State Entomologist MP also deliberated a lecture on morphology and bionomics of Fleas & Flies. He briefly explained about fleas, about 2500 species in about 220 genera, 37 species known to occur in India; *Xenopsylla spp.* Medically important flea (vector of plague and murine typhus); classification and external morphology; Difference between male & female vector; Bionomics of Fleas: Life cycle- Egg, Larva, Pupa and Adult. He also deliberated about vector of enteric diseases: introduction on House Fly (*Musca domestica*), can be a vector of Helminths, faecal bacteria, protozoan & viruses resulting in the spread of enteric diseases- gastrointestinal tract; classification of House fly: 4200 species, 190 genera, almost 70 species of house flies belonging to genus Musca; morphology of the house fly and its life cycle: Egg, Larva (Maggot), Puparium & Adult House fly and its breeding places were discussed.

Training part-8: Introduction to vector borne disease: Leishmaniasis (Kala-azar) and Morphology and bionomics of Sandflies.

Dr. Vijay Kumar (Consultant ICMR) gave a brief introduction of Leishmaniasis (Kala-azar) and its causes: Cutaneous Leishmaniasis, Mucocutaneous Leishmaniasis and Visceral Leishmaniasis & post kala azar dermal leishmaniasis (PKDL); Causative agent: Protozoa Leishmaniasis (*L. donovani*- in India only, *L. infantum* and *L. chagasi*); Vector: only sand fly vector of kala-azar in India *Phlebotomus argentipes*; Life cycle within human (Amastigote) and Sand fly (Promastigate/ flagellate), Environment factors: altitude, season, rural areas, development projects; Burden in India and global burden.

Training part-9: Introduction to Chandipura Virus (CHPV)

Based on the previous online training one chapter on Chandipura Virus has been introduced and Dr. P T Joshi has deliberated this training part with a brief introduction on Chandipura virus (CHPV) with its prevalence in India and at global level. Chandipura virus belongs to the genus Vesiculovirus placed in the order of Mononegavirales of Rhabdoviridae family. The vector is female sandfly,*Phlebatomus papatasi*. He deliberated on outbreaks of Chandipura virus infection, isolation of CHPV, its transmission and clinical features.

Training part-10: Morphology and bionomics of Sandflies.

Dr. Vijay Kumar also deliberated this training session with a brief introduction of vector of kala-azar/ Leishmaniasis disease: Causative agent: protozoan parasite; *Phlebotomus argentipes* only known vector of visceral leishmaniasis or kala-azar in India and *Phlebotomus papatasi*- vector of cutaneous leishmaniasis for human; Classification of Sand Fly; External morphology; Vector biology: complete life cycle of sand fly; Vector ecology: Distribution, Breeding places, resting habits, feeding habit, biting habit, flight range.

5.2 Training session-2 (Day-2: Tuesday- 31/05/2022)

Training part-1: Introduction to vector borne disease: Crimean Congo Haemorrhagic Fever (CCHF)

On the second day, **Dr. P T Joshi**, has deliberated with a brief introduction about CCHF, History of CCHF; Causative agent (*Nairovirus* of the family Bunyaviridae and vector- *Hyalomma* ticks), Transmission (Transovarial and Transstadial transmission), Epidemiology and major risks factors; Major outbreaks in India and extensive global geographic distribution. Tick spp *H. anatolicum, H. asiaticum, H. dromedarii, H. impeltatum, H. marginatum, H. rufipes, H. truncatum, H. turanicum* are recognised as potential vectors to acquire, maintain and transmission of CCHFV; Virus incrimination from ticks; Clinical manifestation & Symptoms, diagnosis, and treatment; Controlling CCHF in animals & ticks, Insecticide recommended for the control of ticks (Malathion, Dichlorvos, Carbaryl etc.); Reducing the risk of tick to human transmission, animal to human transmission, human to human transmission.

Training part - 2: Introduction to vector borne disease: Lymphatic Filariasis

Dr. P. K. Srivastava, Former Jt. Director, NCVBDC deliberated on introduction to Lymphatic Filariasis, its causative agent, microfilarial periodicity, human filarial parasites, transmission cycle (in human and mosquito body), external morphology of the vector (egg, larva, pupa and adult), vector biology and ecology, resting and feeding habitats of the vector, its flight range and breeding places. He also discussed national and global burden of Filariasis, its history in India, salient features of the vector life cycle, elimination of Lymphatic Filariasis, Species of filarial infections prevalent in India, current status of Lymphatic Filariasis in India, difference in *W. bancrofti* and *B. malayi* species, Filariasis disease manifestation (acute & chronic), paradigm shift in LF control, elimination strategy: 1997 and guidelines about elimination of Lymphatic Filariasis in India

Training part –3: Introduction to vector borne disease: Scrub Typhus

Dr. L J Kanhekar, has deliberated a lecture on Section-9 (Scrub Typhus) of Chapter-2 of Training module-1. Brief introduction of Scrub typhus: History; Causative agent: a gram-

negative, obligate intracellular bacterium *Orientia*; Vector: Mites genus- *Leptotrombidium diliense*; Sign & symptoms; Diagnosis & treatment: diagnosis bases on bacterial culture, serology, molecular methods-rapid ICT, ELISA, PCR test, Antibiotics such as Azithromycin, Doxycycline are prescribed drugs & other effective drugs: chloramphenicol and tetracycline; Transmission: Trans-stadial and trans-ovarial transmission; Epidemiology & control; prevention & control using topical application of DMP, DEET etc. Burden in India and global disease burden. A brief on life cycle of mites also discussed.

Training part-4: Vector Control measures/ management: Chemical Method

This training part was introduced by **Dr. P. K. Srivastava**, the contents covered were an introduction of chemical control methods in vector control: Plant products including pyrethrum, neem derived products, synthetic chemicals and its classification (organophosphorus, synthetic pyrethroids and carbamates etc.), Larval source management: Mosquito Larvicidal Oils (MLOs), Temephos 50% EC, Insect growth regulators (IGRs)- Pyriproxyfen 0.5% & Diflubenzuron 25% WP Adult Vector Control: Indoor residual spray (DDT 50%, Malathion 25% and Synthetic pyrethroid (SP)- Deltamethrin 2.5% WP, cyfluthrin 10% WP, lambda cyhalothrin 10% WP, and alphacypermethrin 5% WP); Long Lasting Insecticidal Nets (LLINs); Indoor space spray: outside fogging (thermal fogs or cold fogs); Preparation of ready to use suspension & application of insecticides for IRS (NVBDCP).

