Vector Control & Entomology Scoping Report—Ethiopia

Integrated Vector Management (IVM) Task Order 2

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CURRENT STATUS OF ENTOMOLOGICAL MONITORING AND SURVEILLANCE FOR AN EFFECTIVE DELIVERY OF VECTOR CONTROL INTERVENTIONS IN ETHIOPIA

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1. EXECUTIVE SUMMARY

In Ethiopia, infectious and communicable diseases comprise of about 60 – 80% of the health problems. A large proportion in all out patient morbidity, admissions, and deaths is due to vector borne diseases, of which malaria is the major cause. Lymphatic filariasis, schistosomiasis, onchocerciasis and leishmaniasis are very important vector borne diseases next to malaria. More than 75% of the land mass of the country is suitable for malaria transmission and about 54 million people are at risk of infection. Annually more than 10 million clinical cases are reported, and the prevalence rate is around 12%. Transmission is seasonal and usually occurs in epidemic form and affects all age groups. Lymphatic filariasis, onchocerciasis and leishmaniasis are endemic in the northwest, west, and south western part of the country while schistosomiasis is widely distributed in lowland and mid land areas of the country. Malaria control programme has been in place for more than 40 years by use of case management in health facilities, malaria control sectors and at community level through volunteer village malaria workers. Indoor residual insecticide spray and environmental management were the most widely applied malaria control methods, until 2005 when insecticide treated nets (ITNs) were introduced into the country in limited areas. Currently, Indoor Residual Spraying (IRS) and ITNs are the most widely used interventions, with universal coverage of long lasting insecticidal nets (LLINs) underway. On the other hand there is no organized system or programme to control lymphatic filariasis, leishmaniasis and schistosomiasis.

The vector control component of malaria control is weak, mostly due to shortage of trained manpower on top of resource scarcity. There is a strong need to strengthen the vector control in the country without which impacting on the disease burden of vector borne diseases could be difficult. The implementation of sound vector control measures needs to be based on evidence, which necessitates building of local capacity. On the other hand, underdeveloped health systems, recurrent weather change which mostly leads to epidemics, and occurrence and rapid spread of insecticide resistance have recently been identified as challenges to the control of vector borne diseases in the country.

Integrated vector management (IVM) uses principles of sound management and allows full consideration of the determinants of disease transmission and control. WHO describes IVM as "**A rational decision-making process for the optimal use of resources for vector control**". It aims to improve efficacy, cost effectiveness, ecological soundness and sustainability of vector control interventions for control of vector-borne diseases. IVM is a decision-making process for the management of vector populations, so as to reduce or interrupt transmission of vector-borne diseases.

An IVM approach takes into account the available health infrastructure and resources, and integrates all available and effective vector control measures, both chemical and non-chemical. Judicious use of public health pesticides is thus an essential element of IVM.

The following key essential actions were identified during the country mission:

- A need to conduct a comprehensive Vector Control Needs Assessment (VCNA) to determine the entomological capacity at different levels of the health care system.
- Conduct assessment of needs and resources for strengthening technical personnel, laboratory capacity and training institutions at national, regional, and district levels.
- Establishment of a national reference unit(s) (NRU) and a country plan on capacity strengthening.
- Establishment of a robust Monitoring and Evaluation system to conduct entomological surveillance and resistance management in partnership with academic institutions where possible

- Need to develop up-to-date country databases on the status of malaria vector species and malaria vector resistance to insecticides.
- In collaboration with WHO and FAO:
    - Review, and revise, procurement procedures for public health pesticides (PHPs) with the aim of eliminating identified bottlenecks, and to develop national guidelines for PHP procurement by considering WHO specifications for procurement and quality control;
    - Review and revise national regulations on storage and disposal of (public health) pesticides, taking into account the provisions of relevant international conventions e.g., Basel convention;
    - Build national capacity on pesticide stock management, and carry out training of pesticide storekeepers, while making optimal use of existing training resources;
    - Carry out a national feasibility study on options for recycling and/or disposal of empty pesticide containers and out-lived LLINs and
    - Develop a plan of action for their environmentally sound management

- Ethiopia should be encouraged to develop a comprehensive national strategy to address peculiar challenges and improve on the help management of public health pesticides as well as implementing principles of IVM

2. ABBREVIATIONS

AAU	Addis Ababa University
BPR	Business Processing Re-engineering
CORPs	Community-Owned Resource Persons
DDT	dichloro-diphenyl-trichloroethane
FAO	Food Agricultural Organization
FMoH	Federal Ministry of Health
GoE	Government of Ethiopia
HEWs	Health Extension Workers
HSDP	Health Sector Development Program
Icipe	International Center of insect Physiology and Ecology
IDSR	Integrated Disease Surveillance and Response
IRS	Indoor Residual Spray
ITN	Insecticide Treated Nets
IVM	Integrated Vector Management
KAP	Knowledge Attitude and Practice
LLIN	Long lasting insecticidal nets
M&E	Monitoring and Evaluation
MDG	Millennium Development Goals
MIS	Malaria Indicator Survey
MOH	Ministry of Health
MSc	Master of Science
NMCP	National malaria control program
NNP	National Nutrition Program
NRU	National Research Unit
PhD	Doctor of Philosophy
PMI	Presidential Malaria initiative
PHPs	Public Health Pesticides
RHB	Regional Health Bureau
SNNP	Southern Nations Nationalities and Peoples
USAID	United States Agency International Development
WHO	World Health Organization

3. INTRODUCTION

In Ethiopia, national capacity for entomological surveillance and monitoring has diminished over time. Limited surveys have shown the development of significant insecticide resistance among malaria vectors in some areas, although the distribution and underlying biomolecular drivers are not known. There is a need for an assessment of the status of vector control and needs for effective transitioning to IVM, including the development of relevant entomological capacities to address the threat of insecticide resistance to ongoing vector control implementation.

The purpose of the consultative mission was to:

- Work closely with the Federal Ministry of Health and provincial health bureaus on the the need for transitioning to IVM

The expected outcomes of the missions were:

1. Review the current status of entomological monitoring and surveillance, including the role(s) of various national institutions (FMOH, Bureaus, universities etc).
2. Identify and prioritize needs, and provide options for strengthening entomological capacity to support national vector control efforts (including potential institutional arrangements, and human resource and infrastructural strengthening).
3. Propose a national entomological monitoring and surveillance scheme, including potential sentinel locations, roles and approaches for effective coordination and data management.
4. Provide options for addressing the issue of pesticides disposal, referencing preview assessments on the subject.

3. METHODOLOGY

The mission took place between 8-21 April 2012 (*see Annex 1*) and a schedule of meetings and interviews was organized with relevant authorities. The methodology employed included document reviews of the vector control guidelines, national malaria strategic plans (2011-2015), review of relevant literature, and interviews with Ministry of Health personnel and partners (*Annex 2*) including WHO, PMI and Abt Associates Ltd. Other stakeholders interviewed included Ethiopian Health and Nutrition Research Institute (EHNRI), International Centre of Insect Physiology & Ecology (icipe), Addis ababa University and Jimma University. Guiding questions to facilitate analysis of problems in the existing system of vector control (*Annex 3*) were used in conducting interviews with the Ministry of Health personnel at both national and regional levels while a questionnaire on needs assessment for laboratory support for vector control implementation was used for institutions with entomology capability, such as universities and research institutes, as well as the department of national malaria prevention and control. (*Annex 4*)

4. SITUATION ANALYSIS

4.1 Background

Malaria is one of Ethiopia's leading causes of morbidity and mortality. Ethiopia's population in 2007 is estimated to be 79 million with 53.7 million or 68% being at risk of acquiring malaria infections. Malaria is prevalent in three quarters of the country's land mass (altitude < 2000 m)..

