PMI | Africa IRS (AIRS) Project

Indoor Residual Spraying (IRS 2) Task Order Six

ETHIOPIA
2015 END OF SPRAY REPORT

SPRAY CAMPAIGN: JULY 21 – AUG 24, AUG 11 – SEP 15, 2015

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AIRS ETHIOPIA
2015 END OF SPRAY REPORT

CONTENTS

Contents ..... **iii**

Acronyms ..... **vii**

Executive Summary ..... **ix**

1. Introduction **11**

2. Pre-Season Activities **12**

2.1 Selection of IRS Districts 12
2.2 Insecticide Selection 13
2.3 Technical Support to the FMOH 13
2.4 IRS Training and Planning 13
2.5 Logistics Needs Assessment and Procurement 14
2.6 Human Resource Requirements 14
2.7 IRS Training 17
2.8 Technical Assistance to 24 Graduated Districts 17
2.9 Gender Norms and Income Use in Ethiopia 18

3. Information, Education and Communication **20**

4. Implementation of Spray Activities **21**

4.1 Spray Operations and Supervision 21
4.2 Community-based IRS 22
4.3 Logistics and Stock Management 22

5. Environmental Compliance **25**

5.1 Pre-Season Environmental Compliance Assessments 25
5.2 Mid- and Post-Season Environmental Inspections 26
5.3 Post-Season Demobilization and Waste Disposal 27

6. Post-Season Activities **29**

6.1 Post-Season Review Meeting 29
6.2 De-mobilization and Logistics 29

7. Entomology **30**

7.1 Determination of Quality of Spraying and Decay rate 30
7.2 Monitoring Vector Density and Behavior 31
7.3 Insecticide Susceptibility 35
7.4 Determination of Decay Rate of Insecticides used for IRS in Ethiopia 37

8. Monitoring and Evaluation **38**

8.1 Approach and Key Objectives 38
8.2 Data Collection and Data Quality Assurance Protocols 38
8.3 Data Entry 39
8.4 Data Storage 40

8.5 Data Cleaning 40
8.6 Reporting of Spray Data 40
9. Capacity Building and Support to MOH 51
9.1 Capacity Building 51
9.2 Disposal of Obsolete DDT 52
10. Challenges, Lessons Learned and Recommendations 53
10.1 Challenges 53
10.2 Lessons Learned and Recommendations 53
Annex A: 2015 IRS Procurement 55
Annex B: Inspection Reports and Supervision Results 56
Annex C: Report on 2015 Post IRS Evaluation Meeting 63
Annex D: Data Collection and Quality Assurance Tools 65
Annex E: Ethiopia Monitoring and Evaluation Plan Indicator Matrix 69
Annex F: Proposed Actions for Improving Spray Quality 81

LIST OF TABLES

Table 1: IRS Campaign Summary Results: July - September 2015 x
Table 2: 2015 IRS Target Districts 13
Table 3. National and District Health Staff and Temporary Workers Trained in 2015 15
Table 4. Number of People Trained with USG Funds to Deliver IRS 17
Table 5. IRS Planning Meeting Participants for Graduated Districts 18
Table 6. Spray Operation Performance in CB IRS Areas 22
Table 7. Key Gaps Identified during First-Round PSECA for District Stores 25
Table 8. Key Gaps Identified, First-Round PSECA, Soak Pits 26
Table 9. Wall Bioassay Results for Pirimiphos-Methyl 31
Table 10. Wall Bioassay results for Bendiocarb ..... **Error! Bookmark not defined.**
Table 11. Insecticide Resistance Results in Five Sites in 2015 36
Table 12. Use of DCV Form: Common Issues and Corrective Actions 39
Table 13. Summary of 2015 Spray Results 42
Table 14. Summary of Structures Found and Sprayed by Type and Coverage 44
Table 15. Number and Use of Mosquito Nets 47
Table 16. Insecticide Use and Spray Operator Performance 48
Table A-1. PPE and Other Supplies Procured 55
Table B-1. Summary of Inspections and Mitigation Measures in the 2015 Spray Campaign 59
Table C-1: 2015 Post IRS Evaluation Meeting Participants 63
Table D-1. Ethiopa IRS 2015 Data Collection Tools 65
Table D-2. Data Quality Assurance Tools 65
Table D-3. Data Quality Assurance and Control 66
Table D-4. Human Resource Recruitment by District and Type 67
Table E. Ethiopia Monitoring and Evaluation Plan Indicator Matrix 69