Training part - 5: Introduction to vector borne disease: Plague

Dr. P T Joshi gave a brief Introduction about vector borne diseases: Plague; Causative agent: *Yersinia pestis*- Gram -ve bacteria); Vectors: *Xenopsylla cheopis, X. brasiliensis*; Reservoirs: *Tatera indica, Bandicota bengalensis*; Susceptible hosts: *Rattus rattus, Mus musculus, Bandicota indica*; History; Transmission cycle; its current global status and types of plague (Bubonic plague, Pneumonic plague, Septicemic plague). He also deliberated on current status of plague in India, cases and deaths, plague surveillance network (Rodent, Blood, Organ, Dog sera, Human blood), fleas; surveillance methodology (bacteriology, Serology, molecular & entomological), surveillance-investigation of seas and airports and endemic plague foci in India (1951), treatment, vector control, etc. were discussed.

Training part - 6: Integrated Vector Pest Management: IPM

Dr. P. K. Srivastava, deliberated this training part with a brief introduction about IVPM: IPM (agricultural sectors) & IVM (VBDs control programme)- knowledge about vectors, diseases

& disease determinants; Integrated pest control measures: Biological, Cultural, Chemical, Mechanical & Physical Control; IPM implementation Programme consists suppression of harmful organisms, Monitoring, Adequate decision-making, non-chemical plant protection measures, specific pesticides and evaluation.

Training part –7: IVPM- Behaviour Change Communication (BCC)

Dr. J. C. Paliwal, Former State Entomologist M.P. has deliberated this training session, a brief introduction about Behavioural Change Communication- IEC strategies: IPC between community & Health workers, Social & Community; Objective of BCC; Outcomes of interventions, knowledge & skills, behaviour & activities, Impact- control of vector density & disease; Tools of BCC: Media Information (Radio/ TV Broadcast), Education & Communication, Communication for behavioural impact, and Farmer Field schools; Accredited Social Health Activist (ASHA) trained under National Health Mission (NHM); Multipurpose Health Workers (MPHW)- various kinds of IEC materials like posters, stickers, pamphlets, key materials- prepared to be displayed for BCC & IEC (preferably in local languages).

Training part - 8: Integrated vector pest management: IVM- Integrated vector control methods and IVM in different situations

This training session was covered by **Dr. P.T. Joshi**, lecture started with the basic introduction of VBDs in India, integrated vector and pest management. The main content covered was IVPM basics, fine key elements of IVM, methods of IVM, vector bionomics of IVM. Integrated vector control methods: environmental management (modification, manipulation and changes to human habitation (or) behaviour, personal protection (protective clothing, repellents, installation of vaporization), larval source management (chemical control- larvicides (dosage & formulation), insect growth regulators, biological control (larvivores fish-Gambusia, Guppy), IRS, LLINs, Spray formulation & dosage for impregnation of bed-nets. IVM in different situations: Epidemic and Endemic; Environmental Management, Anti-larval measures, adult control & personal protection; IVM epidemic preparedness and response for malaria- Rapid response team were discussed.

Training part - 9: Introduction to Kyasanur Forest Disease

Dr. L.J. Kanhekar gave a lecture on Kyasanur Forest Disease (KFD) with an Introduction to KFD; Symptoms and Clinical features, Host factors, Diagnosis; History; Transmission: trans

stadial mode (nymphal stage ticks), incubation period- 3 to 8 days; Transmission cycle of KFD; KFD virus ecology, Vector- ticks (*Haemophysalis spinigera* & *H. turturis*); Natural cycle of KFD: Egg→Larva→Nymph→Adult; Environmental factors increasing risks factor for KFD; Burden in India; Epizootiology of KFD in wild monkeys, amplifying host (*Semnopithecus entellus/ macaca radiata*), reservoirs: cattle, dogs & other domestic animals; Preventive protection measures & Control: advise not to go to the forest where monkey death reported, Hot spot spray- Malathion powder, use of tick repellent- DMP (dimethyl phthalate) oil, KFD vaccine; recent outbreaks of KFD were discussed.

Training Part- 10: Equipment for Larviciding and Adulticiding:

This training part was introduced by **Dr P.K. Srivastava** contents covered were equipment/ tools for Larvicide and Adulticide; Various tools have been currently in practices: 1. Knapsack Sprayer (larvicides); 2. Hand Compression pump- Standard equipment for residual spray (Both Adulticide & Larvicide); 3. Stirrup Pump; 4. Fogging Machines: a) Portable thermal fogging machine (PTFM), b) Ultra Low Volume (ULV); 5. Vehicle Mounted Fogging Machines: used in urban or sub-urban areas; 6. Vehicle Mounted Cold Fogging Machines were discussed

Exhibit-3: Photographs of Training session-2

Training part-11: Morphology and bionomics of Ticks and Mites

On the second day, **Dr. P T Joshi**, deliberated on Morphology and bionomics of Ticks and Mites. He introduced about Ticks and its classification; capable of transmitting diseases: mainly Crimean-Congo Hemorrhagic Fever (CCHF), Kyasanur Forest disease (KFD); Type of ticks: Soft ticks and Hard ticks; life span (soft ticks- 15 yrs & hard ticks- about 3 yrs.), Soft Ticks: Introduction; External morphology; Biology & Ecology- Life cycle of soft ticks: Eggs→Larvae (6 legged)→Nymph (8 legged)– 4 instar→Adult; Population depends on various factors: climate, hosts, predators & competitors; Hard ticks (Ixodid); External Morphology; Life cycle of hard ticks: Eggs→Larvae (6 legged)→Nymph (8 legged)→Adult (life span- about 3 years); Introduction of Mites and its Classification; Life span, transmits Rickettsial Pox, Scrub Typhus, Dermatoses, chiggers and scabies; External morphology; *Leptotrombidium* (vector of Scrub Typhus) is medically important species. Biology and Ecology of Mites; Life cycle: Egg→Larva (Pre-larva)→Nymph- 3 instar→Adult; Collection of soft ticks (direct mechanical methods, vacuum collection & CO_2 traps), hard ticks (passive, systematic & special collection) & mites (Sherman trap) and their Identification. (**Exhibit-3**).

5.3 Training session-3 (Day-3: Wednesday- 01/06/2022)

Training part - 1: Alternatives to DDT in vector control management: Conventional methods and Environment management.