4.2 Administrative Units

Ethiopia is a Federal Democratic Republic composed of nine Regional States [Tigray, Afar, Amhara, Oromia, Somali, Benishangul-Gumuz, Southern Nations Nationalities and Peoples (SNNP), Gambella and Harrari] and two City Administrations (Addis Ababa and Dire Dawa). The National Regional States and City Administrations are further divided into zones which are further divided into 736 *woredas* (districts). A *woreda* is the basic realized administrative unit and has an administrative council composed of elected members. The 736 *woredas* are further divided into roughly 15,000 *kebeles* (villages), organized under peasant associations in rural areas (10,000 *kebeles*) and urban dwellers associations (5,000 *kebeles*) in towns. Ethiopia's Federal Ministry of Health (FMoH) has gone through health sector reforms that have posed new challenges in the management of malaria control. With the devolution of power to regional governments, public service delivery, including health care, has to a large extent fallen under the jurisdiction of the regional states. The approach has been to promote decentralization and meaningful participation of the population in local development activities. For administration of public health care at the regional level, there is a Regional Health Bureau (RHB). Due to the Government's commitment to further decentralize decision making power, *woredas* are currently the basic units of planning and political administration.

The Federal republic of Ethiopia subscribes to the Roll Back Malaria Abuja targets and the Millennium Development Goals (MDG). Malaria is considered a priority for poverty reduction and the government's development agenda. Although the FMoH is committed to increasing access to health services and increasing the efficiency and quality of these services nationwide, a weak health infrastructure and shortage of health workers are formidable obstacles. In 2005, Ethiopia adopted a decentralized approach for health, led by the MOH and with the participation of bilateral and multilateral agencies. In the decentralized system, planning and implementation of malaria prevention and control activities belong to the RHBs, while the federal level is mandated to handle policy and guideline development and capacity building.

During the eradication and vertical program era, malaria control personnel were trained in the Malaria Reference Training Center in Nazareth/Adama. Separate basic training for malaria control personnel is not currently provided, and training on basic malariology has little emphasis in the training curricula of health professionals. The newly engaged cadre of health extension workers receives training on malaria as part of their training on the main 16 health packages that are part of their curriculum.

4.3 Malaria transmission

Malaria transmission exhibits a seasonal and unstable pattern in Ethiopia, with transmission varying with altitude and rainfall. The major malaria transmission season in the country is from September to December, following the main rainy season from June/ July to September. There is a shorter transmission season from April to May following the shorter rainy season in some parts of the country. Based on a transmission model, Ethiopia can be divided into 3 distinct malaria epidemiological zones (perennial/endemic, seasonal and epidemic):

i) **Endemic.** Intense transmission occurs throughout the year in areas less than 2000m.
ii) **Highland epidemic prone.** Parasite prevalence is low in the highland areas. However, every 5-8 years, major epidemics can occur at these altitudes (>2000m) as a result of climatic fluctuations, including increased surface temperature, rainfall anomalies and drought–related effects.
iii) **Arid seasonal.** Limited rainfall in these areas limits malaria transmission to a few months in the year. Overall, all districts in this category support low infection prevalence rates in childhood.

The map below depicts the various levels of malarias risk throughout the country. (Figure 1).

4.4 Malaria Vectors: *Anopheles arabiensis*, a member of the *An. gambiae* complex, is the primary malaria vector in Ethiopia, with *An. funestus*, *An. pharoensis* and *An. nili* as secondary vectors. The sporozoite rate for *An. arabiensis* has been recorded to be up to 5.4%. The host-seeking behavior of *An. Arabiensis* varies, with the human blood index collected from different areas ranging between 0.8 and 1. *Anopheles funestus,* a mosquito that prefers to feed on humans, can be found along the swamps of Baro and Awash rivers and shores of lakes in Tana in the North and the Rift Valley area. *Anopheles pharoensis* is widely distributed in Ethiopia and has shown high levels of insecticide resistance, but its role in malaria transmission is unclear. *Anopheles nili* can be an important vector for malaria, particularly in Gambella Regional State.

4.5 Malaria parasite species composition: In Ethiopia *Anopheles arabiensis* is responsible for transmitting *Plasmodium falciparum* and *P. vivax*. *Plasmodium falciparum* and *P.vivax* are the most dominant malaria parasites in Ethiopia. They are prevalent in all malarious areas in the country with *P. falciparum* representing about 66% - 75% of the cases, although their relative composition can be variable. *Plasmodium malariae* and *P. ovale* are rare and account for <1%of all confirmed malaria cases.

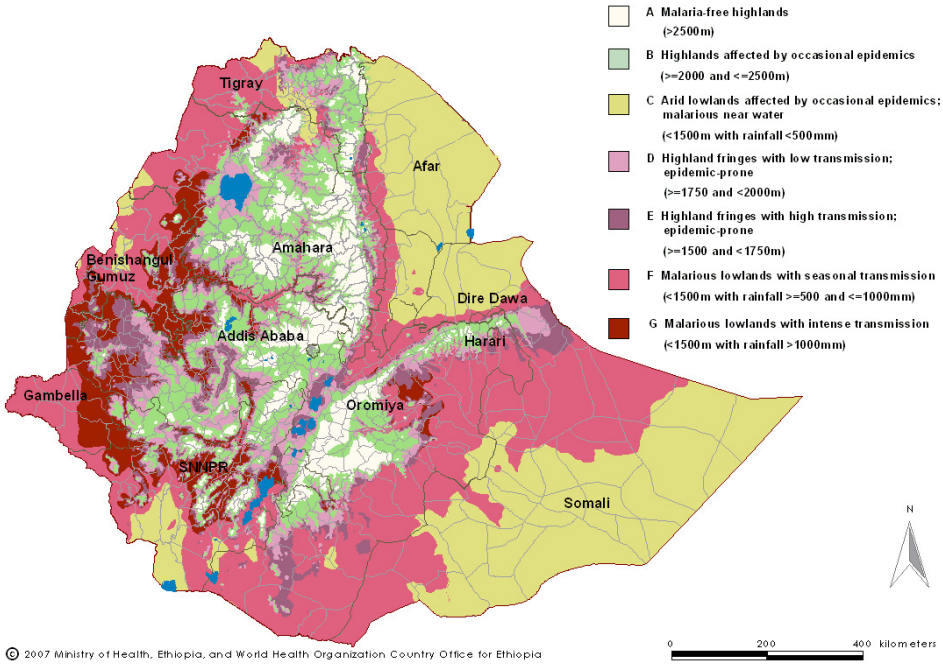

Fig 1: Ethiopia Malaria risk map

4.6 Insecticide Resistance to Malaria vectors: The vector mosquito, *Anopheles gambiae* s.l, is becoming increasingly resistant to DDT. Recent studies by Balkew *et al* (2010) and Abate & Hadis (2011) using adult *An. gambiae s.l.* raised from wild-caught larvae showed survival rates as high as 49.5% with a WHO discriminating concentration of DDT and there was also significant resistance to permethrin (15% survival) and deltamethrin. In the light of these findings, it cannot be assumed that pyrethroid-impregnated ITNs and IRS will continue to be as effective in the future as in the recent past. The lack of both adequate evaluation of currently used public health pesticides and systematic surveillance of insecticide resistance on major public health pesticides used for malaria control in Ethiopia calls for an immediate action.

While ITNs/LLINs and IRS involve the use of chemical insecticides, some of the other methods of controlling larval or adult mosquitoes utilize biological control techniques or environmental management.

4.7 Malaria Vector interventions in Ethiopia

Vector control measures, including selective indoor residual spraying of dichlorodiphenyltrichloroethane (DDT), distribution of long lasting insecticide treated mosquito nets (LLINs) and source reduction of larval habitats, are currently implemented by the Federal Ministry of Health in collaboration with international and non-governmental organizations. The history of utilization of DDT in the country dates back to the mid 1950s with small-scale trials followed by wide and extensive application during the malaria eradication period. The fight against malaria is governed by a five-year strategic plan for 2006–2010 and 2011-2015 based on the above vector control measures. Below is a summary of the main malaria vector interventions and the challenges for their effective implementation.

4.7.1 Indoor Residual Spraying (IRS)

Indoor residual spraying remains one of the most valuable interventions for malaria control in malaria epidemic prone areas. The main objective of IRS activities is aimed at mitigating malaria transmission by reducing the longevity or survival probability of *Anopheles* malaria vectors. A reduction in vector density by reducing their longevity is expected to result in a reduction in the total number of mosquitoes entering houses, and the number of infective bites to which the human population is exposed, hence reducing the level of malaria transmission in the target areas.