LIST OF FIGURES

Figure 1. Map of PMI Fully and Partially Supported Districts 12
Figure 2. Central Warehouse in Addis Ababa with Actellic 300 CS 23
Figure 3. SOP Transport to IRS Sites in Guto Gida District 23
Figure 4. SOP Providing Post-season Key Messages in Sasiga District 27
Figure 5. OP Bottle Storage and Processing 28
Figure 6: *Anopheles* Species Composition and Density in Gobu Sayo District 32
Figure 7: *Anopheles* Species Composition and Density in Ilu Gelan District 32
Figure 8: *Anopheles* Species Composition and Density in Seka Chokorsa District 33

ACRONYMS

AIRS	Africa Indoor Residual Spraying
CB IRS	Community-based IRS
CDC	Centers for Disease Control and Prevention
DB IRS	District-based IRS
DCV	Data Collection Verification
DDT	Dichlorodiphenyltrichloroethane
DEC	Data Entry Clerk
EC	Environmental Compliance
EE	Error Eliminator
FMOH	Federal Ministry of Health
GEMS	Global Environmental Management Support
HEW	Health Extension Worker
HLC	Human Landing Catch
IEC	Information, Education and Communication
IRS	Indoor Residual Spraying
IT	Information Technology
M&E	Monitoring and Evaluation
MFP	Malaria Focal Person
MOH	Ministry of Health
MSP	Mobile Soak Pit
NMCP	National Malaria Control Program
ORHB	Oromia Regional Health Bureau
PMI	President's Malaria Initiative
PPE	Personal Protective Equipment
PSC	Pyrethrum Spray Collection
PSECA	Pre-season Environmental Compliance Assessment
SBCC	Social Behavioral Change Communication
SL	Squad Leader
SNNPR	Southern Nations Nationalities and People Region
SOP	Spray Operator
TL	Team Leader
TOT	Training of Trainers
USAID	United States Agency for International Development
USG	U.S. Government

WHO World Health Organization

EXECUTIVE SUMMARY

Abt Associates supports the implementation of indoor residual spraying (IRS) in Ethiopia through the three-year Africa Indoor Residual Spraying (AIRS) Project funded by USAID under the President's Malaria Initiative (PMI). The objective of the project is to limit exposure to malaria vectors and reduce the incidence and prevalence of malaria. In 2015, AIRS Ethiopia conducted IRS in 36 districts using Actellic 300 CS (organophosphate) in eight districts and bendiocarb 80 WP (carbamate) in 28 districts from July 21 – August 24, and August 11 – September 15, respectively.

A total of 607,303 structures were targeted for IRS using two different models. Thirty districts used district-based IRS (DB IRS) and six used community-based (CB IRS). District and regional government staff and AIRS Ethiopia staff provided supportive supervision in both models. The project also provided technical and logistics support to 24 districts that graduated from PMI support in 2011.

The following are project achievements and key highlights of the July - September 2015 spray campaign (see Table 1), which lasted 31 operational days for each spray round (there was overlap between the Actellic and bendiocarb spray campaigns):

- A total of 704,945 structures were sprayed out of 708,258 structures found by spray operators in the targeted districts, accounting for a coverage rate of 99.5%. In total, 1,655,997 residents were protected, including 230,366 (13.8%) children under five years old and 23,084 (1.4%) pregnant women.
- A total of 2,845 individuals were trained using USG funds to support IRS activities in the 36 districts. Of these, 1,511 were spray operators (SOPs) (1,491 males and 20 females), 484 were squad leaders (SLs) (246 males and 238 females), 495 were porters (268 males and 227 females), 100 were clinicians (77 males and 23 females) and 255 were district supervisors (236 males and 19 females). Overall, 18.5% (n=527) of all IRS trained personnel for the 2015 spray round were female.
- A total of 240,161 sachets of carbamates were used to spray 490,697 structures in 28 IRS districts, with a utilization ratio of approximately 1:2.1 (sachet to structures sprayed) leaving a balance of 12,430 sachets at the end of the spray round.
- A total of 80,836 bottles of organophosphate were used to spray 214,248 structures in eight IRS districts, with a utilization ratio of approximately 1:2.7 (bottles to structures sprayed) leaving a balance of 6,532 bottles at the end of the spray round.
- All IRS insecticide contaminated wastes, including empty sachets and used masks, will be incinerated at the PMI AIRS Project incineration plant in Addis Ababa. Other solid wastes, including empty bottles, used gloves, worn-out boots, and paper cartons will be recycled.
- Wall bioassays conducted within one week of spraying with organophosphates (July 2015) and carbamates (August 2015) to assess the quality of spraying in the target districts recorded 100% mortalities for both susceptible and wild *An. gambiae* s.l.
- Susceptibility tests of the main vector, *An. gambiae* s.l., to the World Health Organization (WHO)-recommended insecticides for IRS in eight sentinel sites showed that the vector is susceptible to propoxur, fenitrothion, and pirimiphos-methyl in all sites; susceptible to bendiocarb in 6 sites, possibly resistant in 1 site and resistant in one site. The vector is susceptible to Malathion in two sites, possibly resistant in two sites and resistant in three sites.

