



CSIR – National Environmental Engineering Research Institute
Nehru Marg, Nagpur – 440020.



8th Online Training Programme Report

On

Ten days online Training Programme for Pilot testing of Modules and ToT (SPOs, VBD Consultants & Entomologists from Gujarat State) to promote non-POPs alternatives based Integrated Vector Pest Management

Date: 04/03/2022 to 16/03/2022
Time: 14:30 PM to 17:30 PM

TRAINING OF TRAINERS AND PILOT TESTING OF MODULES TO PROMOTE NON-POPs ALTERNATIVES BASED INTEGRATED VECTOR PEST MANAGEMENT

Development and promotion of non-POPs alternatives to DDT

The objective of this project is to develop and promote non-POPs alternatives to DDT for the control of malaria and dengue. The project is being implemented in Gujarat State, India. The project is being implemented in Gujarat State, India. The project is being implemented in Gujarat State, India.

Key activities involved in the project are:

- Development and promotion of non-POPs alternatives to DDT
- Training of Trainers (ToT) for the control of malaria and dengue
- Pilot testing of modules for the control of malaria and dengue

Vector control management

Personal Protection

Chemical Control

Biological control

Controlled Methods

Bacillus thuringiensis

Indoor Residual Spraying

Outdoor thermal trapping

Biological control

Controlled Methods

Bacillus thuringiensis

Indoor Residual Spraying

Outdoor thermal trapping



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List of Abbreviations

BCC	Behaviour Change Communication
<i>Bti</i>	<i>Bacillus thuringiensis var. israelensis</i>
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
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 21st 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 (MoHF&W) 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 MoHF&W 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 online training programme was conducted for 10 days for a period from 04/03/2022 to 16/03/2022, the total number of the training sessions were 10 and each session has 3 or 6 training parts. 36 participants from Gujarat states were selected including State Programme Officer (SPO), District Malaria Officers (DMOs), State Entomologists, I/c DMOs, and District Vector Borne Disease Consultants (DVBDC) participated in the training programme. Dr. L. J. Kanhekar coordinated all the training sessions and Dr. Gujju Gandhi welcomed all the speakers/training experts. 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 and training materials developed by CSIR-NEERI under the project “Development and promotion of non-POPs alternatives to DDT”

4.0 Training programme - Inaugural Session

Welcome Address

Inaugural function of the 8th 10-days online training programme for Training of Trainers (ToTs- SPO/Entomologists, and VBD Consultants from Gujarat State) and pilot testing of modules to promote non-POPs alternatives based Integrated Vector and Pest Management was held on 04th March 2022, in an online mode via MS Teams between 14.30 to 15.00 by CSIR-NEERI, Nagpur, Chemical and Hazardous Waste Management Division (CHWMD) (Exhibit-1). Dr. A. Ramesh Kumar (Project Leader and Senior Scientist, CHWMD) greeted all the participant trainees and requested Head & Chief Scientist, CHWMD, CSIR-NEERI to welcome the participant trainees and give their opening remarks. Dr. M. P. Patil, Head & Chief Scientist, CHWMD, CSIR-NEERI on behalf of Dr. A. N. Vaidya, Director, CSIR-NEERI welcomed Dr. Amit Prakash Sharma (Chief Guest), Director, ICMR-NIMR, Delhi; Dr. Jitendra Sharma, UNEP, Geneva; faculty members and all the participant trainees. He 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)- The 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 while working on component 4 & 5 of this project, 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 of 10 days duration with main objective to promote non-PoPs alternative to DDT. So far, NEERI has completed 7 training programmes and this is 8th training programme. 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.

Dr. Jitendra Sharma, Programme Management Officer, UNEP, welcomed the Chief guest, all the team members as well as all the participants from Gujarat state. He briefly introduced about the pilot testing of modules. As we are bound to Stockholm convention that after some point of time, we will phase out DDT and its use. This project is funded by GEF through UNEP (one of the GEF implementing agency), GEF implement it with UNIDO which is a leading agency working on development of some products which helps for vector control. UNEP's role is to mainly implement two components i.e., 1 and 4. MoEF&CC nominated Central Pollution Control Board (CPCB) as National Executing agency and NEERI will provide all the technical support for execution of this project to CPCB. CSIR- NEERI is working with the core group of experts, who are helping us not only in developing but also in identifying gaps and challenges in the field of vector control based on the practical experiences, these training modules are in good shape but need to be revised or updated for consideration and approval by NCVBDC. In long run, these modules will be extremely helpful for NCVBDC not only for malaria but also for other VBDs and also for capacity building and these will be translated into certain regional languages.

Dr. Amit Prakash Sharma (Chief Guest), Director, ICMR- National Institute of Malaria Research, New Delhi, express his deep gratitude and thanked for inviting to inaugurate the training programme. NEERI being a CSIR institute for environmental engineering, as now climate change has become very important and challenging problem world-wide and also it brings challenges in human diseases due to rise in temperature, many parts of the world which is more susceptible to mosquito population, within climate change vector borne disease (VBD) and control of them is a very serious issue. As you know the National programme has division for control of VBD's where they are supposed to control 6 VBD's, 3 of which are eliminable- malaria is one of them. He also discussed about DDT and its long-term harmful effects on environment as well as on human. It is very important to start looking for alternatives to DDT. It is hard to say in future vector ever be controlled as India has a very diverse geographical area. As this is pilot testing, feedback and suggestion from the participants will be vital. At the end, he thanked and gave best wishes to all the participants for this training programme. Dr. A. Ramesh Kumar proposed the vote of thanks at the end of the inaugural session.

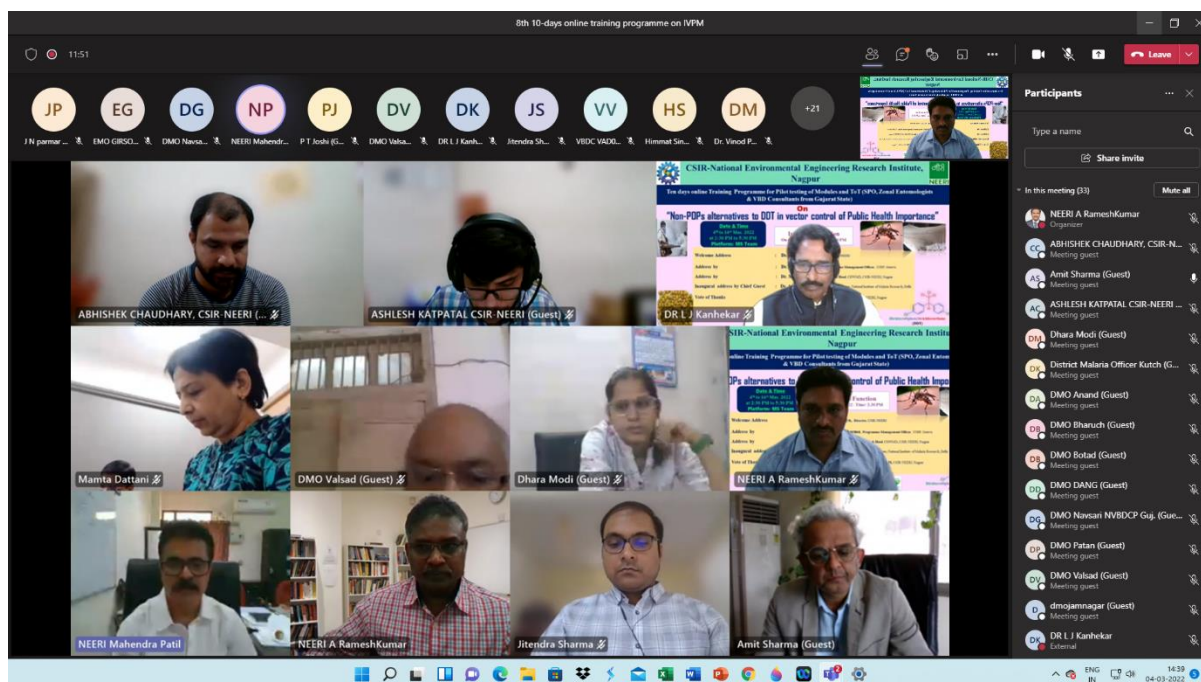


Exhibit-1: Inaugural Session

5.0 Training sessions

The total training sessions were 10, each session covered 4-5 parts and each part was conducted for approximately 30-45 minutes, the time was managed depending on a questionnaire discussion at end of the session. Every session was conducted in the afternoon from 2.30 PM to 5.30 PM.

5.1 Training session-1 (Day – 1 (Monday) 04/03/2022)

Training part - 1: Introduction to Modules 1 to 4

Dr. L. J. Kanhekar briefly introduced about the training modules 1-4 and their content. He informed that training modules were provided to all the participant trainees along with training module booklets, PPT on each module, IEC materials, awareness brochures and FAQ's. He deliberated on each module keeping in view contents and other training course materials. CSIR-NEERI developed these modules, which are approved by NCVBDC for training and during this training pilot testing of these training modules (1-4) is expected. He suggested to all the participants to provide suggestions/ comments, on how to make these training modules more usable/ effective.



Facsimile Training Modules 1 to 4

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

Dr. A. Ramesh Kumar explained Stockholm convention on PoPs, 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). He commented on 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: Introduction to vector borne diseases: Malaria

Dr. R. S. Sharma has deliberated on 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; 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, signs & symptoms and transmission of Malaria (Extra domestic and Urban); Malaria ecosystem: Malaria system & Malaria subsystem (Abiotic factor: Temperature, Humidity & Biotic factors: Parasite & Mosquitoes & their interaction); He deliberated regarding WHO documentation on Malaria elimination framework for Urban area; He conducted an interactive session with the participants.

Training part - 4: Introduction to vector borne disease: Leishmaniasis (Kala-azar)

Dr. Vijay Kumar gave a brief introduction of Leishmaniasis (Kala-azar) and its causes:

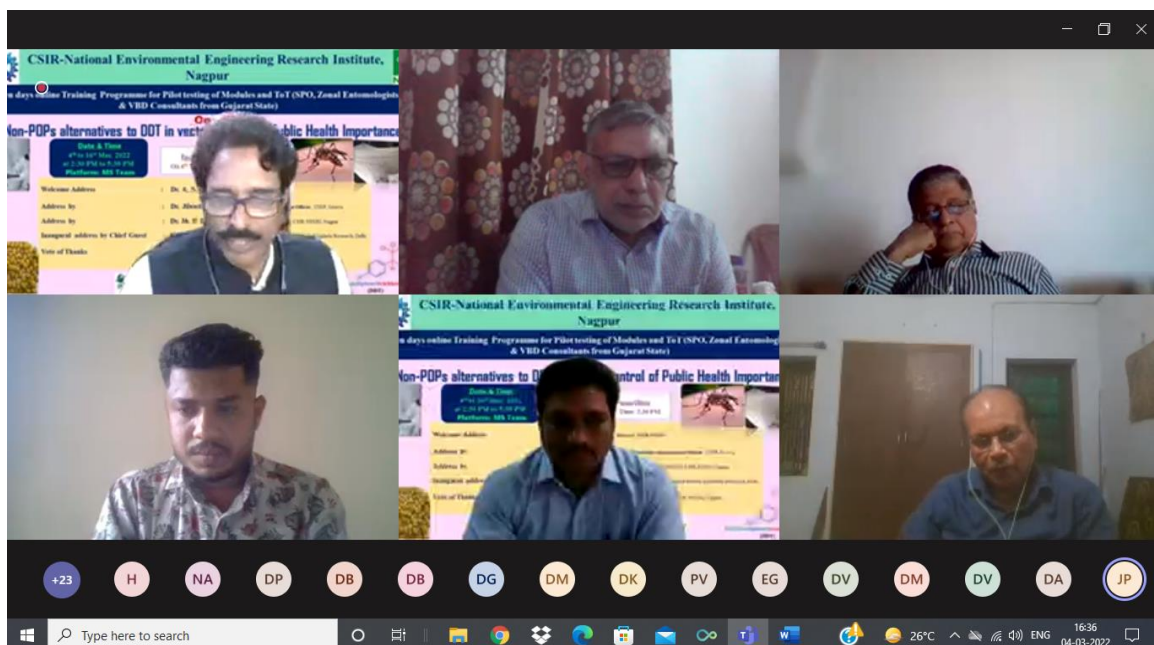


Exhibit -2: Discussion photograph of Training session – 1

Cutaneous Leishmaniasis, Mucocutaneous Leishmaniasis and Visceral Leishmaniasis & post kala azar dermal leishmaniasis (PKDL); Causative agent: Protozoa *Leishmania* (*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 (Promastigote/flagellate), Environment factors: altitude, season, rural areas, development projects; Burden in India and global burden were discussed (Exhibit-2).