Currently in Ethiopia, IRS, as a main component of selective vector control, is targeted to cover epidemic-prone areas, development projects, and malaria-affected communities with low access to the health care system. There has been a dramatic scale up of IRS in households using DDT, from 700 tons in 2005 to 1700 tons in 2008. In 2008, 3.79 million unit structures were sprayed, protecting 11.9 million people. The coverage is estimated to have reached 50% of the target areas. DDT is the first-line insecticide used for IRS in Ethiopia because of its low cost, comparative safety, and significant residual effect (i.e. greater than 6 months). However, regular monitoring of its efficacy has not been done to determine the susceptibility of the local vectors to DDT. Recent studies in selected localities appear to indicate that the main vector, *An. arabiensis,* is resistant to DDT and other 3 classes of insecticides including pyrethroids.

Prior to the integration of the program into the general health service, most of the entomological and operational indicators of IRS were monitored and evaluated using a team of entomologists. This activity gradually deteriorated and current monitoring and evaluation (M&E) of these indicators is left to interested / commissioned academic and research institutions. As such, there is a critical and major gap in M&E of very important entomological and operational indicators such as bioassays and susceptibility tests. Therefore, Ethiopia urgently needs a comprehensive and regular assessment of the susceptibility of local vector(s) to DDT (and other insecticides) in representative eco-epidemiological sentinel sites throughout the country to develop mechanisms for insecticide resistance management.
As the M&E is weak, data collection, analysis, and reporting should be strengthened to help guide the decision making process. These can be strengthened through working in collaboration with partners and other relevant stakeholders.

4.7.1.1 Constraints and gaps for effective IRS implementation:

The effective implementation of the IRS programme in Ethiopia has had some serious constraints and gaps:

- Due to resource limitations including shortages of insecticides spray pumps, spare parts, vehicles and operational funds, only about 20-25% of the epidemic prone areas are protected. This means that IRS is not effectively implemented and therefore majority of the people are not covered.
- Due to lack of skilled manpower and reduced capacity at all levels, no epidemiological surveillance and analysis is done to inform on malaria risk areas at all levels (district, village, etc). This lack of information may lead to inappropriate targeting of malarious localities for IRS, and because disease incidence fluctuates from season to season and from year to year, correct targeting may not be possible.
- There is also a shortage of spray technicians, mainly due to the high attrition rate among malaria workers and the absence of new trainees to replace them.
- There is an urgent need to develop a National IRS Policy and guidelines. The availability of this document will assist in ensuring that IRS is organized, implemented, supervised and monitored accordingly.
- Develop guidelines for IRS impact assessment – It is important for the National and Regional MoH bureaus and partners to know whether IRS has led to a reduction in vector density, malaria morbidity and mortality. There is a need for feedback on the performance of insecticides, vector susceptibility to insecticides or the development of resistance to insecticides if any. These guidelines should include the development of protocols for IRS quality monitoring such as insecticide bioassay protocols, training of staff on quality monitoring, frequency of bioassays and vector density determinations. FMoH and RHBs should develop capacity and collaborate with entomology departments at Addis Ababa University, Jimma University and EHNRI to assist in entomological surveillance and insecticide monitoring. It is important to note that the possibility of insecticide resistance to commonly used insecticides exists. Hence there is need to formulate a mechanism for the use of different insecticides on a rotational basis, or in a mosaic design to delay the development of resistance.
- The GoE has put a lot of effort in ensuring adequate supply of IRS equipment and insecticides; however, the supply of these is still inadequate in most of the districts. There is need to conduct an IRS needs assessment in all the target epidemic districts, based on the proposed coverage expected to determine the needs of each district in terms of training and supply of equipment. This will also assist in development of a national IRS Budget and budgetary allocations.
- The successful achievement of all of the above requires more financial resources for training, equipment, supervision, etc. There is also need for more institutional commitment.

4.7.3 Long Lasting Insecticide Nets (LLINs):

The malaria indicator survey (MIS) conducted in 2007 showed a rapid increase in the number of households with insecticide treated nets (ITNs) from 6% to 66% in the targeted malarious areas since 2004. However, the survey showed that the regional states varied significantly in terms of key malaria intervention indicators, with Oromia region lagging behind.

The 2007 malaria indicator survey (MIS) results indicate that in areas below 2,000m, 65.6% of households own at least one insecticide-treated net (ITN) and 65.3% of households own at least one LLIN. Nationally, 55.7% of the households own at least one net of any kind, 53.8% own at least one ITN, and 53.1% own at least one LLIN. However, net utilization is still low.

4.7.2 *Malaria* Epidemics Prevention and Control

Malaria epidemic prevention and control is a key component of the National Five Year Strategic Plan for Malaria Control (2011-2015). In summary, the strategic plan and Federal Ministry of Health guidelines for epidemic prevention and control have the following as key components:

- Early warning and case detection through epidemiological surveillance and monitoring of environmental precipitating factors such as rainfall and surface temperature anomalies
- Mapping of epidemic-prone areas
- Contingency funding for epidemic response operations
- Epidemic prevention through indoor residual spraying

4.7.2.1 Constraints and challenges:

The key constraints affecting the response to epidemic include:

- Poor, slow and inconsistent surveillance, coverage and reporting systems
- Non operational early warning systems
- Lack of regional and district-level epidemic risk maps, with the criteria for identifying epidemic-prone communities clarified
- Weak epidemic preparedness planning and micro-planning in most regions

4.8 Operational Research

According to the Ethiopian National Malaria Strategic Plan (2011-2015) and through its implementation, a number of operational research studies have been identified to be carried out in collaboration with RHBs, universities and research institutions. Some of these operational studies include: Insecticide susceptibility studies, Drug efficacy studies, Monitoring longevity of LLINs under field conditions, and KAP study on malaria interventions.

a) **Insecticide susceptibility and Drug efficacy studies:** It is proposed that insecticide and drug efficacy studies will be done in collaboration with EHNRI at 25 selected sentinel sites once every two years. However, it is not clear on the selection of the sentinel sites.
b) **Monitoring longevity of LLINs under field conditions:** This will involve continuous monitoring insecticidal residual efficacy of LLINs as well as their physical integrity to help come up with a national replacement strategy and education. It is not clear who is mandated to carry out this activity.
c) **KAP study on malaria interventions:** To help plan for proper utilization of the key malaria interventions, KAP studies will be carried out by FMOH and in-country stakeholders in order to better design and tailor intervention strategies.

4.9 ROLE OF RESEARCH INSTITUTIONS AND/OR UNIVERSITIES WITH ENTOMOLOGY CAPABILITIES

The following institutions were visited and verified to have laboratory facilities including entomology laboratory, functional insectary, and insecticide resistance testing facilities. These are:

i) University of Addis Ababa – Aklilu Lemma Institute of Pathobiology
ii) Jimma University
iii) Ethiopia Health and Nutrition Research Institute

4.9.1 Aklilu Lemma Institute of Pathobiology

The Aklilu Lemma Institute of Pathobiology was established in 1967 by the Addis Ababa University (AAU) with the objective of conducting biomedical research. The Institute is organized into various units depending on the prevailing situations and research activities. Currently, the Institute consists of five units, which carry out the following five major research programs:

- Vector Biology and Control Research Program
- Microbiology Research program on major infectious Diseases
- Endod and other Medicinal plants Research Program

- Human Parasitic Diseases Research Program
- Animal Health and Zoonotic Diseases Research Program

Since 2005, the institute has been running an MSc program in Tropical and Infectious Diseases and recently in 2010 it started the PhD program in the same field. At present, there are 26 academic staff members (faculty and technical assistants) including 4 Medical entomologist/Vector Biologists and 6 Medical parasitologists. The Vector Biology and Control Research program, headed by Dr. Meshesha Balkew has the capacity and facilities to conduct insecticide resistance testing and has a functional insectary including an entomological laboratory. However, the infrastructure needs to be upgraded to meet the current Good Laboratory Practice and to have a standard operating practice.