The vector is resistant to DDT and all pyrethroids tested.

TABLE 1: IRS CAMPAIGN SUMMARY RESULTS: JULY 21 – SEPTEMBER 15, 2015

			Total
Insecticide Used	Organophosphates (Actellic 300 CS)	Carbamates (Bendiocarb 80 WP)	
Number of districts covered by PMI-supported IRS	8	28	36
Number of structures found by SOPs	214,772	493,486	708,258
Number of structures sprayed by PMI-supported IRS	214,248	490,697	704,945
2015 spray coverage	99.7%	99.4%	99.5%
Population protected by PMI-supported IRS	Total Population: 522,345 Children under 5: 80,220 Pregnant women: 8,502	Total Population: 1,133,652 Children under 5: 150,146 Pregnant women: 14,582	Total population: 1,655,997 Children under 5: 230,366 Pregnant women: 23,084
Dates of PMI-supported IRS campaign	July 21 – Aug 24, 2015 (Organophosphates)	Aug 11–Sep 15, 2015 (Carbamates)	
Length of campaign (total days)	31 days	31 days	
Number of people trained with U.S. Government funds to deliver IRS	962	1883	2,845

1. INTRODUCTION

Ethiopia, located within 3.30°–15°N, 33°– 48°E, in the northeastern part of Africa, has a total area of 1.1 million km^2 and a population of approximately 90 million. Malaria transmission in Ethiopia occurs up to 2000m elevation but can also affect areas up to 2300m elevation. The levels of malaria risk and transmission intensity within these geographical ranges, however, show marked seasonal and spatial variability. At least 75% of the country is malarious with about 60% of the total population living in areas at risk of malaria. More than 50 million people are at risk from malaria, and 4-5 million people are affected by malaria annually, primarily caused by *Plasmodium falciparum* and *P. vivax*, which are the dominant malaria parasites in the country. Malaria transmission peaks bi-annually from September to December and April to May, after the long and short rains, respectively. *Anopheles arabiensis* is the predominant vector with *An. pharoensis*, *An. funestus* and *An. nili* having a minor role in transmission of malaria. IRS is one of the malaria interventions recommended for use in the country. Based on the National Malaria Strategic Plan 2014 – 2020, the Federal Ministry of Health (FMOH) targets use of IRS to areas where the malaria burden is high and in highland fringe areas with epidemic risk only[1]

In September 2014, Abt Associates was awarded a new contract to implement IRS under IRS 2 Task Order Six (TO6) in up to 17 African countries. In 2015, AIRS Ethiopia conducted spraying in 36 districts supported by President's Malaria Initiative (PMI) and provided limited support to 24 districts graduated from PMI support. In addition to conducting and supporting IRS, AIRS Ethiopia provided technical support in the following activities:

- Built capacity at the national, regional, district, and local levels to manage IRS operations, including planning, spraying, resource allocation, and monitoring and evaluation (M&E), including training approximately 2,845 people to directly deliver IRS.
- Enhanced national-level capacity to do IRS implementation, entomological monitoring, and environmental compliance (EC) by holding national-level training for MOH staff.
- Organized and conducted regional comprehensive workshops for regional and zonal/district health office staff to strengthen the capacity of planning, implementation, and M&E of IRS operations.
- Started conducting insecticide decay monitoring in experimental huts to determine the residual life of Actellic, propoxur and bendiocarb.
- Conducted insecticide resistance (IR), wall bioassays, vector density, and behavioral studies.
- Supported the disposal of DDT from PMI graduated and fully supported project districts.

[1] Federal Democratic Republic of Ethiopia, Ministry of Health: National Malaria Strategic Plan 2014 – 2020.