Dr. R. S. Sharma (Ex-Addl. Director, NCDC & NVBDCP) has deliberated on Introduction to Alternatives to DDT in vector control management; Learning Objectives; Vector Control Tools; NVBDCP vector management: Introduction to Environmental Management- personal protection, biological control, chemical control, legislative measures, health education etc.; Environmental Manipulation, Environmental Modification, Modification & manipulation of human habitation or behaviour; Types of Environmental manipulation: irrigation system, wet paddy cultivation, controlled vegetation, stream flushing, coastal flooding and impounding, physical alteration- man-made breeding sites; Types of Environmental Modification: Impoundments, irrigation, natural stream, drainage for agriculture and landfilling and grading; Introduction to Environment and Engineering methods; EMM Source reduction: *Ae. aegypti*, *An. stephensi*; EEM technology Irrigation malaria; Environmental approach to vector control pre DDT; Community based vector management; Vector control in tea garden Assam, Vector control in Delhi 1936-1940; EMM in Mumbai- Malaria control; Environmental control

Sabarmati River's changing scenirio, Genesis of EEM in India; Risk factor Urbanization, Construction activities, Outbreak of Malaria (2010) were discussed

Training Part- 2: VBD: Launch of Anti-Malaria Month Campaign Dr. Himanshu Jayswar, SPO, MP

The launch of Anti-Malaria month Campaign (1st June 2022) was organised during this training programme, which was launched by Dr. Himanshu Jayswar, SPO, M.P., Dr. R.S. Sharma, Dr. Y.P. Ramdev, Dr. P.K. Srivastava, Dr. Himmat Singh, Officials from VBDCP, District Malaria Office, Bhopal and DMO/ Entomologists/ Consultant from MP State. The main motto of the campaign is to make the district as well as the state free from Malaria. DMO/Entomologists/Consultants working in this field shall know what will be their duties/ responsibilities, what they want to do in future and what services they provide to create awareness in the society in the Malaria eradication programme (**Exhibit- 4**).

Exhibit-4: Anti-Malaria Campaign on 01 June 2022

Training part -3: Entomological surveillance of VBDs and its importance

Dr. Himmat Singh, Sc.'D' ICMR-NIMR has deliberated about training module- 4: Integrated Vector and Pest Management (IVPM). During his lecture he covered topics such as Entomological Surveillance of VBD's & its key elements: Introduction to Entomological Surveillance; Methods: detection & monitoring of larval and adult population- Collection of Adult mosquito, Larval collection & Eggs; Methods- Qualitative and Quantitative; Vector Traps for disease surveillance & Surveillance tools; Sampling methods of larval collection- Netting method (surface collection), Dipping method; Siphoning method (Tree hole), well net collection, Larva collection by dropper/ pipettes were discussed.

Training part - 4: Monitoring and evaluation of IVPM

This training part was covered by **Dr. P.K. Srivastava** with a brief introduction on Monitoring and evaluation of IVPM: Methods, Outcome indicators: Planning and implementation, Organization and management (Within health sector); Behavioral Changing Communication;

Entomological surveillance; Insecticide resistance monitoring through susceptibility test, Surveillance of dengue/ malaria vector; Entomological survey of Lymphatic Filariasis Epidemiological surveillance: Incidence, Prevalence; Epidemiological parameters of malaria (API, ABER, AfI & SPR) and Epidemiological parameters of Filariasis (Microfilaria rate, Microfilaria density & Filarial endemicity rate) were discussed (**Exhibit-5**).

Training part-5: Introduction to vector borne diseases: Dengue, Chikungunya and Zika

This training part was covered by **Dr. Himmat Singh** deliberated on content covered under learning objectives of training module-1, brief explanation about the introduction of VBD's like Dengue, Chikungunya and Zika; what is Dengue? It's form (Dengue fever and severe dengue), Sign and symptoms; Causative agent: Flavivirus (Four strain- DEN-1, DEN-2, DEN-3 & DEN-4); Vector: *Aedes* Mosquitoes (Primary- *aegypti* & Secondary- *albopictus*); Transmission cycle of Dengue: Forest/Enzootic, Rural/Epidemic & Urban/Endemic/Epidemic; Burden in India and global burden. Introduction to Chikungunya & its symptoms: fever, chills, headache, nausea, vomiting, severe joint pain, rashes; Causative agent: Alphavirus; Vectors: *Aedes* Mosquitoes (*aegypti, albopictus*); Transmission cycle of Chikungunya: Sylvatic CHIKV transmission and Urban CHIKV transmission; Burden in India and global burden.

Introduction to Zika, History: 1st isolated in 1947 from a rhesus monkey in Kampala, Uganda from *Aedes africanus* mosquitoes and its sign & symptoms: high fever, Malaise, stomach ache, Diarrhoea, conjunctivitis, Dizziness, Anorexia; Causative agents.

Training part -6: Vector control measures/ management: Chemical Control

This training part was introduced by **Dr. R S Sharma**, the contents covered were an introduction of chemical control methods: Plant products including pyrethrum, neem derived products, synthetic chemicals and its classification (organophosphorus, organochlorine, synthetic pyrethroids and carbamates), Larval source management: Mosquito Larvicidal Oils (MLOs), Temephos 50% EC, Insect growth regulators (IGRs)- Pyriproxyfen 0.5% & Diflubenzuron 25% WP; Dosage & formulation of different chemical larvicide (NVBDCP); Adult Vector Control: Indoor residual spray (DDT 50%, Malathion 25% and Synthetic pyrethroid (SP)- Deltamethrin 2.5% WP, cyfluthrin 10% WP, lambda-cyhalothrin 10% WP, and alphacypermethrin 5% WP); Long Lasting Insecticidal Nets (LLINs); Indoor space spray: outside fogging (thermal fogs or cold fogs); Preparation of ready to use suspension & application of insecticides for IRS (NVBDCP).

Training part -7: Entomological parameters and its importance

Dr Himmat Singh briefed on introduction about Entomological parameters and their importance: Adult vector parameter; Entomological Indices: Malaria vector density; Vector incrimination; Mosquito life expectancy (longevity) etc.; Flea: Total flea index, percentage of hosts infested, Burrow index; Larval Survey: Indicator (Density of immatures), larval density, Pupal density; Dengue Larval survey- a) House Index, b) Container Index, c) Breteau Index, d) Pupae Index; Entomological Survey of Lymphatic Filariasis: Ten Man-hour Vector density, infectivity rate, infection rate, mean number of L3/infective mosquito) were discussed (**Exhibit-5**).