4.9.2 Jimma University

Jimma University was established in 1997 and is based in the Oromia region, 335km South-west of Addis Ababa. It is the second-largest higher education institution in the country after Addis Ababa University. The 2006-2015 strategic plan of Jimma University envisages transforming the university into a world class institution in the country for its innovative and community based educational approaches that underpin its educational programs, research and scholarly undertakings and delivery of services to the public.

One of the university's core values is networking for collaboration and partnership to enhance its teaching, research and service endevours and to impact socio-economic development of the surrounding community and country in general. According to Prof. Kora Tushume, vice president and administrative officer, the university has established solid collaboration with the Belgian government to build a multidisciplinary approach towards capacity building in human resources, infrastructure and funding. Currently 33 members of the university staff are pursuing either masters or PhD programs in different field through the collaborations. During my visit to the University, technology transfer was evident especially in the provision and development of high tech laboratories capable of conducting research to the highest standards. The University has also established several well equipped field stations where they conduct field entomological and epidemiological surveys.

4.9.3 Ethiopia Health and Nutrition Research Institute (EHNRI)

The Ethiopian Health and Nutrition Research Institute (EHNRI) serves as the leading research and service component of the Ministry of Health. It contributes to the health development strategy and functions to achieve objectives set forth throughout the 15 Health Sector Development Programs (HSDP) by strengthening medical laboratories in Ethiopia, providing referral laboratory services and conducting applied research on health and nutrition. It is also providing a leadership role in research and technology transfer in the accelerated facilitation, coordination and implementation of National Nutrition Program (NNP), and through the support from international organizations, such as the WHO and World Bank, laboratories are becoming better equipped with both human resources and supplies. They also provide trainings and other technical support to regions on the management of public health emergency including malaria epidemics.

Although EHNRI is mandated to conduct public health emergency management, establish and maintain quality laboratory systems and craft a research priority on public health problems, there is no clear policy on the management and research on vector biology in its mandate.

5. SUMMARY FINDINGS:

Ethiopia has long recognized the added value of transitioning to IVM. There are however significant constraints to achieving the set objectives. National capacity for entomological surveillance and monitoring has diminished over time. Limited surveys have shown the development of significant insecticide resistance among malaria vectors in some areas, although the distribution and underlying biomolecular drivers are not known.

An assessment of the status of vector control and needs for effective transitioning to IVM, including the development of relevant entomological capacities to assist in addressing the threat of insecticide resistance to ongoing vector control implementation was undertaken as provided below:

5.1 Current status of entomological monitoring and surveillance, including the role(s) of various national institutions (FMOH, Bureaus, universities etc).

5.1.1 Organization of the NMCP in Ethiopia: Until 2009, the NMCP in Ethiopia was staffed by members of the Malaria and Other Vector-borne Diseases Team and was included in the FMOH's Communicable Disease Prevention and Control Department. The team's responsibilities included overall coordination of malaria and other vector-borne diseases control at the national level, identification of implementation capacity gaps for Regional Health Bureaus (RHBs) and provision of training, formulation and dissemination of malaria national policy and technical guidelines, oversight of policy implementation, monitoring and evaluation (M&E) of impact of operational program activities, and advocacy for malaria as a priority disease.

In 2009, the Government of Ethiopia (GoE) completed a business process re-engineering exercise (BPR) that resulted in the re-organization of ministries and agencies according to eight core processes. Following this re-engineering exercise, the NMCP and Communicable Disease Prevention and Control Department have been absorbed into Directorates, with most malaria activities being implemented by the Directorate for Disease Prevention and Promotion and the Directorate of Medical Services.

5.1.2 Entomological capacity building and monitoring services: Entomological surveillance and monitoring is not a routine exercise and therefore not much exists. However, reports from USAID/PMI office indicate that since 2009, four sentinel sites were selected for vector surveillance including vector identification, density and insecticide resistance status. These 4 sentinel sites were to be expanded to 15 sites by 2012, but due to limited funding this have not taken place yet. There is no entomological staff in the national malaria control team as well as in the Regional Health Bureaus, indicating that the entomological surveillance and monitoring of insecticide resistance will greatly be impeded. However, it has been observed that these activities can be carried out by the PMI implementing partner with assistance from the local institutions such as Addis Ababa University, Jimma University and the Ethiopian Health Research and Nutrition Institute (EHNRI).

5.1.3 Roles of various institutions: Local institutions such as Addis Ababa University, Jimma University and the Ethiopian Health Research and Nutrition Institute (EHNRI) should provide technical assistance to the National malaria control team to coordinate entomological monitoring activities through the support of funding from the Global Fund and the government. Today research institutes and Universities are increasingly involved in policy making, planning and evaluation of vector control activities. EHNRI has been collaborating with national malaria control programme in providing a set of scientific services. However, this collaboration is often on an ad hoc basis with no formal agreement or a long term commitment. In addition, the universities should be provided the critical role in the capacity building through training at higher levels in addition to conduct of operational and applied research.

In order to tighten the collaboration between EHNRI and the national malaria team, three main actions are needed:

Firstly, the critical role of EHNRI to the implementation of control programmes should be formally recognized, clearly defined and endorsed by the Federal Ministry of Health and its partners. This is very important to ensure that funding lines for these entities could be established in the future to allow a continued functioning and support to the control program. **Secondly**, formal agreements and workplans should be developed for EHNRI to deliver predefined products or outputs as their contribution to the operations of malaria control. Thus activities such as laboratory services, data analysis and interpretation, training, etc should be well defined in the agreements, and **thirdly** EHNRI should be systematically be co-opted in national committees that address policy and strategic developments for malaria control. Further,

5.2 Identify and prioritize needs, and provide options for strengthening entomological capacity to support national vector control efforts (including potential institutional arrangements, and human resource and infrastructural strengthening).

5.2.1 Capacity building for entomological surveillance

The success of an entomological surveillance programme will largely depend on a good system of vector collection, handling, storage, analysis and data management, interpretation, and reporting. Such a system is lacking throughout the national health system. Since entomological surveillance will be implemented at the village (community), district and regional levels, it is imperative that basic capacity for entomological surveillance be available at all 3 levels so that they are able to perform their functions properly. The capacity will include human resources, equipment and development of laboratory networks. Details of resources required to conduct entomological surveillance and level are described in the Table 1. A quick assessment undertaken at the National Malaria control team, research institutes and Universities in Ethiopia showed that there is no basic capacity for vector surveillance at the NMCP; while EHNRI had basic capacities and the universities had both basic and advanced capacity for vector surveillance (Table 1, Annex 4). However, there is no established formal collaboration between the National malaria team and the research institute and Universities.

There is need to have a well trained entomologist (s) who will co-ordinate surveillance activities for all regions. These entomologists should receive data, samples and reports from sentinel or surveillance sites, digest and process the information for onward transmission to the policy level in consultation with the National Integrated Disease Surveillance Team. They should be supported by regional and district entomological surveillance focal persons.

5.2.2 Integrated Vector Management: There is no IVM policy in the country and therefore there is need to provide technical support for the FMOH to develop an IVM strategy. In order to streamline this support, an in-depth comprehensive needs assessment to identify policy, managerial and human resource needs is urgently required. . This is important if improvements on policy, legislation and institutional arrangements, capacity-building and integration with other vector-borne diseases in Ethiopia are to be comprehensively reviewed.

There has been confirmed significant insecticide resistance in parts of Oromia and other parts of Ethiopia indicating an urgent need for resistance management efforts, including sound integration of

complementary interventions to augment the current IRS and LLIN programs. In view of these requirements the key issues remain the training of relevant personnel to help coordinate surveillance activities at all levels.

5.2.3 Strengthening Routine Epidemic Detection and Surveillance: Ethiopia has a strong community health workforce including community-level Health Extension Workers (HEWs) and HEW supervisors. These community HEWs and their supervisors are mandated to detect and respond to increases in malaria case loads or epidemic outbreaks at the community level. These community resource persons (CORPs) are distributed in 283 districts in 6 regional states (approximately a third of the country). They help in strengthening surveillance in the health care delivery system as a whole, and to communicate with Regional Health Bureaus with regards to occurring epidemic outbreaks, thereby ensuring that a timely response is forthcoming. The improved IRS coverage and LLIN use has resulted in reduction of malaria transmission, however, there are challenges that comes with such good news including proper utilization of the nets and the lack of vector surveillance to help identify the source with the aim of halting ongoing transmission. To this end, FMOH will need to strength both entomological and epidemiological surveillance and insecticide resistance monitoring to ensure timely response to malaria epidemics.