2. PRE-SEASON ACTIVITIES

2.1 SELECTION OF IRS DISTRICTS

AIRS Ethiopia supports 36 high burden malaria districts in six zones of Oromia region (East Wollega 9; West Wollega 7, Ilu Abo Bora 4, Jimma 6, Kellem Wollega 5, and West Shoa 5). Table 2 shows the number of districts selected for IRS and their population. Oromia region has the highest malaria prevalence in the country. The selection of the districts was done in collaboration with ORHB, FMOH and PMI Ethiopia based on incidence of malaria and altitude. Selection of targeted villages (kebeles) in each of the districts was based on epidemiological data reported from health facilities and altitude. These same 36 districts also received full PMI support in the last three years. In addition, in 2015, 24 graduated districts received partial PMI support.

FIGURE 1. MAP OF PMI FULLY AND PARTIALLY SUPPORTED DISTRICTS

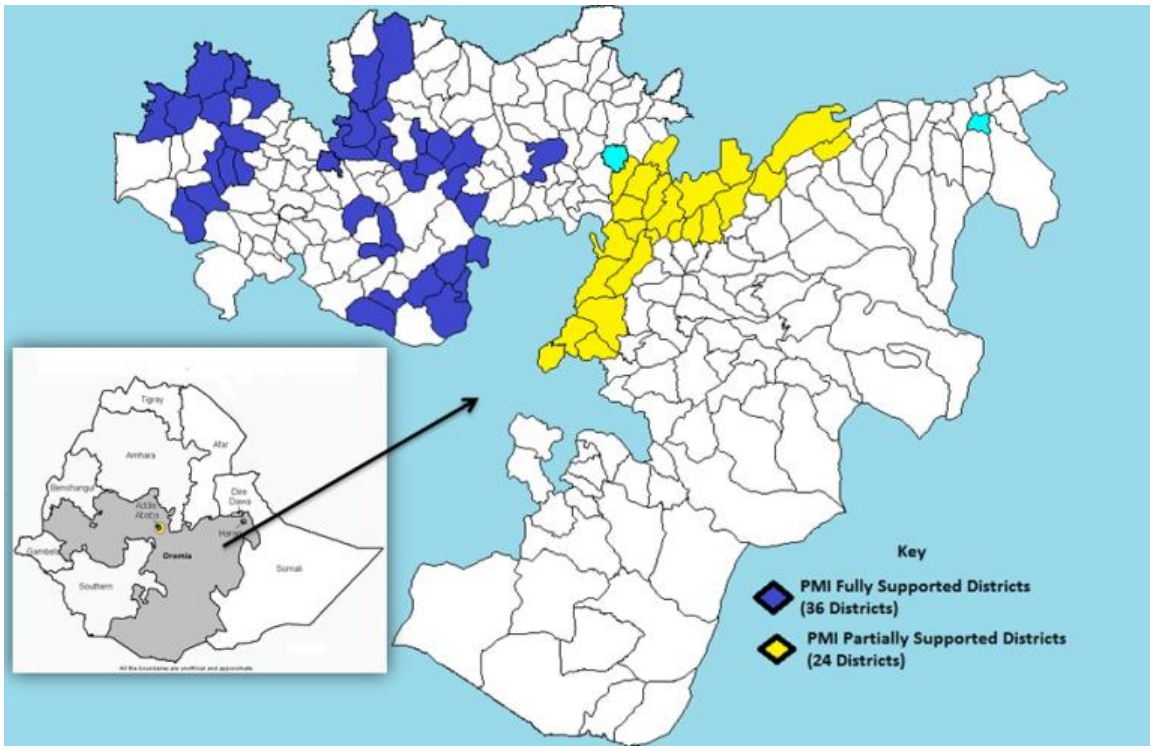


TABLE 2: 2015 IRS TARGET DISTRICTS

Zone	Number of Districts Targeted	Target Number of Districts and Insecticide Used		Number of Target Structures	Target Population		
		Organophosphates	Carbamates		Pregnant women	Children <5	Total
East Wollega	9 of 18	1	8	134,767	4,322	40,221	295,590
West Wollega	7 of 20	2	5	130,962	5,472	50,611	373,376
Ilu Abo Bora	4 of 24	1	3	77,610	4,611	30,504	174,374
Jimma	6 of 17	2	4	145,026	4,683	53,840	394,679
Kellem Wollega	5 of 11	1	4	96,435	2,469	27,481	206,528
West Shoa	5 of 18	1	4	85,503	2,362	28,205	211,540
Total	**36**	**8**	**28**	**670,303**	**23,919**	**230,862**	**1,656,087**

2.2 INSECTICIDE SELECTION

Bendiocarb 80 WP and Actellic 300 CS were used in the 2015 campaign in 28 and 8 districts, respectively. The selection was based on data obtained from insecticide susceptibility tests conducted in 2014 which showed that the main malaria vector, *An. gambiae* s.l., was fully susceptible to pirimiphos-methyl in all sites and to bendiocarb in three sites, with possible resistance in two sites. *An. gambiae* s.l. was shown to be highly resistant to all of the pyrethroids tested. The vector was fully susceptible to malathion in one site, possibly resistant in three sites, and resistant in three other sites.