5.2 Training session - 2 (Day - 2 (Monday) 07/03/2022)

Training part-1: Introduction to vector borne diseases: Japanese Encephalitis

Dr. P.T. Joshi deliberated on VBD - Japanese Encephalitis (Exhibit-3), Causative agents: a virus (Flavivirus); J.E. vectors in India: *Culex tritaeniorhynchus*, *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.

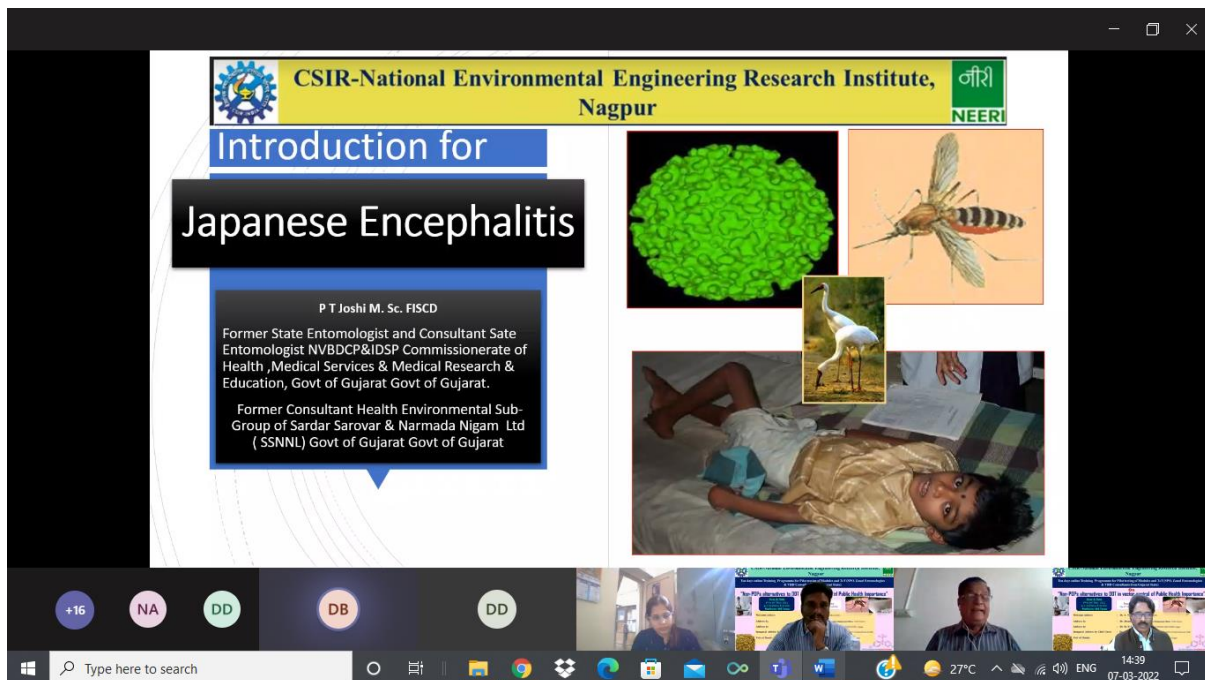


Exhibit-3: Screenshot of training session - 2

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

Dr. P. K. Srivastava deliberated on VBD - Lymphatic Filariasis, Causative agent (Filarial worm: *Wuchereria bancrofti*, *Brugia malayi*), Micro Filaria periodicity (Nocturnal Periodicity,

Diurnal Periodicity), Transmission and life cycle (in human and mosquito body), Vector: *Culex quinquefasciatus*, *Mansonia annulifera*, *Mn. uniformis*. He also discussed national and global burden of Filariasis, its history in India, salient features of the vector life cycle, elimination of Lymphatic Filariasis, differences between *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 and Endemic urban & Rural area-2019 Triple Drug Therapy with IDA were discussed.

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

Dr. T Ratna Joseph deliberated on VBD - Scrub typhus: History; Causative agent: a gram-negative, obligate intracellular bacterium *Orientia tsutsugamushi*; Vector: Mites - *Leptotrombidium deliense*; Sign & symptoms; Transmission: Trans-stadial and trans-ovarial transmission; Life cycle of mites: Egg→Larva→Nymph→Adult; Epidemiology & control; prevention & control using topical application of DMP, DEET etc. Burden in India and global disease burden.

Training part - 4: Introduction to vector borne disease: Crimean Congo Hemorrhagic Fever (CCHF)

Dr. K. Regu deliberated on 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 life cycle: Egg→Larva→Nymph→Adult; *H. Anatolicum*, *H. asiaticum*, *H. dromedarii*, *H. impeltatum*, *H. marginatum*, *H. rufipes*, *H. truncatum*, *H. turanicum* recognised as potential vectors for acquiring, maintenance 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 and human to human transmission were discussed.

Training part –5: Introduction to vector borne disease: Dengue, Chikungunya & Zika

Dr. Amit Katewa on behalf of Dr Kalpana Baruah deliberated on VBD's viz., 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- *Aedes aegypti* & Secondary- *Aedes albopictus*);

Transmission cycle of Dengue: Forest/Enzootic, Rural/Epidemic & Urban/Endemic/Epidemic; Burden in India and global burden.

He deliberated on Chikungunya & its symptoms: fever, chills, headache, nausea, vomiting, severe joint pain, rashes; Causative agent: Alphavirus; Vectors: *Aedes* Mosquitoes (*Aedes aegypti* & *Aedes albopictus*); Transmission cycle of Chikungunya: Sylvatic CHIKV transmission and Urban CHIKV transmission; Burden in India and global burden.

He also deliberated on 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 agent: Flavivirus; Vectors: *Aedes* Mosquitoes (*Aegypti*, *Albopictus*, *Vitattus*, *Furcifer*, *Africanus* & *Apicoargenteus*); Birth complications: Microcephaly, Gulllain-Barre syndrome; Incubation and Viremia- incubation period of zika virus 3 to 14 days; Transmission of Zika virus: Vector transmission and Non vector transmission; Burden in India and global burden.

Training part - 6: Introduction to vector borne disease: Kyasanur Forest Disease

Dr. N. Balakrishnan gave a lecture on Kyasanur Forest Disease (KFD). He deliberated about Introduction of KFD; Symptoms and Clinical features, Host factors, Diagnosis; History; Transmission: trans-stadial mode (nymphal stage ticks), Transmission cycle of KFD; KFD virus ecology, Vector- ticks (*Haemophysalis spinigera* & *H. turturis*); Natural cycle of KFD:

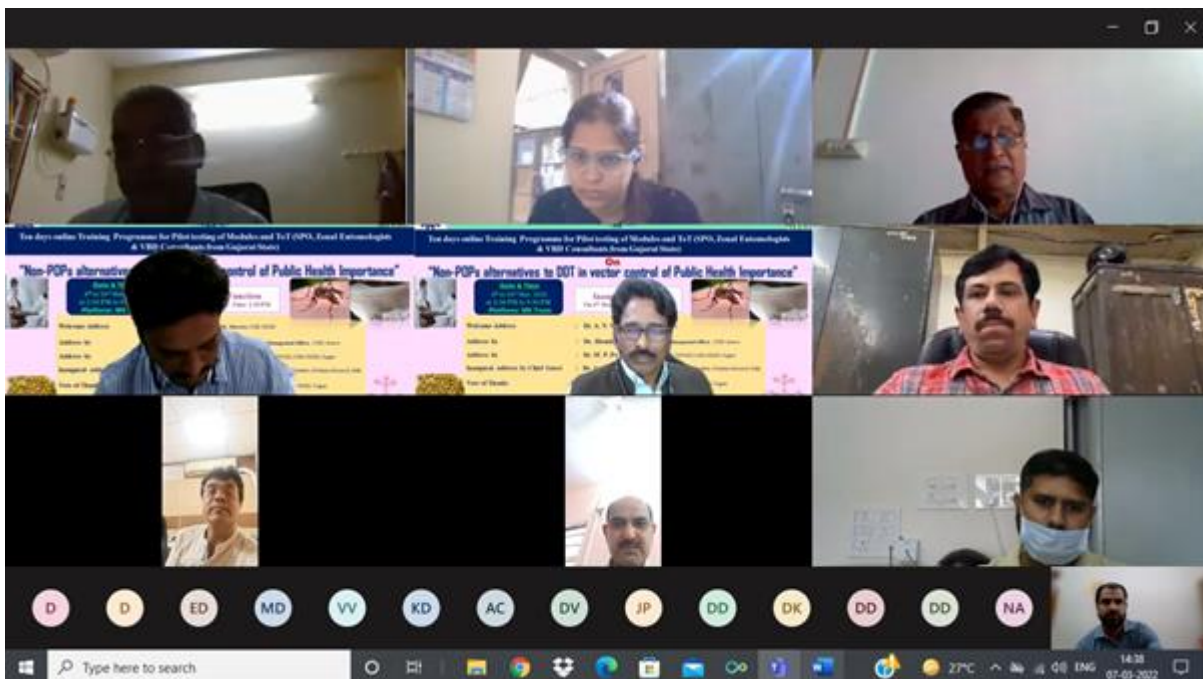


Exhibit-4: Discussion photograph of Training session – 2

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: advice 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 (Exhibit- 4).

5.3 Training session-3 Day 3 (Tuesday) 08/03/2022

Training part-1: Introduction to vector borne disease: Plague

Dr. N. Balakrishnan gave a brief introduction about vector borne diseases: Plague (Exhibit- 5); 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.