5.3 Propose a national entomological monitoring and surveillance scheme, including potential sentinel locations, roles and approaches for effective coordination and data management.

There is an urgent need to improve data and information management for malaria control in Ethiopia. PMI is assisting the FMoH to improve routine surveillance and more support should be provided to the country to initiate and expand its capacity for entomological monitoring, including testing for insecticide resistance in anopheline mosquitoes. Recent evidence of resistance to dichloro-diphenyl-trichloroethane (DDT) and, to some exten,d to pyrethroids prompted the FMoH to pursue a long-term insecticide resistance management strategy and to discontinue DDT after almost six decades of use as the insecticide of choice.

A needs assessment of Ethiopia's entomological capacity to conduct routine vector surveillance revealed that this is a very weak component of national disease control programmes. / Vector surveillance should be an integral component of the planning, implementation, monitoring and evaluation of vector control interventions. As vector borne disease programmes scale up vector control activities, timely information on the ecology, behavior and population dynamics of the local vector species is vital. It is fundamental to assess the efficacy of the vector control operations and also enable the detection or prediction of unusual fluctuations in trends that may have significant consequences on disease. With the revised National strategic plan, and in view of malaria elimination strategies, it is important to draw up guidelines with commonality in procedures with the Integrated Disease Surveillance and Response Strategy (IDSR) which is now widely applied in the African region. The rationale for vector surveillance is the provision of timely information for the determination and implementation of appropriate responses on vector characteristics that are associated with and contribute to disease transmission in a specific area. In order to achieve this, there is a need to establish a network or partnerships of Ethiopian institutions and entomologists to sustain and coordinate entomological monitoring.

Institutions such as University of Addis Ababa (Aklilu Lemma Institute of Pathobiology), Jimma University (Department of Biology) and the Ethiopian Health and Nutrition Research Institute (EHNRI) should be strongly linked the national malaria control team. These institutions have been rated as having good infrastructure, personnel (entomologists), functional insectaries, and good molecular laboratories for

use in mosquito identifications, mechanisms of resistance, etc. They should be nominated as the national reference units for the NMCP.

The role of these institutions should be to confirm entomological data through laboratory analysis by identifying vector species which belong to species complexes, verifying infection rate by parasites, assessing host preference of vector species, determining insecticide susceptibility of vector species and mechanism of resistance involved. Above all they should be able to provide training and conduct data analysis on behalf of the National malaria control team.

5.3.1 Selection of Sentinel site

As Ethiopia is scaling up its LLIN and IRS programs, there is increased insecticide selection pressure on the populations of vector mosquitoes. One can expect to see changes in the species composition, as well as changes in susceptibility to insecticides and possibly changes in behaviour. The large investments in LLINs and IRS, and our dependency on a very few types of insecticides, make it imperative that national programs monitor and evaluate a few basic entomological parameters. Ethiopia should therefore select a significant number of sentinel sites to monitor malaria vectors and resistance to insecticides used for IRS and/or LLINs. The selection should be based on an initial stratification taking in into consideration, eco-epidemiological zones, demographic, local level of malaria cases, history of insecticide used and vector bionomic. As an approximate guide, one sentinel site per 500,000 nets distributed or 200,000 houses sprayed is recommended (the equivalent of one site per million people protected). Sites should be focused on areas of greatest malaria incidence and pesticide use including both agricultural and public health use.

It is therefore recommended that districts should be the standard geographical area for vector surveillance. Within each district, sentinel sites should be selected based on disease transmission profiles (low, high transmission areas), or type of area (urban, rural environments), etc. A sentinel site is the exact location within the district where samples are collected. It is recommended that each district establishes a minimum of 3 sentinel sites based on the distribution of human habitations and variations in vector ecology in the area to ensure that the district is properly represented.

5.3.2 Selection of houses for sampling

In the circumstances where endophilic vectors have to be collected within dwellings it is recommended that about 5-10 houses be used at each sentinel site for sampling. Thus a total of 15-30 houses will be surveyed in each district. The frequency of sampling can be weekly, monthly, etc and depends on the resources available (personnel, infrastructure, funding, etc).

5.3.3 Insecticide resistance test

Insecticide susceptibility test should be carried out on a yearly basis at pre-determined periods of the year using discriminating dosages for testing resistance to commonly used insecticides, as defined by WHO. Tests to determine insecticide resistance should be carried out using adults or larvae of anopheline species. Standard kits with equipment and fresh treated papers should be used.

5.3.4 Data Management: There is a great need to improve data and information management for vector control interventions including LLINs and IRS. The Health Management Information Systems should be supported to carry out routine collection of facility-based data; establishment of sentinel site should be done to enable the regions to capture entomological indicators including insecticide resistance data to evaluate effectiveness of the existing malaria interventions. The National Malaria control team should be assisted by the partners and other stakeholders.

5.4 Provide options for addressing the issue of pesticides disposal, referencing preview assessments on the subject.

Over the past decades, the Ethiopia FMoH has gone through health sector reforms that have posed new challenges in the management of public health pesticides at decentralized levels (e.g. regional, zonal, district or below), such as selection, purchase, procurement, storage, use and waste disposal of these chemicals, and in monitoring of their application. These reforms, however, have not adequately included capacity building to address this highly specialized area of work.

The technical capacity to ensure effective, judicious and low-risk use of public health pesticides is still limited at various levels of government. The availability of trained and experienced managers remains critical for proper planning and effective implementation of vector control programmes with good management of pesticides. This includes, among others, assessment of needs for effective pesticide management, including the technical issues of procurement, storage, and disposal of pesticide waste and empty containers. The lack in technical know-how of vector control personnel and other public health staff involved in vector control at the field level is a serious concern. As mentioned above, regular training and supervision have become ever more challenging as a result of decentralization. In addition, there is limited capacity for monitoring and evaluation of vector control interventions, and for operational research to support evidence-based decision-making for judicious use of pesticides in public health. This results in suboptimal use of pesticides in vector control and nuisance pest control, lower efficacy, and increases the risk for resistance development and adverse effects on human health and the environment. It also slows down the development of truly integrated vector control approaches.

The use of public health pesticides generates various types of waste: left-over pesticides which have become obsolete or otherwise unusable, empty pesticide containers and sachets, and used-up or torn long-lasting insecticidal mosquito nets, contaminated personal protective equipment and disused spraying equipment. The disposal of pesticide waste is neither well-regulated nor organized in Ethiopia, as in many countries in the region, and public health pesticide waste is no exception in that respect. In fact, no legislation exists in Ethiopia to ensure proper disposal of obsolete public health pesticides. The prevention of pesticide waste generation, local recycling of empty pesticide containers, and the environmentally sound disposal of left-over waste, all pose great challenges to the national government and require urgent attention.

Ethiopia has large amounts of obsolete DDT stocks and other public health pesticides (PHPs) that have resulted from poor procurement practices or donations; poor stock management; and poor quality control in the past. Currently about 900 to 1,400 tons of obsolete DDT stockpiles are reported held in the country awaiting disposal. Addressing the problems of obsolete pesticides is costly (up to US$ 5000 per ton) and many countries, including Ethiopia, will require the assistance of the donor community to fund their safeguarding and disposal. Food Agricultural Organization (FAO) has developed methodologies supported by guidelines and training modules to assist countries in undertaking inventories, developing safeguard strategies, repackaging pesticides and facilitating the environmentally sound management of waste. Unusable pesticide products should be disposed of according to recommendations of the Basel Convention, typically by exporting to dedicated hazardous waste disposal plants in industrialized countries.

Ethiopia should review current practices for procurement, storage, transport and disposal of public health pesticides (PHPs), and identify issues and challenges for further strengthening of these aspects in the pesticide life-cycle management including legislative framework for procurement, transport, storage and

disposal of PHPs, capacity for environmentally sound management of empty pesticide containers and pesticide waste, and the need to develop appropriate recycling/disposal mechanisms.