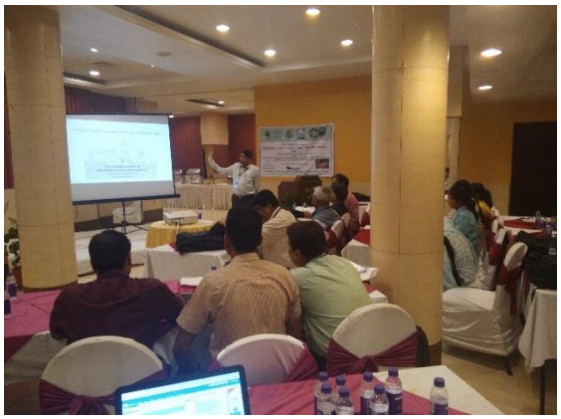


Exhibit-5: Lecture/Discussion on Training part-5

Training part - 8: Alternatives to DDT: LLIN, Biolarvicides & Neem derived products for vector control (UNIDO Project)

Dr. Y. P. Ramdev, National Technical Advisor, UNIDO covered this training part, he gave some introduction about UNIDO, an alternative to DDT in vector control, and in this training part, content covered was an introduction of neem, DDT, Stockholm convention on POPs, the status of ratification, DDT application, rational pesticide use (RPU), effective pesticide application (coverage, dosage and timing), droplet size, droplet density, spray retention, the contact angle of a droplet, concentration organism susceptibility, dosage temperature, humidity, air velocity. Application inefficiency existing strategy: adulticide-IRS, national implementation of suitable alternative products, methods and strategies. He also deliberated on introduction about non-POPs alternative to DDT: Problem associated with use of Synthetic Pesticide; Promote effective alternatives to DDT and synthetic pesticides: Neem (*Azadirachta spp.*) & *Bacillus thuringiensis* (Bt) as Bio-botanical pesticides; Objective of the Project; Mosquito Life Cycle; He also discussed progress made in project: Neem based formulations developed and process standardized for pilot plant production: 1. Process for coil formulation;

2. Process for Cream formulation; 3. Process for Suspension Concentrates formulation; 4. Process for spreading oil formulation; 5. Process for Tablet production; Bio-efficacy of neem-based Spreading formulation/ SC/Tablets/Cream; Technology, Transfer & Training; Bacillus thuringiensis (Bt) based formulation (**Exhibit-6**).

Training part - 9: Alternatives to DDT: Manufacturing, marketing and distribution-LLIN, Bio larvicides & Neem derived products for vector control.

This training part was deliberated by **Dr. Rajendra Thapar,** Manager, HIL (India) Ltd., with a brief introduction about HIL (India) Ltd. Business segment expansion in various sectors (Public health, agrochemicals, Fertilizers, seed etc.); HIL contribution in DDT phasing out as part of DDT alternative project; Agreement between UNIDO-HIL in 2015 to develop locally appropriate cost-effective and sustainable alternatives to DDT (LLIN, *Bti* based Biolarvicides & Neem derived products); Present status of HIL in production of DDT alternatives (**Exhibit-6**).

Training part - 10: IVPM: Vector management through Farmer Field School (FFS) approach

This training part under the integrated vector and pest management (IVPM), was covered by **Dr. R.S. Sharma**, content covered was background, rational and concept of FFS in IVPM. He gave training to trainees about how to implement FFS in the public health and agricultural community. Farmer Field School (FFS): Evolution of the farmer field school approach, integrated production and management through FFS, vector and VBDs management through FFS, farmers health risks associated with agriculture in India. Role of FFS at the field level for increasing continued monitoring and evaluation to reduce the vector and pest population. Management of mosquito breeding in rice field through FFS (Sri-Lanka). He also suggested FFS is a very important part in Integrated vector and pest management in the community.

Training part - 11: NVBDCP Recommended insecticide: Larval source management and adult vector control

This training part was covered by **Dr. P.K. Srivastava,** the contents covered were introduction of larval source management and NVBDCP recommended insecticide, importance of larval source management, methods of larval source management, Mosquito Larvicidal Oil (MLO), Temephos 50% EC, insect growth regulators (IGR) including pyriproxyfen 0.5% and Diflubenzuron 25% WP. He also deliberated a lecture on adult vector control: adulticides;

LLINs; adult vector control (outbreak condition)- indoor space spray, outdoor fogging; preparation and application of ready to use suspension (insecticides).

Training part - 12: Planning & Implementation of IVPM

In this session, **Dr. R.S. Sharma** discussed about Planning & Implementation under IVPM: Learning objectives; Introduction to IVPM; Planning & implementation of vector control management (WHO)- Technical steps: 1. Disease situation: a) Epidemiological Assessment- Measures and Estimation of disease occurrence; b) Entomological assessment- Xeno-monitoring or xeno-surveillance; 2. Operational steps: a) Local determinants of disease: i) Parasite, ii) Vector, iii) Human activities & iv) Environment; b) Selection of vector control methods: Environmental, Mechanical, Biological and Chemical to reduce vector population or to reduce human vector contact; Need & resources; He also discussed roles of various sectors in IVM implementation strategy(**Exhibit-6**).

Exhibit-6: Lecture /Discussion on Day-3

Training part - 13: Methods of mosquito and its immature collection

In this session, Dr R S Sharma elaborated on adult mosquito collection in different terrain keeping in view abiotic factors. Dr P T Joshi explained aquatic collection in different types of

mosquito breeding places. Various types of equipment for collection, various types of breeding habitats, and the resting posture of mosquitoes were discussed. The session of day-3 was concluded with a memento present to the subject experts and other resource persons for their contribution during the training (**Exhibit-7**)

Exhibit-7: Memento presentation to experts/ resource persons

5.4 Training session-4 (Day-4: Thursday- 02/06/2022)

Training part - 1: Field visit to the locality to explore vector prevalence, demonstration of vector breeding and collection method

CSIR NEERI has organised a field visit for all participant trainees from Madhya Pradesh to the locality (Sair Sapata, Bhopal) to explore vector prevalence, demonstration of vector breeding and collection method (**Exhibit-8**). Apart from participant trainees, District Malaria officer team, SPO, and Subject experts (Dr. R.S. Sharma, Dr. P.T. Joshi and Dr. J.C. Paliwal) were also present. Participant trainees were divided into six teams and asked them to perform entomological surveillance (vector biology and vector ecology) such as breeding places/sites, biotic/abiotic factors etc keeping in view landscape. All teams were equipped with collection

tools (Ladle, Enamel bowl, Pipette, Larval vials, larval nets, Aspirators, Torch, paper cups with nets covers, Cotton wool, a pencil, a notebook, a bag to put all material etc.).