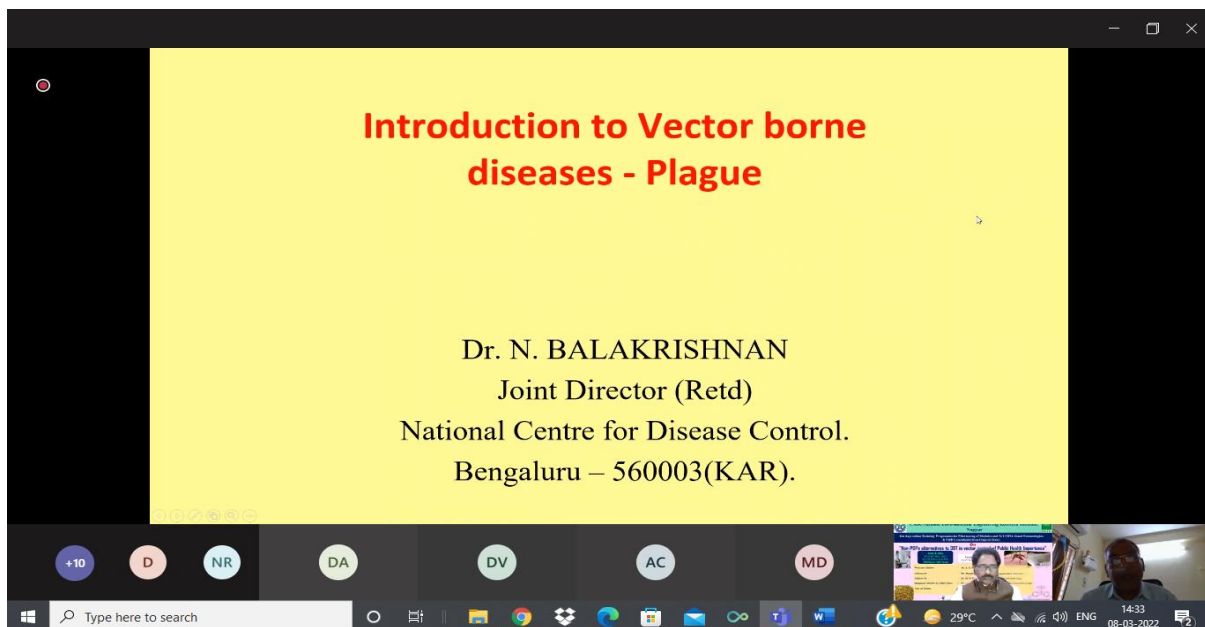


Exhibit-5: Screenshot of training session - 3

Training part - 2: Morphology of Vector Mosquitoes

Dr. L. J. Kanhekar deliberated on learning objectives of training module-2, Introduction to mosquito vectors: *Anopheles*, *Culex*, *Aedes*, and *Mansonia* spp.; Classification of mosquitoes;

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, vector biology (life cycle of vector mosquitoes) and ecology (Distribution, breeding places etc.); Vectors of lymphatic filariasis and Japanese Encephalitis: Introduction, *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 Vector biology (egg, larva, pupa, adult); and Vector ecology; Vectors of Dengue, Chikungunya, and Zika: Introduction; External morphology of vector; Vector biology and Vector ecology: two medically important species viz *Aedes aegypti* & *Ae. albopictus* was also discussed.

Training part - 3: Bionomics of vector mosquitoes

Dr. R. S. Sharma has deliberated on bionomics of vector mosquitoes: Rational (Insecticides based interventions mainly- LLIN's & IRS) & Bionomics (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); variable endemicity (hypo, meso, hyper, halo). He also discussed about malaria transmission: basic factors- Malaria parasite \leftrightarrow Vector \leftrightarrow Human Host; Concept of ecosystem: Terrestrial & aquatic ecosystem (adaptation, interdependence, carrying capacity & Interaction); Morphological adaptation: Thermophilic species and Hydrophilic species; Epidemiological & Ecological consequences; morphology of eggs, life cycle of mosquitos, feeding behaviour; climate zones and natural distribution of malaria vectors in India; Epidemiology of diseases, vector composition, susceptibility, target population and environment; Vector Succession and Vector Disappearance.

Training part – 4: Morphology and bionomics of Sandflies

Dr. Vijay Kumar has deliberated on 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 in insectarium; Vector ecology: Distribution, Breeding places, resting habits, feeding habit, biting habit, flight range; Types of parasite development were discussed.

Training part – 5: Morphology and bionomics of Fleas & Flies

Dr. Amit Katewa 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→Adult; He also deliberated introduction on House Fly (*Musca*), can be a vector of Helminths, faecal bacteria, protozoan & viruses resulting in the spread of enteric diseases- gastrointestinal tract; classification of Housefly: 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)→Pupa→Adult, Housefly breeding places were discussed (Exhibit- 6).

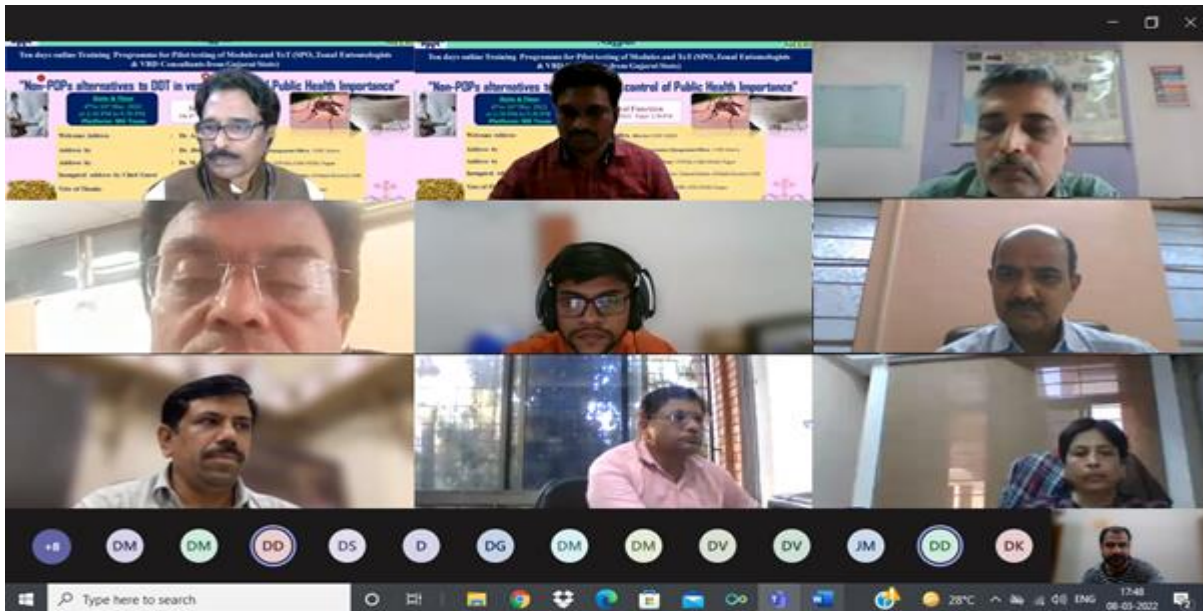


Exhibit-6: Discussion photograph of Training session – 3

5.4 Training session - 4 (Day - 4 (Wednesday) 09/03/2022)

Training part –1: Morphology and Bionomics of Ticks and Mites

Dr. T Ratna Joseph (Medical Entomologist) deliberated on Vector morphology and bionomics of Ticks and Mites (Exhibit-7). 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 & CO₂ traps), hard ticks (passive, systematic & special collection) & mites (Sherman trap) and their Identification were discussed.

Module-II :
Vector Morphology & Bionomics

Chapter-9 :
Non-Insect Vectors of CCHF, KFD & Scrub Typhus

Section-1: Soft Ticks **Section-2:** Hard Ticks **Section-3:** Mites

T.RATNA JOSEPH
Medical Entomologist
Andhra Pradesh, India.

Exhibit-7: Screenshot of training session – 4

Training part - 2: Entomological surveillance of VBDs

Dr. Himmat Singh 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- Regular and systematic collection, analysis and interpretation of entomological data for risk assessment, planning, implementation, monitoring and evaluation of vector control intervention; Methods: detection & monitoring of larval and adult population- Collection of Adult mosquito: 1) Hand collection, 2) Collection of adult Sand fly, 3) Larval collection methods; Collection of inactive stage of Sand fly; Purpose of Collection; Types of collection: Adult collection, Larval collection & Eggs; Methods- Qualitative and Quantitative; Hand Collection; Spray Sheet Collection; Landing Collection; Trap Collections: Types of Traps; Vector Traps for disease

surveillance & surveillance tools; Sampling methods of larval collection: Qualitative & Quantitative methods- Netting method (surface collection), Dipping method; Larval collection method: Siphoning method (Tree hole), well net collection, Larva collection by dropper/ pipettes were discussed.

Training part - 3: Alternatives to DDT in vector control management: Conventional methods and Environment management.

Dr. R. S. Sharma 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 scenario, Genesis of EEM in India; Risk factor Urbanization, Construction activities, Outbreak of Malaria (2010) were discussed (Exhibit-8).

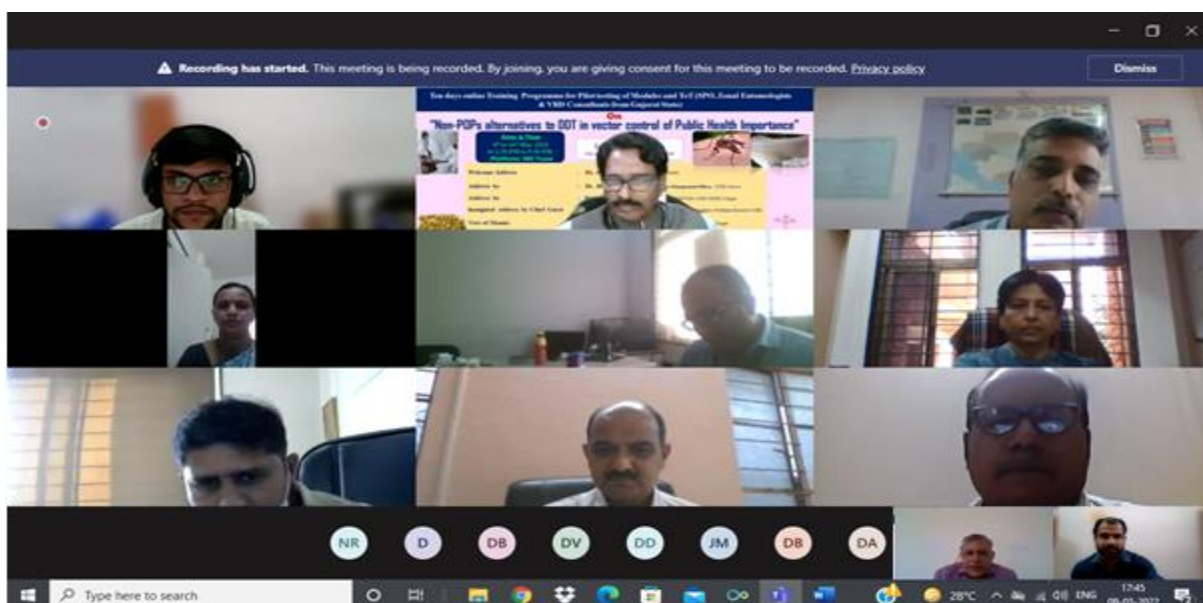


Exhibit -8: Discussion photograph of Training session - 4

5.5 Training session - 5 (Day - 5 (Thursday) 10/03/2022)

Training part –1: Vector control measures/ management: Biological Control

Dr. T. Ratna Joseph has deliberated this training part and gave brief introduction about module-3: Alternatives to DDT in vector control/ management (Exhibit- 9): Introduction to Biological control- Different Biological agents used in vector control: 1) Copepods, 2) Nematode, 3) Flatworms, 4) Fungi, 5) Invertebrate Predators, 6) Anuran Predators, 7) Micro-organism: Bacteria (Bt), *B. sphaericus* & Protozoans, 8) Fish: Larvivorous Fishes (*Gambusia affinis*, guppy *Poecilia reticulata*); NIMR– suitable fish species used in different mosquito breeding habitats; Phytophagous Fish: *Cyprinus carpio*, *Ctenopharyngodon idella*, & *Oreochromis mossambicus*; Desirable attributes of Bio-control agents and Advantages of Biological Control.