6. RECOMMENDATIONS:

- There is need to conduct a comprehensive Needs Assessment to determine the entomological capacity at different levels of the health care system. This will help to determine existing gaps in the malaria interventions in Ethiopia and to make recommendations to strengthen entomological surveillance and monitoring of insecticide resistance.
- Conduct assessment of needs and resources for strengthening technical personnel and training institutions at national, regional, and district levels. Thus there is need to have a well functioning co-ordination mechanism between all partners and collaborators with the Federal and Regional Health Bureaus.
- Establish national reference units (NRU) and country specific capacity building plan. The collaboration between the National Malaria team and the NRU should be formalized so that the implementation of the 5-year strategic plan can be enhanced. It is recommended that the research institute (EHNRI) should be nominated as the NRU in collaboration with the national universities.
- Establish a robust M&E system to conduct entomological surveillance and resistance management in partnership with academic institutions where possible
- There is need to develop up to date country databases on the status of malaria vector resistance to insecticides and facilitate the use of this information for the selection of insecticides to be used for malaria vector control. This will help the country capacity to develop and introduce new tools in malaria vector control and to manage insecticide resistance.

- In collaboration with WHO and FAO, Ethiopia, should
    - review, and if necessary revise, procurement procedures for PHPs with the aim of eliminating identified bottlenecks, and to develop national guidelines for PHP procurement by considering WHO specifications for procurement and quality control;
    - review, and if necessary revise, national regulations on storage and disposal of (public health) pesticides, taking into account the provisions of relevant international conventions e.g., Basel convention;
    - build national capacity on pesticide stock management, and carry out training of pesticide storekeepers, while making optimal use of existing training resources;
    - carry out a national feasibility study on options for recycling and/or disposal of empty pesticide containers and out-lived long-lasting insecticidal nets (LNs) and
    - develop a plan of action for their environmentally sound management

- Ethiopia should be encouraged to develop a national policy on public health pesticide management as well as implementing principles of IVM, to ensure low-risk and judicious use of insecticides

In conclusion, I strongly recommend that in order to have an effective delivery of vector control interventions in Ethiopia with particular emphasis on insecticide resistance management, the infrastructure, technical and institutional capacities need to be strengthened.

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Annex 1: Meetings with Ministry of Health Personnel and Partners

Monday, 9th April 2012

- Meeting with Mr. Sheleme Chibsa, Senior Malaria Advisor, USAID/PMI at the USAID offices at USA embassy, Addis Ababa
- Mr Sheleme gave an overview of the activities by USAID/PMI. He reported that PMI support to malaria prevention and control in Ethiopia began in 2008. He indicated that the country does not have an IVM policy but a policy on Vector Control guidelines is available.
- They have been working with the National malaria control team and other partners including Ethiopian Health and Nutrition Research Institute (EHNRI) which conducts research nationally and therefore acts as the technical arm of the Federal Ministry of Health (FMOH).
- The main malaria control interventions currently used are: Indoor residual Spray (IRS), Long lasting Insecticidal Nets (LLINs) and Environmental management and larvicides though on a small scale.
- That insecticide resistance has developed in almost all classes of insecticides with DDT showing a 100% resistance and pyrethroid resistance is not less than 25%. Other classes of insecticides including organophosphates, carbamates (propoxur and bendiocarb) have also been reported as having resistance.
- On pesticide disposal, Dr. Sheleme reported that currently the DDT stockpiles are high in the range of 900 – 1,400 tons waiting for disposal. However, the mechanisms for disposal are not readily available and therefore consultations are on-going between the government and the Stockholm convention.
- DDT use in IRS was stopped in 2009, and the use of malathion and Deltamethrin was introduced in some areas for IRS in 2010 and 2011. However, this year (2012) the country is proposing use of propoxur, deltamethrin and bendiocarb instead of the above two. Further it was noted that there are limited supplies of propoxur but the little that will be available will be used in epidemic prone areas.
- Larval source management has not been incorporated in the regular vector control strategies.
- Dr. Sheleme proposed that I meet the following persons:
    - Dr. Hiwot Solomon – Malaria Manager, FMOH- Tel: 0910 100 255
    - Dr. Dereje – Unicef – Tel: 0911239 995
    - Dr Meshesha Balkew, University of Addis Ababa – Tel: 0911 914 477
    - Jimma University
    - Dr. Ashenafi Assefa – EHNRI - Tel: 0911 612 555
    - Dr. Yemane Yeebiyo – Abt Associates Ltd; Tel: 0911 665 964
    - Dr. Messay – WHO country office – Tel: 0911 990 284

FEDERAL MINISTRY OF HEALTH (FMOH): Dr. Hiwot Solomon – Head, Malaria Prevention and Control

- Malaria control is under the Directorate of Disease Prevention and Control. It is responsible for formulating policy guidelines for malaria control. Some of the guidelines are:
    - i) Guidelines on Vector Control
    - ii) National Malaria Control Strategy 2011-2015
- Vector control guidelines focuses on 3 major areas of operations – IRS, LLINs, and Environmental management + larviciding

- The FMoH works closely together with EHNRI especially on research on efficacy studies on anti-malarial drugs, IRS management strategies, etc. However, there is no close collaboration with the universities on operational research
- A technical advisory group consisting of partners (PMI, Abt, etc) exists and is responsible for advising the Ministry on the best practices for vector control and management.
- Sentinel sites for drug efficacy studies are available and these are distributed only in one region, Oromia. Currently, they are only 10 but they will be expanded to more than 50 as per 2011-2015 national strategic plan. There are no sentinel sites for entomological and insecticide resistance monitoring.
- There is no capacity at the FMOH to conduct regular entomological, epidemiological and insecticide resistance. However, this can be done with the collaboration with the EHNRI who have the capacity to roll it out. But the problem is that there is no formal collaboration between the Research and control group and therefore this might pose some challenges.
- On other vector borne diseases (VBDs) including Leishmaniasis, lymphatic filariasis, onchocerciasis, etc, these are under the department of Neglected Tropical Diseases and therefore falls under NTDs strategic plans.
- Training is regularly conducted by WHO and other partners on vector control, IRS spraying and management including maintenance of equipments, etc.
- In 2005/2006, approximately 41 million LLINs were distributed all over the country and currently the net coverage is about 92%. The main challenges faced are the low utilization of the nets.
- Environmental management is implemented nationwide but the activities are normally done at the Regional Health bureaus. Ethiopia has one of the best Health Extension program where community mobilization is conducted by Health extension workers to conduct EM and larviciding using temephos. Each region is expected to conduct its own larviciding and EM activities.
- Funding is from the government and donors such as GF, USAID, Carter Centre, WHO, etc)
- The FMOH is working closely with USAID/PMI on the mechanism for pesticide disposal. There is no clear policy on public health pesticide disposal and also for the nets. Currently, more than 1,000 tons of DDT is waiting disposal.

Tuesday, 10th April 2012; 10.00 am: Aklilu Lemma Institute of Pathology, University of Addis Ababa; Dr. Meshesha Balkew, Head, Vector Biology & Control Research Unit

- Developing capacity to conduct metabolic resistance
- Conduct insecticidal bioassays
- In collaboration with WHO and FMOH, the Unit is involved in training short courses on vector biology including taxonomy (both morphological and molecular techniques).
- Involved in Training M.Sc and PhD in Tropical and infectious Diseases. This started about 5 years ago. So far, over 200 students have been trained and these have been absorbed in both government and the NGO's.
- The Unit is also involved in advising and mentoring Masters Students from the department of Biology and the ARPIS group.
- On the infrastructure, the unit has a functional insectary which was set up in 2001. The *Anopheles arabiensis* strain is reared under normal conditions. No susceptible *Anopheles* strain is maintained in the insectary. However, the insectary lacks a number of equipments and supplies. A well trained technician is also available.
- The Unit has 5 entomologists trained up to PhD level and all help in building capacity at the University and beyond.