Exhibit-8: Photographs of Field visit at Sair Sapata, Bhopal

Training part - 2: Legal perspective to the development of IVPM Training Materials

This training was deliberated by two legal associates namely **Ms. Fizza Zaidi** and **Ms. Mansi Bachani,** Enviro Legal Defence Firm (ELDF) on behalf of **Adv. Sanjay Upadhyay**, Supreme Court of India. She has started the session with an overview of four modules developed by CSIR-NEERI for implementation of IVPM programme under the GEF funded project on development and promotion of non- PoPs alternatives to DDT, which should conform to the law of the land (**Exhibit-9**). The legal chapter on Gap analysis and Action Plan covers the International Laws such as Stockholm Convention on PoPs as well as Insecticides Acts and Rules. National Implementation Plan for assistance and capacity building for the NVBDCP programme (MoEF&CC being a focal point for coordination w.r.t funds issued by Global Environment Facility and the Stockholm Convention). Aspects of Specific enviro legal laws that governs various alternatives to DDT: Under the Indian Constitution- threefold distribution of legislative power between the Union and the States: Article 246(3); Insecticide Act of 1968 (1971 Rules)- establishes Central Insecticide Board (CIB) and Registration Committee (RC) for facilitating better monitoring of insecticides (registration, toxicity, bio-efficacy, packaging/labelling standards, import, manufacture, sales and transportation of pesticide as well as insecticide); framework for control and prevention of pollution under the Environment Protection Act of 1986 (Air Pollution Act 1981); Ministry of Agriculture & Farmers Welfare (MoA&FW), the Coastal Regulation Zone notification, 2019; The River Ganga (Rejuvenation,

Protection and Management) Authorities Order, 2016; Land Acquisition, Rehabilitation, and Resettlement Act, 2013 and the Disaster Management Act, 2005 under environmental management methods for vector control management; *Bacillus Thuringensis* (Bt) and Bacillus species included in the schedule to the Insecticide Act, 1968- registration, grant of licenses, packaging, labelling, transport, disposal, storage and places; use of Larvivores/exotic fishes for vector management: WHO guidelines on 'use of Fish for Mosquito Control', 2003. Draft National Fisheries Policy 2020 exotic species of fishes, the Indian Fisheries Act, 1897 and the Wildlife (Protection) Act, 1972. Long Lasting Insecticide Nets (LLINs) one of the interventions of the WHO global strategy for malaria control, plant- based pesticides in food under the Food Safety and Standards (Contaminants, Toxins and Residues) Regulations, 2011; Bio-pesticides and Bio-fertilizers without inorganic chemicals comes under white category issued by the CPCB in 2016 for which no consent is required. For manufacturers of synthetic chemicals or LLINs firms need to require Consent to Establish and Consent to Operate under the Water (prevention and control of pollution) Act 1974 and the Air Act 1981. Environmental clearance prior to Establishment/ expansion of all manufacturing units is required under the Environment Protection Act 1986 (EIA notification 2006). Utilization of synthetic chemicals and organic chemicals for IVM leads to generation of waste which shall be disposed as per the Hazardous Waste and Management Rules of 2016 under the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and for LLINs disposal as per Plastic Waste Management Rule 2016; Use of Neem derived products under Plant Varieties and Farmers Right Act, 2001, the Essential Commodities Act, 1955 (neem as fertilizer), import of neem derived products under the Destructive and Pests Act, 1914 and certain states such as U.P., Tamil Nadu, A.P., Jharkhand, Odisha, Kerala have laws to regulate neem as raw material; Environmental modification and Environmental manipulation to prevent vector propagation and to reduce human vector contact can be practised under the Central Water Commission 2018; The Wetlands (Conservation and Management) Rules, 2017 under the E(P) Act 1986 for the conservation and use of wetlands; Changes to Human habitation and behaviour: The Ministry of Urban Development has issued Model Building Bye-Laws 2016, the Construction and Demolition Waste Management Rules, 2016 and the Solid Waste Management Rules, 2016.

Training part - 3: Vector control measures/ management: Biological and Genetic Control

Dr. L. J. Kanhekar, deliberated this training part and gave brief introduction about module-3: Alternatives to DDT in vector control measures/ management: Introduction to Biological

control- Different Biological agents used in vector control such as Flatworms, Fungi, Invertebrate Predators, Micro-organism: Bacteria and Larvivorous Fishes (*Gambusia affinis*, guppy *Poecilia reticulata*) etc.; NIMR– suitable fish species used in different mosquito breeding habitats; Desirable attributes of Bio-control agents and Advantages of Biological Control. He also gave brief Introduction to Genetic Control: Mutagenesis, trans-genesis– gene delivery, Cis-genesis– Gene transfer, Para-transgenesis; Sterile Insect Techniques; Population replacement using Wolbachia; Gene Silencing using RNA interference; other genetic approach: gene drive; Advantages & disadvantages of genetic control were discussed (**Exhibit-9**).

Training part - 4: Preparation of the field report

During this session, all the participant trainees were engaged in the preparation of the field report with the CSIR-NEERI team, Dr R S Sharma & P T Joshi (subject experts), SPO and DMO Bhopal.

Exhibit- 9: photographs of Training session – 4

5.5 Training session-5 (Day - 5: Friday- 03/06/2022)

Training part - 1: Epidemiological surveillance and parameters

Dr. R. S. Sharma briefly introduced about the IVPM: Epidemiological surveillance and parameters; To determine the incidence and prevalence (point and period) of all vector borne diseases; Epidemiological parameters of Malaria: Annual Parasite Index (API), Annual Blood Examination Rate (ABER), Annual *falcipuram* Incidence (AFI), Slide positivity rate (SPR);

Epidemiological parameters of filariasis: Microfilaria rate, Microfilaria density, Filarial endemicity rate were discussed.