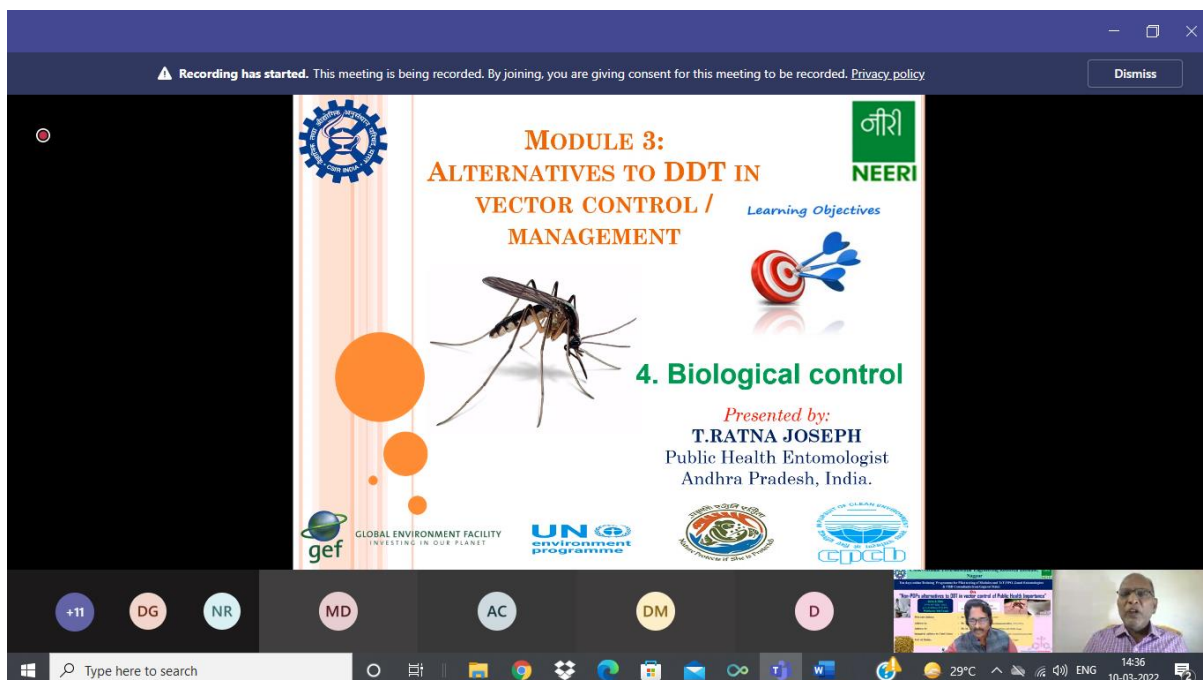


Exhibit-9: Photograph of training session – 5

Training part – 2: Entomological Parameters and their Importance

Dr. Himmat Singh deliberated this training part and gave brief introduction about Entomological parameters and their importance: Adult vector parameter: Adult parameters used in Malaria: Density, Resting collection (aspirator/ handhold net), Indoor resting density, Human-biting rate (ethical clearance required), Human blood index (HBI), Sporozoites rates, Insecticide susceptibility; Entomological Indices: Malaria vector density- Abdominal condition: Unfed, Fullfed, Semi gravid, Gravid, Vector incrimination: whole night vector landing collection, space spray collection, Entry/ exit traps collection; Mosquito life expectancy (longevity), Parity rates, vectoral capacity; 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 (*Culex quinquefasciatus* for filaria): Ten Man-hour Vector density, infectivity rate, infection rate, mean number of L3/infective mosquito) were discussed.

Training Part – 3: Vector control measures/ management: Genetic Control

Dr. T. Ratna Joseph has also deliberated this training part, with a brief Introduction to Genetic Control: Mutagenesis, trans-genesis– gene delivery, Cis-genesis– Gene transfer, Para-transgenesis; Sterile Insect Techniques: 1. Conventional SIT- Sterilization & Irradiation, 2. Translocation of Heterozygotes; 3. Genetic sexing; 4. Cytoplasmic Incompatibility; 5. Hybrid Sterility; Refractoriness to disease transmission; Population replacement using *Wolbachia*; Release of insects carrying lethal gene; Gene Silencing using RNA interference; other genetic approaches: gene drive; Advantages & disadvantages of genetic control were discussed.

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

This training part was introduced by Dr. P. K. Srivastava, 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 -5: IVPM- Behavioural Change Communication (BCC)

Dr. P. T. Joshi 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) were discussed (Exhibit-10).

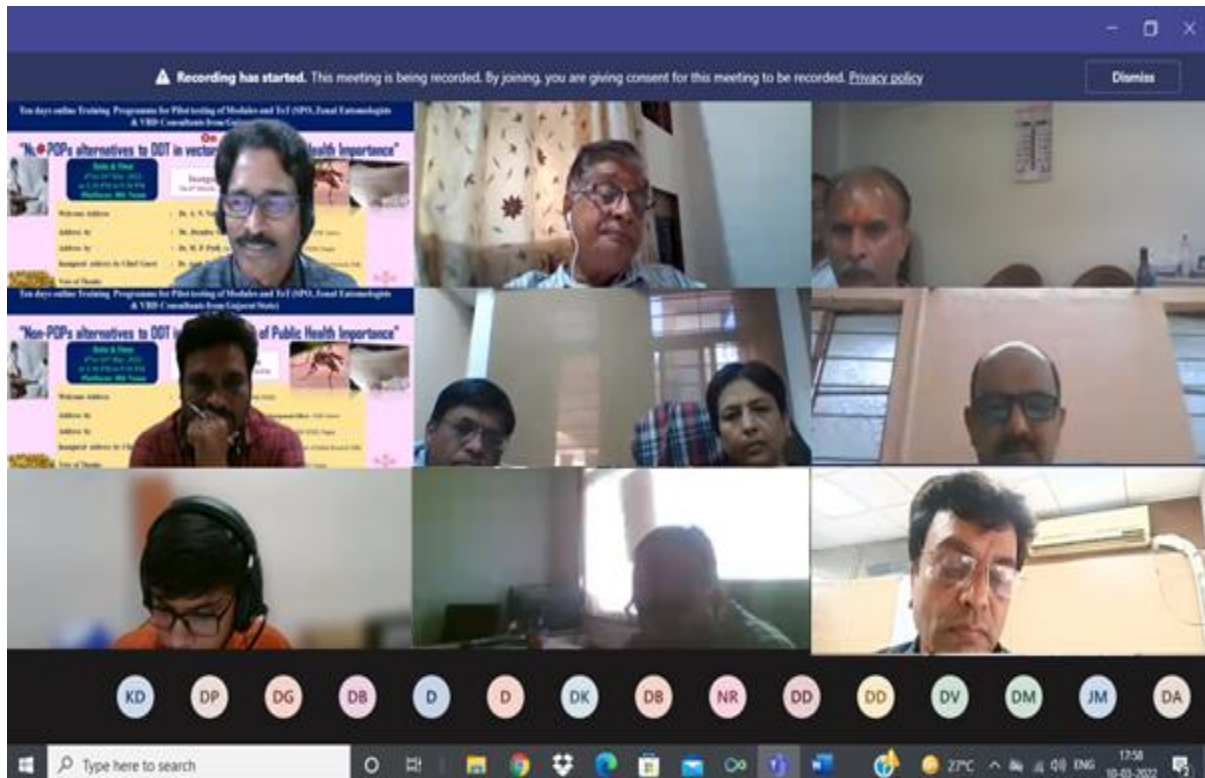


Exhibit -10: Discussion photograph of Training session – 5

5.6 Training session - 6 (Day - 6 (Friday) 11/03/2022)

Training part - 1: Equipment for Larvicide and adulticide:

Dr T. Ratna Joseph deliberated on equipment/ tools for Larvicide and Adulticide (Exhibit-11); Various tools have been currently in practice: 1. Knapsack Sprayer (larvicides); 2. Hand Compression pump- Standard equipment for residual spray (Both Adulticide & Larvicide); 3. Stirrup Pump; 4. Fogging Machines: a) Portable (Handheld/ operated)- Portable thermal fogging machine (PTFM), b) Ultra Low Volume (ULV) sprayer; 5. Vehicle Mounted: a) Thermal Fogging Machines: used in urban or sub-urban areas; b) Cold Fogging Machines.

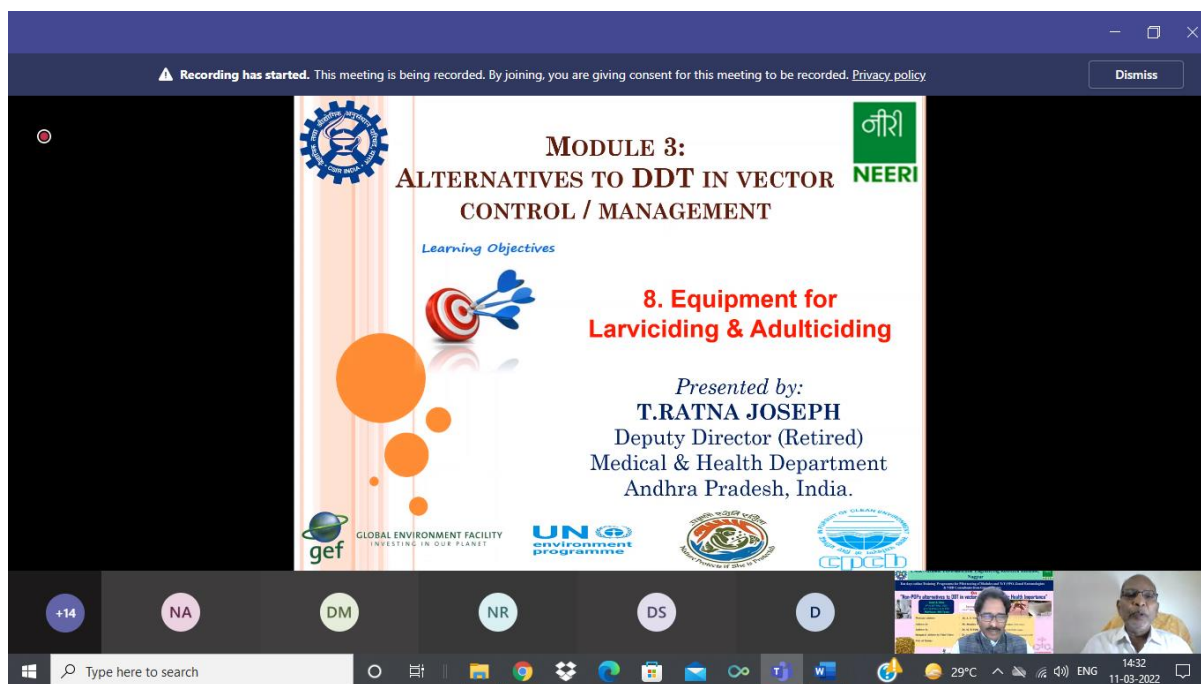


Exhibit-11. Screenshot of Training session - 6

Training part - 2: Alternatives to DDT: Neem derived products for Vector Control

Dr. Amrish Agrawal, Institute of Pesticide Formulation Technology- Gurugram has deliberated this training session with brief 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.