Tuesday 10th April 2012; 14.30 h: Ethiopian Health and Nutrition Research Institute (EHNRI);
Dr. Ashenafi Assefa, Team Leader, Malaria, Parasitic and Other Vector Borne Diseases Research Unit & Esayas Kinte, Entomologist.

- Conducts research on malaria and other vector borne diseases
- Has 4 entomologists (1 PhD and 3 MSc)
- Laboratory equipped to perform advance level analysis using molecular techniques especially for drug studies but not for entomological studies.
- A functional insectary is also available with *Anopheles* and Tsetse flies being reared and maintained.
- The Research Unit maintains about 20 sentinel sites where drug studies including drug resistance are carried out. However due to limited funding these sentinel sites are not regularly monitored. At most about 8 representative sentinels are monitored regularly although it was not clear at what interval of sampling is maintained.
- The Unit has established a good network with funding agencies such as PMI/CDC and works closely with FMOH.
- A lot of data is being collected from the sentinel but the ability for data management is hampered by lack of enough statisticians as well as data managers.

Wednesday, 11th April 2012
INTERNATIONAL CENTRE OF INSECT PHYSIOLOGY AND ECOLOGY, (icipe)- Addis Ababa; Dr. Melaku Girma, Entomologist

The International Centre of Insect Physiology and Ecology (icipe) offices are based at the International Livestock Research Institute (ILRI) in Addis Ababa. *icipe*'s malaria programme is based on 'Integrated Vector Management' (IVM) as one of the best alternative methods to conventional approaches to prevent diseases transmitted by insects. They conduct operational research based on 'Adaptive management' principles which stipulate active participation of the communities. The cornerstone of 'adaptive management' is decision support for the people through participation in integrated, sustainable problem-solving processes.

According to Dr. Melaku Girma, *icipe's* main objective in integrated vector management strategies is to reduce of malaria prevalence and mosquito populations based upon three pillars:

i) The first pillar of the project is **education**. The affected people are informed and sensitized to the danger presented by stagnant pools as breeding areas for the malaria mosquitoes. These pools are drained in community work.
ii) Where this is not possible, the second pillar comes into force: **stagnant bodies of water are treated with environmentally compatible bacteria** (Bti, *Bacillus thuringiensis israelensis*) to decimate the mosquitoes at the larvae stage in their breeding areas.
iii) The third pillar consists of the **scale up and distribution of impregnated bed nets** to the inhabitants of Tolay where the project is undertaken. When used correctly these mosquito nets are the surest protection from mosquito bites.

The overall goal of *icipe's* research in human health is to contribute to the reduction of malaria and other vector-borne diseases by developing tools and strategies that control the vectors and break the cycle of transmission and that can be integrated with disease management efforts. The focus is on mosquito ecology, mosquito behaviour and malaria transmission, with emphasis on developing new tools for integrated malaria control that go beyond bednets and traditional chemical-based approaches. The

attention focuses on changes in malaria trends due to global warming, insecticide resistance and land use, among other factors.

Thursday, 12th April 2012: USAID/ABT ASSOCIATES LTD; Dr Yemane Yeebiyo, Chief of Parties, IRS.

Dr. Yemane Yeebiyo, is the Chief of party at the Abt Associates Ltd in-charge of indoor residual spray (IRS). According to him, ABT Associates have 6 sentinel sites but due funding only 3 have been established. There is also shortage of manpower which will compromise vector surveillance in these sentinel sites. USAID/Abt is also carrying out IRS studies in 5 sites.

- Starting this year (2012), they are going to use propoxur, Bendiocarb and Deltamethrin for IRS. This is going to be a trial to understand the insecticide resistance management.
- On disposal of pesticides used for malaria control especially DDT, they approached a cement company regarding the disposal of DDT through incineration but the discussions are not yet concluded.
- Dr Yemane further reiterated that disposal of pesticides is the sole responsibility of the Ministry of Agriculture but however, once approached they do not want to be involved in the process. This leaves the Ministry of Health helpless.

Friday, 13th April 2012: Good Friday in Ethiopia- Spent the day reviewing documents that were provided to me by senior malaria advisor, Dr. Sheleme Chisba.

Saturday 14th & Sunday 15th April: Continued reviewing documents and literature search.

Monday, 16th April 2012: Continued reviewing documents and making plans for the week to meet personnel at Regional Health Bureaus (Oromia region), Jimma Zonal Health Bureau, and Jimma University.

Tuesday, 17th April 2012: Meeting with Oromia Regional Health Bureau personnel.

I met with Mr. Addis Mekasha, team leader, Oromia Regional Health Bureau together with 5 other members of the team (see Annex 2). Here below is a summary of our discussions.

- In Oromia, malaria and other vector-borne diseases are organized as a department with two teams, the Malaria Diagnostics and Epidemiology Team and the Vector Biology and Control Team; staff in this department reports to the Deputy Head of the ORHB. The department is responsible for coordination of malaria and other vector-borne control activities in Oromia region, including planning, implementation and M&E, and support to capacity building of the Zonal and District Health Offices.

- In Oromia, at the zonal level, two experts are expected to work on malaria and other vector-borne diseases under the Communicable Disease Team of the Zonal Health Department, one for malaria diagnosis/epidemiology and one for entomology/vector control. These two staff serves as backstops for district malaria control activities, liaising directly with the district malaria control program and the region, ensuring the availability of human resources, equipment and supplies in districts as well as coordinating resources of different malaria stakeholders operating in the zone.

- There are programmatic challenges affecting the RHBs in malaria control including shortages of appropriate health professionals to fully staff the program, high staff turnover, and less attention to monitoring and evaluation. These challenges have impeded the successful implementation of malaria program activities.

Wednesday, 18th April 2012: Travel to Jimma Zone (345Km south west of Addis Ababa); meeting with Zonal Health Bureaus official in the afternoon.

Thursday, 19th April 2012: Meeting with the Vice President and Administrative officer, Prof Kora at the University of Jimma, personnel from the Biology Department and field visit to see experimental huts. Return to Addis Ababa late afternoon.

Friday, 20th April 2012: Final Meeting with the Senior Malaria Advisor, Dr. Sheleme Chisba to discuss the outcome of my visit to various partners and other stakeholders.

Saturday 21st April 2012: Departure for Mombasa from Addis Ababa.

Annex 2: List of persons contacted during the mission on needs Assessment for malaria control in Addis Ababa, Ethiopia; 8-21 April, 2012

Name	Institution & Address	Email Address	Tel Number
Dr. Sheleme Chibsa	Senior Malaria Advisor, USAID/PMI	schibsa@USAID.GOV	+251 911 790 697
Dr. Ashenafi Assefa	Team Leader, EHNRI, Malaria, parasitic & other vector-borne diseases Research Unit	Ashyaega@yahoo.com; ashenafia@ehnri.gov.et	+251 911 612 555
Mr. Esayas Kinte	Entomologist, EHNRI, Malaria, parasitic & other vector-borne diseases Research Unit	esayaski@yahoo.com	
Dr. Hiwot Solomon	Head Malaria Control Unit, Directorate of Preventable Diseases, FMoH	Hiwisol2006@yahoo.com	+251 910 10 02 55 +251 115 152 054
Prof. Meshesha Balkew	Associate Professor & Head, Vector Biology &Control Research Unit, Aklilu Lemma Institute of Pathology, Addis Ababa University, P.O. Box 1176 Addis Ababa	Meshesha-b@yahoo.com	+251 911 91 44 77
Prof. Teshome Gebre-Michael	Associate Professor, Vector Biology &Control Research Unit, Aklilu Lemma Institute of Pathology, Addis Ababa University, P.O. Box 1176 Addis Ababa	teshomegm@yahoo.com	
Dr. Yemane Yeebiyo	Chief of Party, Abt Associates Ltd, IRS	Yemane-yihdeg@atrieairs.net; yemaney@ethionet.et	+251 911 66 59 64
Dr. Messay Fatene	WHO malaria Advisor	messayf@et.afro.who.int messayg@yahoo.com	
Mr. Kedir Gobena	Malaria & NTDs Expert, Oromia Regional Health Bureau (ORHB)		
Mr. Dawit Teshome	Malaria & NTDs Expert, ORHB		
Mr. Addis Mekasha	Team Leader, ORHB		
Dr. Gebbisa Tolosa	Malaria & NTDs Expert, ORHB		
Ms. Million Oljira	Malaria & NTDs Expert, ORHB		
Mr. Tekola Workneh	Malaria & NTDs Expert, ORHB		
Dr. Kunuz Haji Bedru Abadula	Head, Jimma Zone Health Bureau		
Prof. Kora Tushune Godana	Vice President for Administration & Development Jimma University, Ethiopia	Kora.tushune@ju.edu.et korakito@gmail.com	+251 911 241 916
Mr. Abebe Asale	Lecturer, Dept of Biology, Jimma University	Abebea663@gmail.com Abebe.asale@ju.edu.et	+251 912 123 305
Dr. Melaku Girma	International Centre of Insect Physiology and Ecology (icipe)-Addis Ababa, Ethiopia	melakugmg@yahoo.com	+251 911

Annex 3: Guiding questions to facilitate analysis of problems in the existing system of vector control

1 Advocacy, social mobilization and legislation

- Are current legislation and regulation on pesticide management adequate?
- Are community-based services a priority?
- Do communities comply with vector control practices?
- Are communities aware of their role in vector control?