Training Part 2: Presentation of the field report

During this training part **Dr. Satyendra Pandey**, DMO- Bhopal, and all participant trainees has given the presentation of the field report. Dr. Satyendra Pandey presented the field report which includes general topography of the site, biotic (cattle, water hyacinth) and abiotic factor (Temperature, Wind, humidity), Collection of Adult mosquitoes (2 mosquitoes of *Anopheles* species), Larval collection (*Culex* spp., *Anopheles* spp.), and some pupae also collected (*Culex* spp.); other breeding sources for mosquito were empty containers, tyres, tree holes etc. were seen and informed the Sair Sapata, Bhopal authority to made arrangement to remove those things from the site. He thanked to CSIR-NEERI team to organise such field visit for trainers to understand the vector prevalence, demonstration of vector breeding and collection method. He also suggested that regular field training shall be provided and make more efforts to distinguish *Aedes* and *Culex* spp. He also discussed importance of intersectoral coordination: BCC in the VBDs control.

Training Part 3: Pilot Testing of IEC materials

Dr. R.S. Sharma/ Dr. P T Joshi deliberated this training session, a brief introduction about Information, Education & Communication (IEC) materials and its importance for IVPM: IEC campaign/ IEC Operation/ Programme, it should be in a local language/ terminology so that people can cooperate, participate and perform various activities to be done at their home particularly concerned to vector borne diseases (VBDs); IEC materials provided in the form of posters, pamphlets, stickers etc. are of great importance for awareness programme. IEC material included following topics: Mosquito life cycle *Aedes*, *Anopheles*, *Culex*; Mosquito transmitted diseases; How to use insecticide treated nets (ITNs); Awareness on insecticide treated nets (ITNs), Malaria (No Mosquitoes- No Malaria); ways to prevent mosquito bite; Diseases caused by mosquito bite; Awareness poster (Let's prevent breeding of mosquitoes and protect public health diseases); Introduction, Vectors and its life cycle, Sign & Symptoms, breeding sites, Transmission, Transmission cycle, and preventative measures of VBDs (Malaria, Chikungunya, Dengue, Filaria, Japanese Encephalitis and Zika); Kyasanur Forest Disease: Introduction, Vectors and its life cycle, Sign & Symptoms, Transmission, Transmission cycle, and prevention. At the end of this session, **Dr. L J Kanhekar** requested participants trainee to provide inputs/ changes to make this IEC material more informative and helps people in the community to become aware about VBDs programme. Dr Gujju Gandhi,

Mr. Abhishekh Chaudhary and Mr. Ashlesh Katpatal facilitated and noted the suggestions for changes.

Training Part 4: Pilot Testing of FAQs materials/ Glossary of all modules

Dr. P T Joshi / Dr. L J Kanhekar deliberated this training session, a brief introduction about FAQs material and glossary on Vector Borne Diseases and asked the participant trainees (DMOs, SPO/entomologists/VBD consultants) from Madhya Pradesh state to provide inputs on FAQs material and Glossary of all modules.

Training Part 5: Feedback on Modules and training materials from trainees

This training part deliberated by **Dr. L. J. Kanhekar/Dr. Gujju Gandhi** for Feedback on Modules and training materials from trainees. He gave a brief introduction about all the four modules: Vector morphology and Bionomics and all the contents included in the training module. He asked the participants to give their valuable responses and inputs on the training module. Participants has raised queries, suggestions, and also healthy discussion on various topics of modules. **Dr. L.J. Kanhekar** asked all the participants to provide feedback via e-mail also, if any.

Training Part-6: Virtual valedictory session followed by group photo and certificates distribution

Dr. L.J. Kanhekar conducted a valedictory session followed by certificates distribution to all the participants trainees and a group photo and proposed the vote of thanks to all the participants and experts, thus summing-up the training programme. During this session all the participants were asked to give their opinions on the training programme by filling the feedback form provided to them (**Exhibit-10**).



Exhibit-10: Valedictory session training programme – 5

6.0 Annexures

6.1 List of organizing members

1. **Dr. A. N. Vaidya,**
   Director, CSIR – National Environmental Engineering Research Institute,
   Coordinator, Stockholm Convention Regional Centre, Nagpur

2. **Dr. M. P. Patil**
   Chief Scientist & HOD, Chemical and Hazardous Waste Management Division,
   CSIR – National Environmental Engineering Research Institute, Nagpur

3. **Dr. A. Ramesh Kumar**
   Sr. Scientist, (Project Investigator),
   Chemical and Hazardous Waste Management Division,
   CSIR – National Environmental Engineering Research Institute, Nagpur

4. **Dr. L. J. Kanhekar**
   Project Consultant & Training Coordinator,
   CSIR – National Environmental Engineering Research Institute, Nagpur

5. **Dr. Gujju Gandhi**
   Research Associate-II,
   CSIR – National Environmental Engineering Research Institute, Nagpur

6. **Mr. Abhishek Chaudhary**
   Project Associate-I,
   CSIR – National Environmental Engineering Research Institute, Nagpur

7. **Mr. Ashlesh Katpatal**
   Project Associate-I,
   CSIR – National Environmental Engineering Research Institute, Nagpur

6.2 List of faculties

1. **Dr. R. S. Sharma**
   Ex-Additional Director, National Centre for Disease Control

2. **Dr. P. K. Srivastava**
   Ex-Joint Director, National Vector Borne Disease Control Programme

3. **Dr. Y. P. Ramdev**
   National Technical Adviser,
   United Nations Industrial Development Organization

4. **Dr. Rajendra Thapar**

Manager, (Public Health & Export), HIL (India) Ltd

5. **Dr. Himmat Singh**
   Scientist – D, ICMR - National Institute of Malaria Research.

6. **Dr. Vijay Kumar**
   ICMR- Consultant, (Ex- Scientist E),
   ICMR-Rajendra Memorial Research Institute of Medical Sciences

7. **Dr. J. C. Paliwal**
   Former State Entomologist, Madhya Pradesh

8. **Dr. P. T. Joshi**
   Former State Entomologist, Gujarat state.