Training part - 3: Integrated Vector & Pest Management (IVPM): IVM- Integrated vector control methods and IVM in different situations

Dr. P.T. Joshi deliberated this training session, a brief introduction about IVPM: IPM (agricultural sectors) & IVM (VBDs control programme)- knowledge about vectors, diseases & disease determinants; Integrated vector control methods, Key elements of IVM: Evidence-based decision making, Integrated approach, Collaboration within health & other sectors, Advocacy Social mobilization and Capacity Building; Vector bionomics & it's significance for IVMs; IVM targeted on vectors bionomics; Integrated vector management: Environment

Management, Chemical management and Biological management; Chemical control: Adulticides- Insecticidal Residual Spray: Anti-adult measures & priority; Manpower requirement trained- Art of spray; equipment's for spray; preparation of insecticide spray suspension; spraying technique; effectiveness of IRS; guidelines for spraying activity; Space spray- Indoor space spray, rules for spray: single storey buildings & multi-storey buildings; Outdoor fogging- using portable equipment, spraying application, outdoor fogging and formulation (NVBDCP). 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 (Exhibit-12).

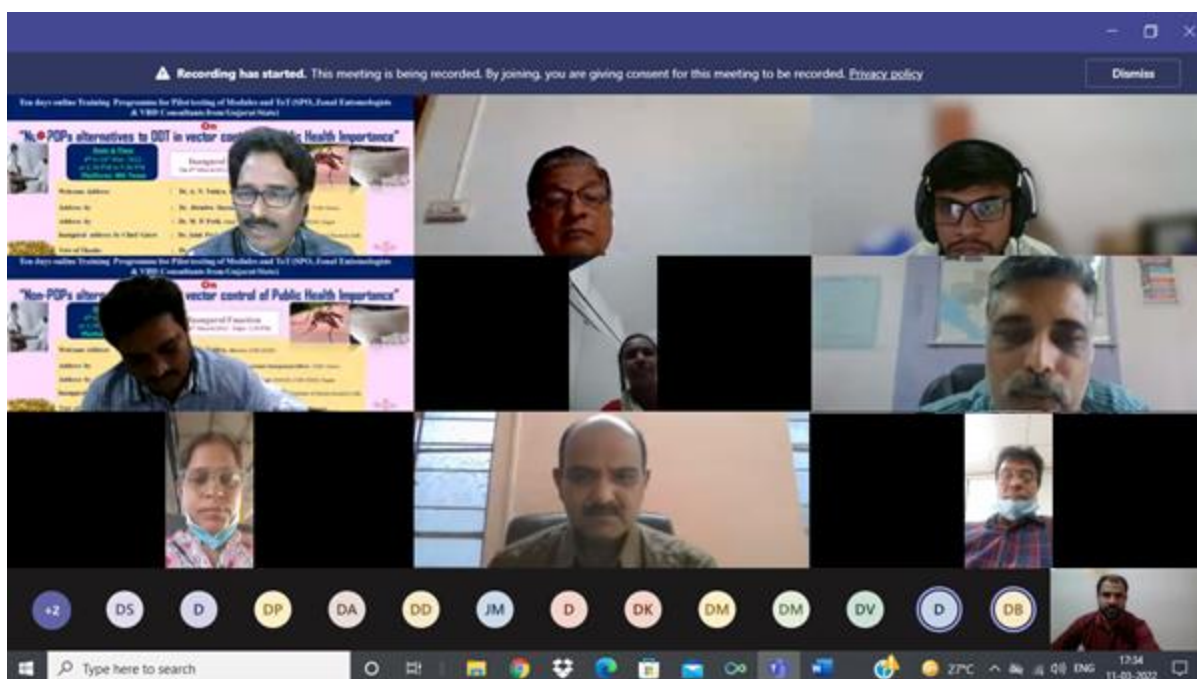


Exhibit-12: Discussion photograph of Training session – 6

5.7 Training session-7 (Day – 7 (Saturday) 12/03/2022)

Training part - 1: Integrated Vector Pest Management: IPM

On the seventh day, Prof. V. J. Tambe deliberated on Integrated Pest Management (Exhibit-13); Principle of vector control: Integrated vector control approach; life cycle of mosquito; habitats of vectors: mosquito & housefly; selection criteria for vector control measures: effectiveness, safety, simplicity of use, cost, time & effort, type of benefits etc.; Mosquito control measures; anti-larval measures: Environmental control, chemical control: petroleum oil, Insect growth regulators, bacterial larvicides, organophosphorus compounds, expanded polyester beads; Biological control: larvivorous fish- Gambusia & Guppy (advantages & disadvantages) and Bio-larvicides (*Bacillus thuringiensis*, *B. sphaericus*), other bio-larvicides:

fungi, nematods; Anti adult measures: space sprays (advantages & dis-advantages); Indoor residual sprays: knapsack sprayer, compression pneumatic sprayer, problem related to house spraying; Genetic control: Sterile male technique, Cytoplasmic incompatibility, Chromosomal translocation, Sex distortion, Gene replacement; Zooprophyllaxis; Personal prophylaxis- mosquito nets, insecticide treated bed nets, Repellents (Indalone, DEET), screening, protective clothing; Insecticides vaporizer- transfluthrin; Legislative control; IVC- biological, chemical, personal protection, health education & source reduction; key elements of IVC strategy: 1. Advocacy, social mobilization & legislation, 2. Collaboration within health sector & other sectors, 3. Integrated approach, 4. Evidence-based decision-making, 5. Operational and implementation research, 6. Capacity building, 7. Monitoring and evaluation.

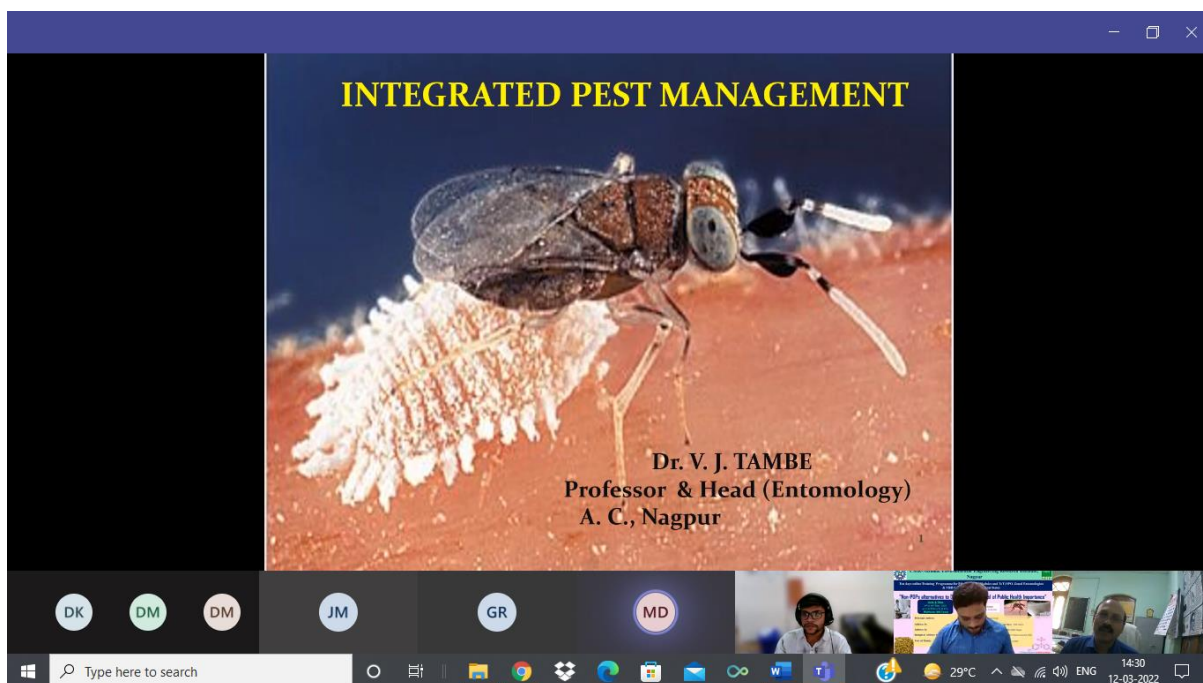


Exhibit-13: Screenshot of training session- 7

Training part - 2: IVPM: Vector Management through Farmer Field School (FFS)

Dr. R. S. Sharma deliberated this training session, a brief introduction about IVPM
 Background: Rational of IVPM, Objectives of IVPM: 1. Raise agricultural productivity & 2. Reduce risks of VBDs; Concept of IVPM: close interaction between host, parasite & vector; Pyrethroid resistance in malaria endemic states (vector resistant to deltamethrin (SP)- Chhattisgarh, M.P., Odisha & Andhra Pradesh); Farmer Field School (FFS), Evolution of the FFS approach: Asia (1989)→ 2016 (90+ Countries); Farmer Approach towards VBD's; Vector Management through the FFS approach; Country-wise FFS approach; Health risks associated with agriculture: Outbreak of Malaria due to Indira Gandhi Canal for Irrigation- Jaisalmer

District, Rajasthan, 2001; Role of FFS at the Field Level; Rice Field and Japanese Encephalitis- Outbreak of JE in Assam State in 2018; Behaviour change communication (BCC); Mosquito breeding and rice field; Success Story: Malaria Mosquito control in rice paddy farms using bio-larvicides mixed with fertilizer in Tanzania.

Training part - 3: Planning & Implementation of IVPM:

Dr. R.S. Sharma deliberated on Planning & Implementation under IVPM: Learning objectives; Introduction to IVPM- operational steps: Disease situation, Local determinants of disease, Selection of vector control methods, Need & resources, implementation of strategy & monitoring and evaluation; Epidemiological Assessment: 1. Measures of disease occurrence- a) Prevalence: Point & Period Prevalence, b) Incidence: Risk & Incidence; 2) Estimation of disease occurrence: a) Case Study, b) Primary survey, c) Cohort Study, d) Sampling; Entomological Assessment: it is one of the tools used in monitoring and controlling vector borne diseases; Collection of Adult mosquitoes: a) Qualitative studies & b) Quantitative studies; Methods for sampling of mosquitoes; Determinants of Local diseases: i) Parasite, ii) Vector, iii) Human activities & iv) Environment; Selection of vector control methods: Environmental, Mechanical, Biological and Chemical to reduce vector population or to reduce human vector contact. Selection criteria of vector control method (WHO); IVM implementation Strategy. He also discussed roles of various sectors in IVPM implementation: Agriculture, Water resources development, Water supply, Road & building sector, Urban development, Industry/ mining, Railways, Environment/ Forest, Fisheries Institutional, Remote sensing; Private Pest control Agencies, Planning departments, Sea/ air ports, Education, Mass media, Village councils, Local Governments; Role of Health trainers and trainers in coordinating IVM & IPM: SIMA- System-wide, Initiative on Malaria and Agriculture; Evaluation of IVPM project in Sri Lanka.