2 Collaboration within the health sector and with other sectors

- Is vector control a high enough priority at ministerial level?
- Is vector control considered important in district health offices?
- Are other health division's involved in vector control?
- Do activities in other sectors contribute to vector-borne disease risk?
- Is there high-level support for inter-sectoral collaboration?
- Is inter-sectoral collaboration formalized and facilitated?

3. Integrated approach

- Do vector-borne disease programmes interact or collaborate?
- Which methods of vector control are used?
- Are there signs of resistance to insecticides?

4 Evidence-based decision—making

a. What expertise is there for making decisions on vector control?

- At what level are decisions about implementation made?
- Does the research being conducted generate useful data for vector control?
- Is an effective vector surveillance system in place? Entomological and epidemiological
- How strong is the evidence for the effectiveness of vector control methods?

5 Capacity-building

- Is the infrastructure for vector control adequate?
- Is there enough expertise on vector control at central level?
- Are human resources for vector control available in provinces, districts and villages?

12. Health Sector Policy

- Is there a vector control policy for malaria and other vector borne diseases?
- Are there national vector control policy guidelines?
- Is there a policy on decentralization or health reforms?
- Is the vector control interventions decentralized?

13. Organization of vector control

- Are vector-borne disease controls integrated in a single unit?
- Is there a national vector core group or task force who can provide policy and technical support?
- Is there a relationship between vector control and environmental health programmes?
- Is there a human resource development plan?
- Are research institutions and universities linked to the malaria and other vector-borne diseases?

- What facilities are available in these institutions, e.g., entomology laboratory, functional insectary, insecticide resistance study facility, etc

Annex 4: QUESTIONNAIRE ON NEEDS ASSESSMENT FOR LABORATORY SUPPORT FOR VECTOR CONTROL IMPLEMENTATION

1. Institutional Information	
Name of in-charge:	
Institution	
Address	
Contacts: telephone no.	
fax	
Mobile phone	
Email	
Postal Address (if different to above)	
2. Facilities & Equipment	
2.1 Laboratory with reliable electricity supply	Yes ☐ No ☐
2.2 Laboratory with reliable water supply	Yes ☐ No ☐
2.3 Laboratory with air-conditioning	Yes ☐ No ☐
2.4a Dissecting microscopes present	Yes ☐ No ☐
2.4b Compound light microscope present	Yes ☐ No ☐
2.5 Computers available	Yes ☐ No ☐ If 'Yes', state number available:
2.6 PCR equipment:	Yes ☐ No ☐
2.6a Thermocycler	Yes ☐ No ☐
2.6b Electrophoresis equipment	Yes ☐ No ☐
2.6c Microcentrifuge	Yes ☐ No ☐
2.6d Gel recording system	Yes ☐ No ☐
2.6e -70 deep freeze	Yes ☐ No ☐

2.6f -20 deep freeze	Yes ☐ No ☐
2.6g Refrigerators	Yes ☐ No ☐
2.6h pH meter	Yes ☐ No ☐
2.6i Water bath	Yes ☐ No ☐
2.6j Pipettes	Yes ☐ No ☐
2.6k Balance	Yes ☐ No ☐
2.6l Autoclave	Yes ☐ No ☐
2.6m Incubator	Yes ☐ No ☐
2.6n Microwave oven	Yes ☐ No ☐
2.7 PCR equipment functional	Yes ☐ No ☐ If no, elaborate in box below
National Programme Plans for Basic and advanced activities	
2.7 PCR equipment required:	
2.8 ELISA equipment present (plate reader and computer)	Yes ☐ No ☐ If only partially equipped, detail additional requirements below
Details	
2.8b ELISA equipment functional	Yes ☐ No ☐ If no, elaborate in box below
2.9 Functional Insectary facilities in place	Yes ☐ No ☐
If 'yes' to above, do you have a standard susceptible mosquito colony for use as controls and for bioassay monitoring	Yes ☐ No ☐
If 'no' to above, do you have the following:	

2.9a A room designated as 'insectary'	Yes ☐ No ☐
2.9b Controlled humidity	Yes ☐ No ☐
2.9c Controlled air-conditioning	Yes ☐ No ☐
2.9d Controlled lighting for dusk and dawn simulation	Yes ☐ No ☐
2.9e Clean (distilled) water	Yes ☐ No ☐
2.9f Shelving	Yes ☐ No ☐
If no to any of the above, detail requirements here:	
2.10 Technical back-up available for maintenance of equipment	Yes ☐ No ☐
2.11 Standard operating procedures for laboratory and field tests complete	Yes ☐ No ☐
3. Supplies	
3.1 Efficient institutional system for procurement	Yes ☐ No ☐
3.2a Stocks of laboratory reagents	Yes ☐ No ☐
3.2b Stocks of insecticide treated papers	Yes ☐ No ☐
3.2c Stocks of WHO susceptibility test kits	Yes ☐ No ☐
3.2d Stocks of WHO cones for monitoring IRS and ITNs	Yes ☐ No ☐
3.3 Accessing supplies problems:	
4. Staffing as in 2012	
Number of employed graduate scientists	
Number of employed laboratory technical staff	
Number of employed field technical staff	
Number of staff trained in data management	

Number of trained insectary managers	
Number of insectary technical staff	
Number of BSc (Honours) students	
Number of MSc students	
Number of PhD students	
5. Training	
Elaborate on training offered within your institution on the following topics	
5.1 Training in data management	
5.2 Ethical considerations of research projects	
5.3 Project planning and monitoring	
5.4 Basic entomological assays	

Table 1: Levels of vector surveillance activities and the required technical resources*

Level	**Corresponding activities**	**Required human resources**	**Required facilities and equipment**
BASIC	Mosquito collection and identification Morphological identification Vector incrimination Sporozoite Identification by microscopy Determination of infection rates Vector susceptibility testing Mapping and characterization of breeding sites	Technologists: diploma/ BSc entomological assistants	Siphons, torches, light traps, rechargble batteries, battery chargers, dippers, hand lenses, dissecting microscope, silica gel, tubes, assorted entomology equipment, identification keys, pinning kits, preservatives, dissection kits, susceptibility kits, treated papers, GPS units, collection trays, bottles, strainers, tape measures
ADVANCED	Identification of operational research needs, selection of sentinel sites, analysis of data, detection of sporozoites and source of bloodmeal by ELISA, insecticide bioassys, assessment of vector behaviour, biting resting	Entomologists: MSc/ Ph.D Technologists: diploma, B.Sc, M,Sc Field assistants Knowledge of statistics	Knowledge of vectors Entomological and transmission data, maps ELISA equipment WHO cones, treated papers Insectary Mosquito sampling equipment ELISA
HIGH	Molecular identification of vector species Detection and determination of resistance mechanisms Operational research Eg vector behaviour (oviposition, swarming, dispersal)	Entomologists/ molecular biologists: MSc, Ph D Technologists: Diploma, BSc	PCR ELISA equipment Imaging facility INSECTARY

**Adopted from ANVR*