9. **Ms. Fizza Zaidi**
   Senior Associate, Enviro Legal Defence Firm (ELDF), New Delhi, India

10. **Ms. Manshi Bachani**
    Senior Associate**,** Enviro Legal Defence Firm (ELDF), New Delhi, India

6.3 List of nominated trainees

S. No	Names	Designation	Location
1	Dr. Himanshu Jayswar	Deputy Director (NVBDCP)	Bhopal
2	Dr. Man Mohan Mahulia	Entomologist, RD Bhopal	Bhopal
3	Shri C. S. Sharma	Entomologist, RD Indore	Indore
4	Mrs. Bhawna Dubey	State Consultant M & E	Bhopal
5	Dr. Satyendra Pande	State Entomologist	Bhopal
6	Mr. Praveen Tiwari	Consultant Vector Control	Bhopal
7	Premalata Dabi	DMO	Agarmalwa
8	Jagat Singh Kanesh	DMO	Alirajpur
9	Smt. Manisha Juneja	DMO	Balaghat
10	Abdul Vaism Sekh	DMO	Barwani
11	Jitendra Singh Rajput	DMO	Betul
12	Akhilesh Dubey	DMO	Bhopal
13	Devendra Bhalekar	DMO	Chhindwara
14	Yamini Silarpuria	DMO	Damoh
15	Rashmi Sharma	DMO	Dewas
16	Dharmendra jain	DMO	Dhar
17	Brijesh Kumar Patel	DMO	Dindori
18	Radha Chouhan	DMO	Harda
19	Arun Srivastava	DMO	Hosangabad
20	Daulat Patel	DMO	Indore
21	Shri Yogendra Singh	DMO	Jabalpur
22	D. S. Sisodiya	DMO	Jhabua
23	Smt. Shalini Namdeo	DMO	Katni
24	Karansingh Bhuria	DMO	Khandwa
25	Manoj Kumar Patidar	DMO	Kharegon
26	Ram Shankar Shahu	DMO	Mandla
27	Sadab Khan	VBD Consultant	Panna
28	Alpesh Kumar Bariya	DMO	Neemuch
29	Arunendra Pratapsingh	DMO	Panna
30	Priyamvada Gupta	DMO	Raisen
31	Durga Prasad Patel	DMO	Rajgarh
32	Pramod Kumar Prajapati	DVBDC	Ratlam
33	Smrita Namdeo	DMO	Rewa
34	Sheela Sonkar	DMO	Satna
35	Kshama Barvey	DMO	Sehore
36	Ramji Bhalawavi	DMO	Seoni
37	Shiv Shankar Shukla	DVBDC	Shahod
38	R. S. Jatav	DMO	Shajapur
39	Kirat Singh Kawache	DVBDC	Sheopur
40	Mr. Rajesh Verma	DVBDC	Shivpuri
41	Hari Om Singh	DMO	Sidhi
42	Nagendra Singh	DMO	Singrauli
43	Hari Mohan Rawat	DMO	Tikamgarh
44	Ravi Sahu	DVBDC	Umaria
45	B. M. Varma	DMO	Vidisha

6.4. List of Attended trainees

S. No	Names	Designation	Location
1	Dr. Himanshu Jayswar	Deputy Director (NVBDCP)	Bhopal
2	Dr. Man Mohan Mahulia	Entomologist, RD Bhopal	Bhopal
3	Shri C. S. Sharma	Entomologist, RD Indore	Indore
4	Mrs. Bhawna Dubey	State Consultant M & E	Bhopal
5	Dr. Satyendra Pande	State Entomologist	Bhopal
6	Mr. Praveen Tiwari	Consultant Vector Control	Bhopal
7	Premalata Dabi	DMO	Agarmalwa
8	Jagat Singh Kanesh	DMO	Alirajpur
9	Abdul Vaism Sekh	DMO	Barwani
10	Jitendra Singh Rajput	DMO	Betul
11	Akhilesh Dubey	DMO	Bhopal
12	Devendra Bhalekar	DMO	Chhindwara
13	Yamini Silarpuria	DMO	Damoh
14	Rashmi Sharma	DMO	Dewas
15	Dharmendra jain	DMO	Dhar
16	Brijesh Kumar Patel	DMO	Dindori
17	Radha Chouhan	DMO	Harda
18	Arun Srivastava	DMO	Hosangabad
19	Daulat Patel	DMO	Indore
20	Shri Yogendra Singh	DMO	Jabalpur
21	D. S. Sisodiya	DMO	Jhabua
22	Smt. Shalini Namdeo	DMO	Katni
23	Karansingh Bhuria	DMO	Khandwa
24	Manoj Kumar Patidar	DMO	Kharegon
25	Ram Shankar Shahu	DMO	Mandla
26	Sadab Khan	VBD Consultant	Panna
27	Alpesh Kumar Bariya	DMO	Neemuch
28	Arunendra Pratapsingh	DMO	Panna
29	Durga Prasad Patel	DMO	Rajgarh
30	Pramod Kumar Prajapati	DVBDC	Ratlam
31	Smrita Namdeo	DMO	Rewa
32	Kshama Barvey	DMO	Sehore
33	Ramji Bhalawavi	DMO	Seoni
34	Shiv Shankar Shukla	DVBDC	Shahod
35	R. S. Jatav	DMO	Shajapur
36	Kirat Singh Kawache	DVBDC	Sheopur
37	Mr. Rajesh Verma	DVBDC	Shivpuri
38	Hari Om Singh	DMO	Sidhi
39	Nagendra Singh	DMO	Singrauli
40	Hari Mohan Rawat	DMO	Tikamgarh
41	Ravi Sahu	DVBDC	Umaria
42	B. M. Varma	DMO	Vidisha

6.5. Training Schedule

CSIR-National Environmental Engineering Research Institute, Nagpur

(*Project: - Development and promotion of non-POPs alternatives to DDT*)

Training of Trainers (ToT) and pilot testing of modules to promote non-POPs alternatives based on IVPM from 30th May 2022 to 3rd June 2022 to SPO/Entomologists and VBD Consultants from Madhya Pradesh