Training part - 4: Integrated Vector and Pest Management: Epidemiological Surveillance and parameters

Dr. T. Ratna Joseph briefly introduced about section-5 of the module-4, the IVPM: Epidemiological surveillance and parameters; Introduction to Epidemiological studies: Epidemiological triads of VBD's: Host \leftrightarrow Vector \leftrightarrow Pathogen; Epidemiological surveillance: IDSP-Integrated Health Information Platform (IHIP)- Surveillance units established at all States/Districts (SSU/DSU), Central Surveillance Unit (CSU) and integrated in NCDC, Delhi; Presumptive (P) form consists of 22 diseases including Malaria, Dengue,

Chikungunya, AES, PUO etc.; Laboratory (L) form consists of 12 diseases including Dengue, Chikungunya, JE, Malaria etc.; NVBDCP: Blood Smear, Rapid Diagnostic Test (Antigen/Antibody) Source: Active & Passive case detection, mass & contact detection, sentinel sites and surveys; Incidence (no. of new cases occurring in a defined population during a specified period of time) and Prevalence (to all current old and new cases existing at a given point of time or over a period of time)- Point prevalence & Period prevalence; Parameters of Malaria: Annual Blood Examination Rate (ABER), Annual Parasite Index (API), Annual *falcipuram* Incidence (AFI), Slide positivity rate, Slide *falcipuram* rate; Other parameters- Pf%- P. *falcipuram*; Infant Parasite; Case Fatality; Drug Resistance; Severe & complicated; Economic injury; Source of Infection: Primary, Secondary, Migration/Immigration, Relapse etc.; Malaria classification: Indigenous, Imported and Induced; Malaria paradigms: Demography, topography & ecological based; Parameters of Lymphatic Filariasis: Filarial Endemicity Rate, Microfilaria Rate and Microfilaria density- Frequency: Weekly interval for Viral disease (DEN/CHK/JE), Fortnightly interval for Malaria, Quarterly interval for Filariasis; Parameter for other VBDs: 1. Dengue, 2. Chikungunya, 3. JE, 4. KFD, 5. Zika, 6. Plague. He ends the lecture with conclusion on epidemiological surveillance outcomes: Sporadic (cases occur irregularly), Outbreak (local/ focal)- disease occurs suddenly in a relatively confined geographic area, Epidemic- unusual occurrence in a community or region – specific health-related events, Endemic- constant presence of a disease/ infectious agent within a given geographic area or population group and Pandemic- an epidemic usually affecting a large proportion of the population over a wide geographic area were discussed (Exhibit- 14).



Exhibit -14: Discussion photograph of Training session – 7

5.8 Training session-8 (Day – 8 (Monday) 14/03/2022)

Training part - 1: Monitoring & Evaluation of Integrated Vector and Pest Management

Dr. Amit Katewa briefly introduced about the IVPM: Monitoring & Evaluation and its methods (Exhibit-15); Methods of Monitoring and Evaluation- Design, Data collection, use of result & roles; Outcome Indicators- Process, Outcomes & impacts; Outcomes indicators followed though- Planning and implementation, Organization and Management: Structure of Monitoring & Evaluation within health sector- At Central level, At Local Level, Inter-Sectoral collaboration; Behaviour Change Communication (BCC): Planning & Implementation of IVPM: Indicators to monitor and evaluate progress in Organization and Management of IVM; Indicators to monitor and evaluate progress in advocacy and communication of IVM; Entomological Surveillance: The distribution, Population density, Larval Habitats & Susceptibility to insecticides in order to prioritize vector control in terms of time and space- Methods available: Adult surveillance- per man hour density, collection of adult mosquito, collection of adult sandfly, mosquito larval collection methods; Insecticide Resistance monitoring through susceptibility test: i) Adult Susceptibility & ii) Larval Susceptibility; Adult Aedes Survey: Landing/biting Collection; Resting Collection; Oviposition traps; Aedes Larval Indices & Significance- House Index, Container Index & Breteau Index; Surveillance of Malaria Vector; Entomological Surveillance of Lymphatic Filariasis: Ten Man- hour Vector density, infectivity rate, infection rate, mean number of L3/infective mosquito).

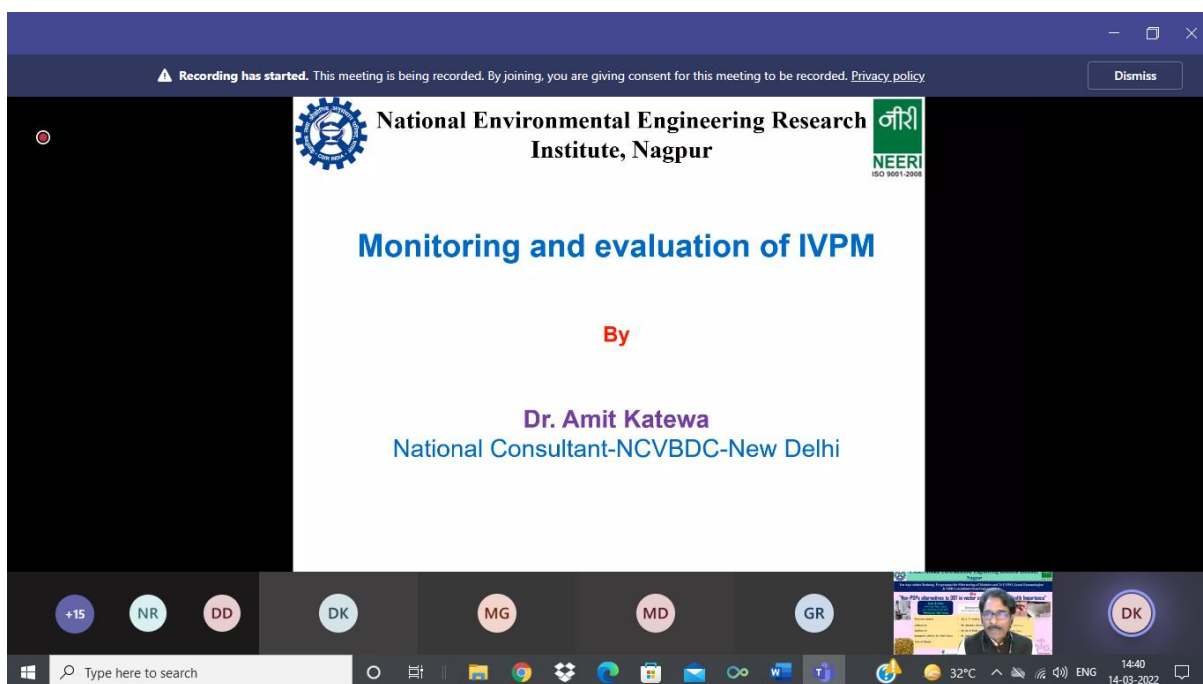


Exhibit - 15: Screenshot of Training session – 8

Training part - 2: Inputs from participant trainees on Pilot testing Module – 1

Dr. R S Sharma/ Dr. L J Kanhekar deliberated this training session, a brief introduction about Module-1: DDT and Vector Borne Diseases and all the contents included in the training module and asked the participant trainees from Gujarat state to give their valuable responses and provide inputs to make the module more effective in capacity building.

Training Part 3: Input from participant trainees on Pilot testing Module –2

The training session on Day-8 came to an end with the feedback/ discussion of the participants (Exhibit-16). Dr. Amit Katewa/ Dr. L. J. Kanhekar gave a brief introduction about module –2: 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 have raised queries, suggestions, and also healthy discussions with Dr. Amit Katewa on various topics of module-2. Dr. L.J. Kanhekar asked all the participants to provide feedback via e-mail also if any.

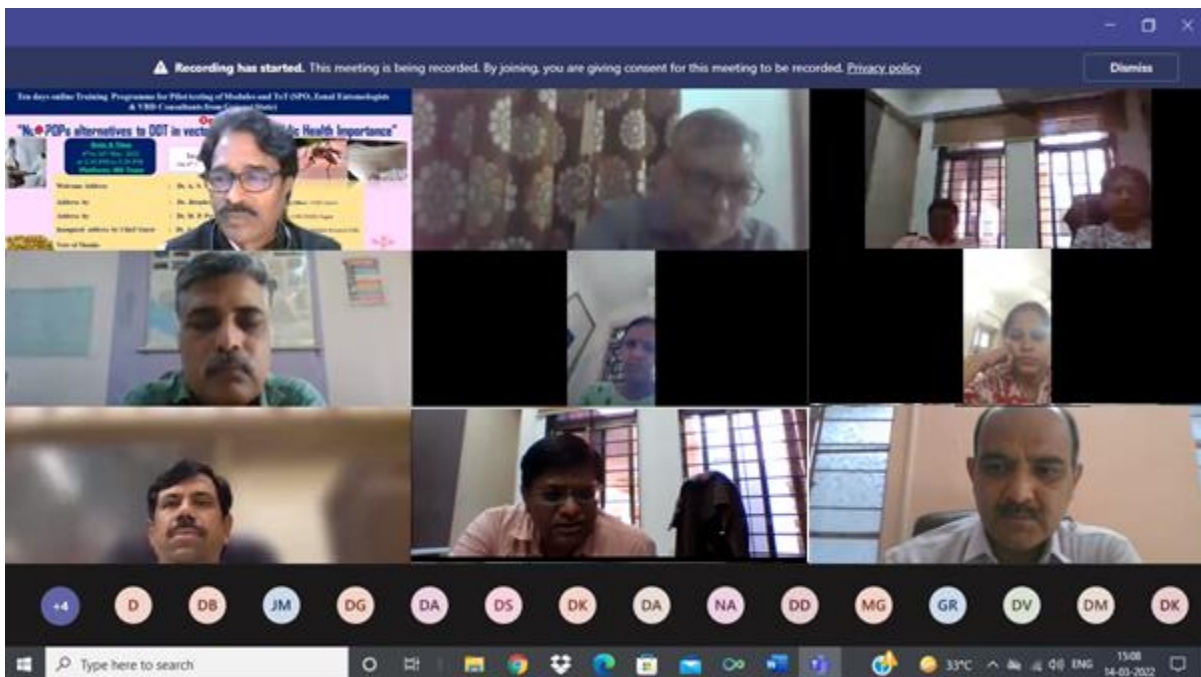


Exhibit16: Discussion photograph of Training session – 8

5.9 Training session-9 (Day – 9 (Tuesday) 15/03/2022)

Training part - 1: Pilot testing Module – 3 inputs from participant trainees

Dr. P. T. Joshi/ Dr. L J Kanhekar deliberated this training session, a brief introduction about Module-3 (Exhibit-17): DDT alternatives to Vector Control Management and all the contents

included in the training module and asked the participant trainees (DMOs, entomologists etc.) from Gujarat state to provide feedback/inputs, suggestions to make it useful for the community.