Venue: Hotel Amer Palace, MP Nagar, Bhopal - 462011

Training Programme Schedule

Time	Topic	Resource Person
	Day 1 (Monday) 30/05/2022	
0900-0930	Registration – Distribution of training materials	
0930-1000	**Inaugural Function** **Welcome Address: Dr. A. Ramesh Kumar**, Sr. Scientist, CSIR-NEERI, Nagpur **Address by: Dr. M. P. Patil,** Head & Chief Scientist, CHWMD, CSIR-NEERI, Nagpur **Address by: Dr. Himanshu Jayswar,** Deputy Director (NVBDCP) & SPO, DHS, MP **Address by: Dr. J. C. Paliwal,** Former State Entomologist, MP **Guest of honour: Dr. P. T. Joshi**, Former State Entomologist, Gujrat **Inauguration by: Dr. Santosh Jain**, Addl. Director, DHS, Bhopal **Vote of Thanks**: Dr L J Kanhekar, Project Consultant, CSIR-NEERI, Nagpur	
1000-1015	**High Tea**	
1015-1045	Introduction to Training Modules 1 to 4 & Training materials	Dr L J Kanhekar, Project Consultant
1045-1125	Introduction to DDT and its use in Vector Control	Dr A Ramesh Kumar, Sr. Scientist & Project Leader
1125-1210	VBD: Entomological and epidemiological situation in Madhya Pradesh	Dr Satyendra Pandey, State Consultant Entomologist, MP
1210-1250	Introduction to VBD: Malaria	Dr L J Kanhekar
1250-1330	Morphology and Bionomics of vector mosquitoes	Dr. J. C. Paliwal, Former State Entomologist MP
1330-1430	**LUNCH BREAK**	
1430-1510	Introduction to VBD: Japanese Encephalitis	Dr P T Joshi, Former Entomologist, Gujrat State
1510-1550	Morphology and Bionomics of vector flea and flies	Dr. J. C. Paliwal, Former State Entomologist MP

1550-1630	Introduction to VBD: Leishmaniasis (Kala-azar)	Dr Vijay Kumar, Former Scientist, ICMR-RMRIMS
1630-1700	Introduction to Chandipura Virus	Dr P T Joshi
1700-1730	Morphology and Bionomics of sandflies	Dr Vijay Kumar
Day 2 (Tuesday) 31/05/2022		
1000-1030	Introduction to Crimean Congo Hemorrhagic Fever	Dr P T Joshi
1030-1100	Introduction to VBD: Lymphatic Filariasis	Dr P K Srivastava, Former Jt. Director, NCVBDC
11.00-11.30	Introduction to VBD: Scrub Typhus	Dr L J Kanhekar
1130-1210	Vector Control measures/ management: Chemical Method	Dr P K Srivastava
1210-1250	Introduction to VBD: Plague and Morphology and bionomics of fleas	Dr P T Joshi
1250-1330	Integrated Vector Pest Management: IPM	Dr P. K. Srivastava
1330-1430	**LUNCH BREAK**	
1430-1510	IVPM: Behavior Change Communication	Dr. J. C. Paliwal
1510-1540	Integrated Vector Pest Management: IVM – Integrated vector control methods and IVM in different situations	Dr P T Joshi
1540-1610	Introduction to Kyasanur Forest Disease	Dr L J Kanhekar
1610-1650	Equipment for larviciding and adulticiding	Dr P. K. Srivastava
1650-1730	Morphology and bionomics of Ticks and mites	Dr P T Joshi
Day 3 (Wednesday) 01/06/2022		
0930-1000	Alternatives to DDT in Vector Control Management – Conventional Methods & Environmental Management	Dr R S Sharma
1000-1030	VBD: Launch of Anti-Malaria Month campaign	Dr.Himanshu Jayswar, SPO, MP
1030-1100	Entomological surveillance of VBDs	Dr Himmat Singh, Scientist -D, ICMR-NIMR
1100-1130	Monitoring and evaluation of IVPM	Dr P. K. Srivastava
1130-1200	Introduction to VBDs: Dengue, Chikungunya and Zika	Dr Himmat Singh,
1200-1245	Vector Control measures/ management: Chemical Method	Dr R S Sharma
1245-0130	Entomological parameters and its importance	Dr Himmat Singh
1330-1430	**LUNCH BREAK**	

1430-1500	Alternatives to DDT: LLIN, Biolarvicide & Neem derived products for vector control (UNIDO Project)	Dr Y P Ramdev, National Technical Adviser, UNIDO
1500-1530	Alternatives to DDT: Manufacturing, marketing and distribution - LLIN, Biolarvicide & Neem derived products for vector control	Dr Rajendra Thapar, Manager (Public Health & Exports), HIL (India) Ltd
1530-1610	IVPM: Vector management through Farmer Field School approach	Dr R S Sharma
1610-1650	NVBDCP Recommended Insecticide: Larval Source Management and Adult Vector Control	Dr P. K. Srivastava
1650-1730	Planning and implementation of IVPM	Dr R S Sharma
1730-1800	Methods of mosquito and its immature collection	Dr R S Sharma / Dr P T Joshi
Day 4 (Thursday) 02/06/2022		
09.00-1330	Field Visit to the locality (Sair Sapata, Bhopal) to explore vector prevalence, demonstration of vector breeding and collection method	Dr L J Kanhekar /Dr R S Sharma/ Dr P T Joshi/ Dr. J. C. Paliwal, / Dr G Gandhi /Abhishek Chaudhary /Ashlesh Katpatal, CSIR-NEERI
1330-1430	**LUNCH BREAK**	
1430-1520	Legal perspectives to the Development of IVPM Training Materials	Ms. Fizza Zaidi / Ms. Mansi Bachani
1520-1610	Vector control measures/ management: Biological Control and Genetic Control	Dr L. J. Kanhekar
1610-1730	Preparation of the field report: Entomological surveillance at Sair Sapata, Bhopal	Dr R S Sharma /Dr G. Gandhi /Abhishek Chaudhary /Participant Trainees
Day 5 (Friday) 03/06/2022		
1000-1030	Epidemiological surveillance and parameters	Dr R S Sharma
1030-1100	Presentation of the field report	Dr Satyendra Pandey
1100-1215	Pilot Testing of IEC materials	Dr R S Sharma/ Dr P T Joshi/ Dr G Gandhi /Abhishek Chaudhary / Dr L J Kanhekar
1215-1330	Pilot Testing of FAQs materials / Glossary of all modules	Dr P T Joshi / Dr L J Kanhekar / Dr Gujju Gandhi
1330-1430	**LUNCH BREAK**	
1430-1530	Feedback on Modules and training materials from trainees	Dr L J Kanhekar /Dr G Gandhi /Abhishek

		Chaudhary /Ashlesh Katpatal CSIR-NEERI
1530-1600	Valedictory session followed by group Photo and certificates distribution	Dr Ramesh Kumar/ Dr L J Kanhekar /

(Dr L J Kanhekar)
Project Consultant & Training Coordinator
CSIR-NEERI, Nagpur

Copy to: **1. SPO, Madhya Pradesh**

2. All Participant Trainees