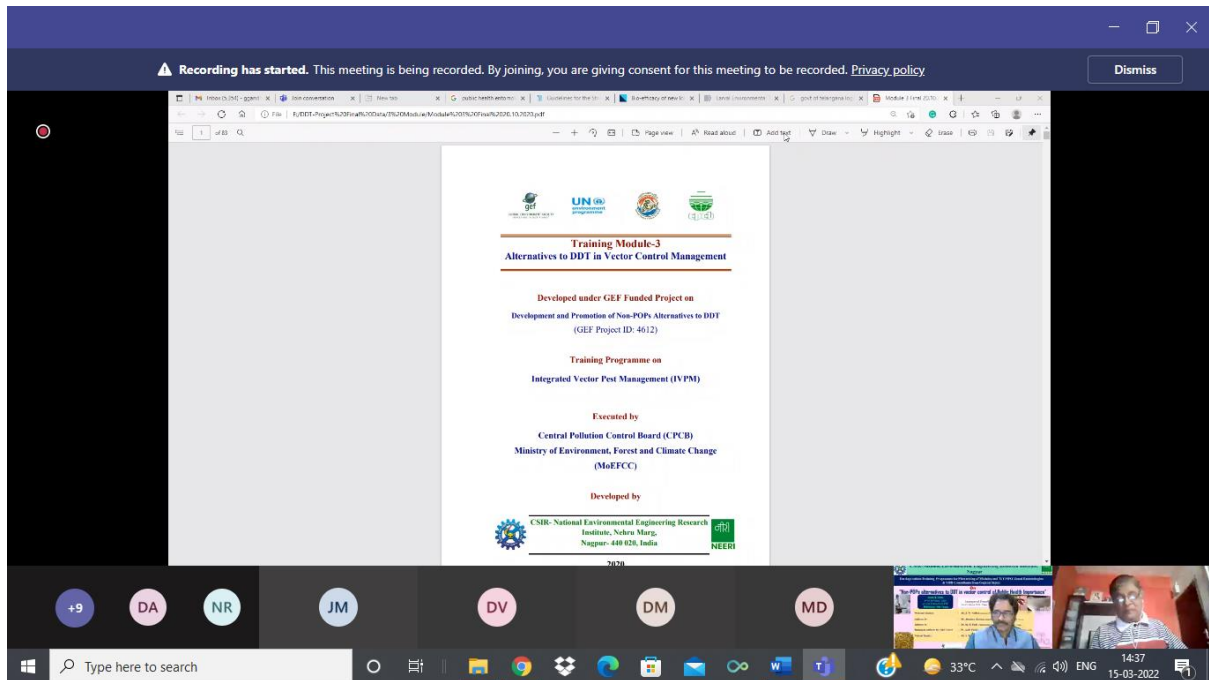


Exhibit-17: Screenshot of Training session – 9

Training part - 2: Pilot testing Module – 4 inputs from participant trainees

Dr. R.S. Sharma/ Dr. Gujju Gandhi has deliberated this training session, a brief introduction to training module-4: Integrated Vector and Pest Management 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 have raised queries, suggestions, and also healthy discussions with Dr. R.S. Sharma/ Dr. P.T. Joshi on various topics of module-4 (Exhibit-18).

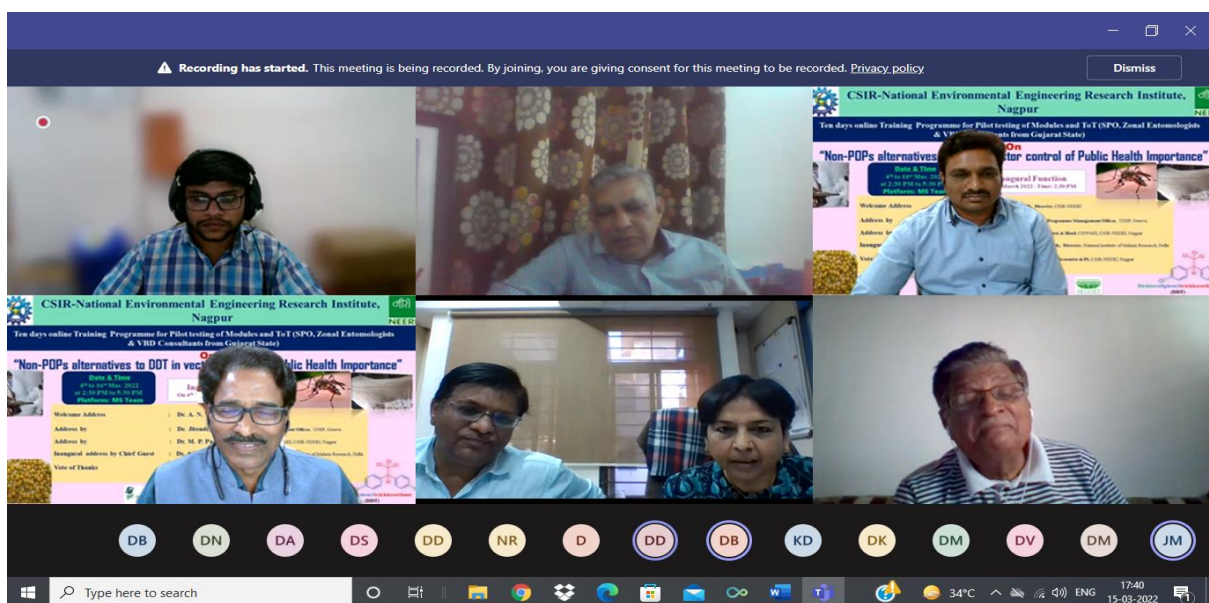


Exhibit-18 Discussion of training session-9

5.10 Training session-10 (Day – 10 (Wednesday) 16/03/2022)

Training part - 1: Lecture/Discussion on FAQs Materials

Dr. T Ratna Joseph/ Dr. R.S. Sharma deliberated this training session (Exhibit-19), a brief introduction about FAQs on each VBD, Mosquito and IVPM and asked the participant trainees (DMOs, SPO/entomologists/VBD consultants) from Gujarat state to provide inputs on FAQs material.



Exhibit-19: Screenshot of training session – 10

Training part - 2: Lecture/ Discussion on IEC Materials

Dr. R. S. Sharma/ Dr. Amit Katewa deliberated GEF 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, Filariasis, 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. Amit Katewa discussed importance of these IEC materials to make awareness in the community about VBDs programme through social media, digital media, print media, electronic media etc.- what are the preventive measures and how to protect themselves from mosquito bite. Community should be sensitized- how these methods can be applied and community should be mobilized, when community starts participation then we should take the community in our activities. After sensitization, mobilization, participation & community enrolment, our final goal is community ownership. He also congratulates CSIR-NEERI team for their hard work and efforts to develop this training more effective.

Training Part-3: Feedback from participants/trainees on modules

The 8th online training programme came to an end on 16th of March with the feedback of the participants. Dr. L. J. Kanhekar asked the participants to give their valuable responses and inputs on the training modules, booklets, PPTs and the IEC material provided to them via filling the Feedback forms (Part A- Pilot testing feedback, and Part B- Training feedback) sent to them via post.

Training Part-4: Virtual valedictory session

Dr. L.J. Kanhekar, Project Consultant and Training Coordinator briefed regarding online ten-day training and brought out to notice that SPO, Gujarat nominated 36 participants trainee and among them only 25 trainees participated and attended the online training successfully. Dr. M.P. Patil, Head, CHWM Division conducted a virtual valedictory session (Exhibit-20) and proposed the vote of thanks to all the participants and experts, thus summing up the training programme. He also asked the participants for their opinions on the training programme by filling out the feedback form provided to them. 25 participant trainees were awarded certificate of participation.

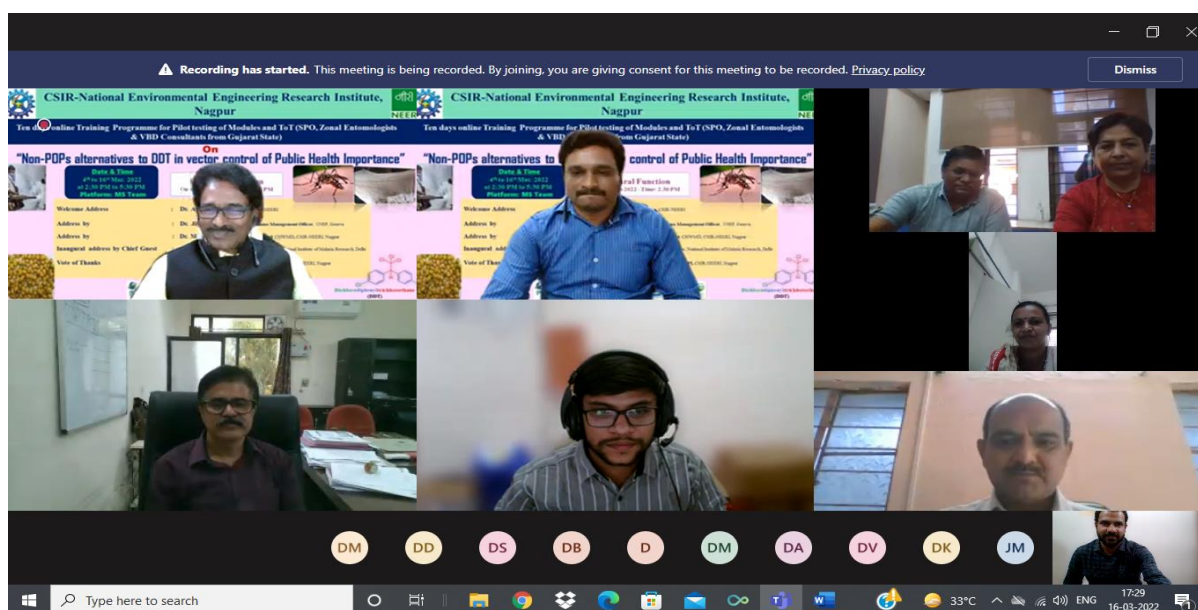


Exhibit-20: Photograph of end of Training Programme

6.0 Annexures

6.1. List of organizing members

1. **Dr. M.P. Patil**,
Chief Scientist and Head, CHWM Division,
CSIR – National Environmental Engineering Research Institute
2. **Dr. A. Ramesh Kumar**
Sr. Scientist and Project Leader,
CSIR – National Environmental Engineering Research Institute
3. **Dr. L. J. Kanhekar**
Project Consultant and Training Coordinator,
CSIR – National Environmental Engineering Research Institute
4. **Dr. Gujju Gandhi**
Research Associate-II,
CSIR – National Environmental Engineering Research Institute
5. **Mr. Abhishek Chaudhary**
Project Associate-II,
CSIR – National Environmental Engineering Research Institute
6. **Mr. Ashlesh Katpatal**
Project Associate-I,
CSIR – National Environmental Engineering Research Institute.

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,
Directorate of National Vector Borne Disease Control Programme
3. **Dr. Kalpana Baruah**
Ex-Addl. Director,
Directorate of National Vector Borne Disease Control Programme
4. **Dr. Amit Katewa**
National Consultant,
National Centre for Vector Borne Disease Control
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. N. Balakrishnan**
Ex-Joint Director,
National Centre for Disease Control
8. **Dr. P. T. Joshi**
Ex-State Entomologist, Gujarat state.
9. **Dr. T. Ratna Joseph**
Medical Entomologist, Ex-Deputy Director,
Government of Andhra Pradesh
10. **Dr. Y.P. Ram Dev**
National Technical Adviser,
United National Industrial Development Organization
11. **Dr. Regu**
Addl. Director,
National Centre for Disease Control.
12. **Dr Vilas J. Tambe**
Prof. & Head, Dept. of Entomology, Agriculture College, Nagpur

6.3. List of Nominated

S. No	Name	Designation	Location
1	Dr. Piyush Patel	Joint Director, NVBDCP	HQ
2	Smt. Mamta Dattani	I/c State Entomologist	HQ
3	Dr Mukesh Kapadia	Medical Officer	HQ
4	Shree Narendrasinh L Rathod	DMO	Ahmedabad
5	Jitendrakumar Narsinhbhai Parmar	Malaria Supervisor	Nadiad
6	Shree Aalok P. Kulshreshtha	DMO	Anand
7	Modi Dhara N	VBDC	Surendranagar
8	Dr. Dinesh Patel	DMO	Gandhinagar
9	Dr. Vinodkumar Bhogilal Patel	DMO	Mehasana
10	Dr. N. P. Patel	I/c D.M.O.	Patan
11	Dr. N K Garg	I/c DMO	Banaskantha
12	Dr. P. L. Asari	DMO	Sabarkantha
13	Dr. Pravin S Damor	I/c DMO	Aravali
14	Vijaykumar Bidla	I/c DMO	Vadodara
15	Dr. Kalyan K Pandey	I/c DMO	Chhota Udaipur
16	Mr. R B Patel	DMO	Godhara
17	Dr. C.R. Pateliya	DMO	Mahisagar
18	Mr. Atit Damor	DMO	Dahod
19	Dr. Nilesh G Patel	I/c DMO	Bharuch
20	Dr. R.S. Kashyap	EMO	Narmada
21	Krupa Ramubhai Patel	I/c ADMO	Surat
22	Dr. Snehal B Patel	I/c DMO	Tapi
23	Dr. S S Haque	I/c DMO	Valsad
24	Dr. Dhaval Mehta	I/c DMO	Navsari
25	Dr. D. C. Gamit	DMO	Dangs
26	Mr. Gaurang P. Upadhyay	DMO	Rajkot
27	Dr. Chetan L. Varevadiya	DMO	Morbi
28	Dr. Rajesh T Gupta	I/c DMO	Jamnagar
29	Dr. M. D .Jethva	I/c, DMO	Devbhumi Dwarka
30	Prakash H Durgani	DMO	Kutch
31	Dr. B. P. Boricha.	I/c DMO	Bhavnagar
32	Dr R R Chauhan	I/c DMO	Botad
33	Dr. A.K. Singh	I/c, DMO	Amreli
34	Mr. H F Radadia	DMO	Junagadh
35	Dr. K.B. Nimavat	DMO	Gir Somnath
36	Dr B B Karamtha	I/c DMO	Porbander

6.4 List of Attended

S. No	Name	Designation	Location
1	Smt. Mamta Dattani	I/c State Entomologist	HQ
2	Dr. Mukesh Kapadia	Medical Officer	HQ
3	Shree Narendrasinh L. Rathod	DMO	Ahmedabad
4	Jitendrakumar Narsinhbhai Parmar	Malaria Supervisor	Nadiad
5	Shree Aalok P. Kulshreshtha	DMO	Anand
6	Dhara Modi	VBDC	Surendranagar
7	Dr. Vinodkumar Bhogilal Patel	DMO	Mehasana
8	Dr. N. K. Garg	I/c DMO	Banaskantha
9	Dr. P. L. Asari	DMO	Sabarkantha
10	Vijaykumar Bidla	I/c DMO	Vadodara
11	Dr. C. R. Pateliya	DMO	Mahisagar
12	Dr. Nilesh G. Patel	I/c DMO	Bharuch
13	Krupa Ramubhai Patel	I/c ADMO	Surat
14	Dr. Snehal B. Patel	I/c DMO	Tapi
15	Dr. S. S. Haque	I/c DMO	Valsad
16	Dr. Dhaval Mehta	I/c DMO	Navsari
17	Dr. D. C. Gamit	DMO	Dangs
18	Mr. Gaurang P. Upadhyay	DMO	Rajkot
19	Dr. Chetan L. Varevadiya	DMO	Morbi
20	Dr. Rajesh T. Gupta	I/c DMO	Jamnagar
21	Prakash H. Durgani	DMO	Kutch
22	Dr. B. P. Boricha	I/c DMO	Bhavnagar
23	Dr. R. R. Chauhan	I/c DMO	Botad
24	Dr. A. K. Singh	I/c DMO	Amreli
25	Dr. K. B. Nimavat	DMO	Gir Somnath

6.5. Training Schedule

CSIR-National Environmental Engineering Research Institute, Nagpur

Training of Trainers (ToT) and pilot testing of modules to promote non-POPs alternatives based Integrated Vector and Pest Management

Time Table: 10 days online Training Programme to SPO/Entomologists and VBD Consultants from Gujarat State.

Time	Topic (Lecture discussion)	Faculty
All Participant Trainees are requested to join daily by 02.20 PM		
Day 1 (Friday) 04/03/2022		
Inaugural Function		
1430-1500	Welcome Address: (2.30-2.35 PM)	Dr. A. N. Vaidya , Director, CSIR-NEERI
	Address by: (2.35-2.40 PM)	Dr. Jitendra Sharma , Programme Management Officer, UNEP, Geneva
	Address by: (2.40-2.45 PM)	Dr. M. P. Patil , Chief Scientist & Head, CHWMD, CSIR-NEERI
	Inaugural address by Chief Guest: (2.45-2.55 PM)	Dr. Amit Prakash Sharma , Director, National Institute of Malaria Research, New Delhi
	Vote of Thanks: (2.55-3.00 PM)	Dr. A. Ramesh Kumar , Sr. Scientist and Project Leader CSIR-NEERI
1500-1530	Introduction to Modules 1 to 4 and training materials	Dr L J Kanhekar
1530-1600	Introduction to DDT and its use in Vector Control	Dr A Ramesh Kumar/ All participant
1600-1645	Introduction to vector borne diseases: Malaria	Dr R S Sharma / All participant
1645-1730	Introduction to vector borne diseases: Leishmaniasis (Kala-azar)	Dr Vijay Kumar/ All participant
Day 2 (Monday) 07/03/2022		
1430-1500	Introduction to vector borne disease: Japanese Encephalitis	Dr P T Joshi/ All participant
1500-1530	Introduction to vector borne diseases: Lymphatic Filariasis	Dr. P K Srivastava / All participant
1530-1600	Introduction to vector borne disease: Scrub Typhus	Dr T Ratna Joseph / All participant
1600-1630	Introduction to Crimean Congo Hemorrhagic Fever	Dr. K. Regu / All participant
1630-1715	Introduction to vector borne diseases: Dengue, Chikungunya and Zika	Dr Kalpana Baruah/ All participant
1715-1745	Introduction to Kyasanur Forest Disease	Dr N Balakrishnan / All participant
Day 3 (Tuesday) 08/03/2022		

1430-1500	Introduction to vector borne diseases: Plague	Dr N Balakrishnan/ All participant
1500-1530	Morphology of vector mosquito	Dr L J Kanhekar/ All participant
1530-1600	Bionomics of vector mosquitoes	Dr R S Sharma / All participant
1600-1630	Morphology and Bionomics of sandflies	Dr Vijay Kumar / All participant
1630-1720	Morphology and bionomics of flies and fleas	Dr Amit Katewa / All participant
1720-1745	Feedback on Modules 1	Dr L J Kanhekar/ Dr G Gandhi/ All Participants
Day 4 (Wednesday) 09/03/2022		
1430-1520	Morphology and bionomics of Ticks and mites	Dr T Ratna Joseph / All participant
1520-1620	Entomological surveillance of VBDs	Dr Himmat Singh/ All participant
1620-1710	Alternatives to DDT in Vector Control Management – Conventional Methods & Environmental Management	Dr R S Sharma / All participant
1710-1745	Feedback on Modules 2	Dr L J Kanhekar/ Dr G Gandhi/ All participant
Day 5 (Thursday) 10/03/2022		
1430-1515	Vector control measures/ management: Biological Control	Dr T Ratna Joseph / All participant
1515-1600	Entomological parameters and its importance	Dr Himmat Singh/ All participant
1600-1630	Vector control measures/ management: Genetic Control	Dr T Ratna Joseph / All participant
1630- 1700	Vector control measures/ management: Chemical Methods	Dr P. K. Srivastava /All participant
1700-1745	IVPM: Behavior Change Communication	Dr P T Joshi/ All participant
Day 6 (Friday) 11/03/2022		
1430-1515	Equipment for larviciding and adulticiding	Dr T Ratna Joseph / All participant
1515-1600	Neem derived products for vector control	Dr Y P Ramdev/ Dr. Amerish Agarwal/All participant
1600-1645	Integrated Vector Pest Management: IVM – Integrated vector control methods and IVM in different situations	Dr P T Joshi / All participant
1645-1730	Feedback on Modules-3	Dr L J Kanhekar/ Dr G Gandhi/ All participant
Day 7 (Saturday) 12/03/2022		
1430-1515	Integrated Vector Pest Management: IPM	Dr Vilas Tambe / All participant
1515-1600	IVPM: Vector management through Farmer Field School approach	Dr R S Sharma/ All participant
1600-1645	Planning and implementation of IVPM	Dr R S Sharma/ All participant

1645-1745	Epidemiological surveillance and parameters	Dr T Ratna Joseph / All participant
Day 8 (Monday) 14/03/2022		
1430-1500	Monitoring and evaluation of IVPM	Dr Amit Katewa / All participant
1500-1615	Pilot testing Module – 1 input from participant trainees	Dr R S Sharma / Dr L J Kanhekar/Participants
1615-1730	Pilot testing Module – 2 inputs from participant trainees	Dr Amit Katewa / Dr L J Kanhekar/Participants
Day 9 (Tuesday) 15/03/2022		
1430-1600	Pilot testing Module – 3 inputs from participant trainees	Dr P T Joshi / Dr L J Kanhekar/ All Participants
1600-1730	Pilot testing Module – 4 inputs from participant trainees	Dr R S Sharma/ Dr Gujju Gandhi
Day 10 (Wednesday) 16/03/2022		
1430-1530	Lecture/Discussion on FAQs materials	Dr T Ratna Joseph/ Dr R S Sharma / All Participant
1530-1630	Lecture/Discussion on IEC materials	Dr R S Sharma /Dr Amit Katewa / All Participant
1630-1720	Feedback from Participant trainees & instructions	Dr L J Kanhekar/ Dr Gujju Gandhi
1720-1745	Virtual Valedictory session	Dr Ramesh Kumar/ Dr L J Kanhekar /


(Dr L J Kanhekar)

Project Consultant & Training Coordinator
CSIR-NEERI, Nagpur

Copy to: 1. All Participant Trainees

2. Joint Director (Mal. & Fil.),
Commissionerate of Health Services &
Medical Education, Dr. Jivraj Mehta Bhawan,
Block No-5, GANDHINAGAR-382010, Gujarat.