2.3 TECHNICAL SUPPORT TO THE FMOH

AIRS Ethiopia participated in technical meetings as members of the Technical Advisory Committee to the National Malaria Control Program (1 meeting) and the national vector control working group (3 meetings). AIRS contributed to the development of the insecticide resistance management strategy in 2015 and the malaria indicator survey in 2015. The project has also participated in a consultative meeting to develop malaria elimination working documents. Besides the technical meetings, AIRS Ethiopia was engaged in capacity building activities for the FMOH including the national entomology training for 34 participants and environmental compliance training for 35 participants for FMOH staff nationally. The project also provided support and participated in the World Malaria Day activities held in April 2015. On World Malaria Day, the project provided up to $5,000 to support communication activities.

2.4 IRS TRAINING AND PLANNING

The project held two sessions of comprehensive IRS training in July 2015. A total of 255 health personnel from the 36 IRS target districts and zones attended. Participants included malaria focal persons (MFPs), IEC coordinators, Environmental Health Officers and zonal representatives. The training of trainers (TOT) was conducted in two sessions:

- June 16-20, 2015, Nekemte: 144 participants from East Wollega Zone (61), West Wollega Zone (47), and West Shoa Zone (36) attended.
- June 22-26, 2015, Jimma: 111participants from Jimma Zone (47), Ilu Aba Bora Zone (28), and Kellem Wollega Zone (36) attended.

The training included IRS techniques and operational planning for the 2015 IRS campaign. The participants developed detailed action plans including schedules for supervision visits, training and spraying.

2.5 Logistics Needs Assessment and Procurement

The central AIRS Ethiopia warehouse in Addis Ababa served as the hub for storage of IRS commodities, including insecticides, before distribution to the target districts. Reference was made to the inventory records from the previous IRS campaign, and a logistics needs assessment conducted at the end of the 2014 spray round, to develop the logistics distribution plan. In developing this plan, the following were considered:

- Available stock of materials, consumables, and equipment;
- Transport arrangements for distribution of equipment, materials, and supplies.
- Estimation of insecticide, PPE, and spray equipment required to meet any gaps.

Based on the information from each district, the AIRS Ethiopia team performed a detailed analysis to determine the total number of spray pumps, PPE, and other IRS materials required for the IRS activities in 2015. A full list of all PPE and materials procured for the 2015 IRS campaign is found in Table A-1in Annex A.

AIRS Ethiopia also established the number and type of vehicles required for IRS operations in each district based on the number of spray actors and topography of the spray areas. Mini trucks with seating capacity of 25 spray actors and 4WD long base with capacity of transporting 12 persons were procured. The procurement was conducted through an open competitive bidding process. Two local companies were selected to provide transport of IRS materials and spray actors during IRS.

2.6 Human Resource Requirements

AIRS Ethiopia used the number of structures found in the 2014 spray campaign as a baseline to determine the number of seasonal workers needed for 2015 IRS activities. As in previous IRS campaigns, team leaders (TLs), squad leaders (SLs), and other supervisors were recruited from among health professionals working in the IRS target districts and zones. SOPs were recruited as seasonal staff from respective kebeles targeted for IRS in 2015. Table 3 shows the number of spray actors recruited and trained for the 2015 spray campaign. Unlike other AIRS countries, all spray actors involved in the implementation of IRS in Ethiopia, are government staff, minus the SOPs, porters and washers.

Overall, implementation of IRS operations in 2015 was conducted with the support of MFPs (36), TLs (64), SLs (484), SOPs (1,511), porters (495), washers (69), security guards (191), water fetchers (67), store assistants (36), data clerks (40 of 44 trained) and drivers (102). Table D-4 in Annex D shows the number and type of spray actors per district.

TABLE 3. NATIONAL AND DISTRICT HEALTH STAFF AND TEMPORARY WORKERS TRAINED IN 2015

Categories of Persons Trained	Training on IRS Delivery						Other Trainings														Total		
	Training of Trainers		Spraying Operations		Poison Management		National Environmental Compliance training		National training on basic entomology		Data Capture and Reporting		EC, Washing, Fire safety and operation site security		EC, stock management and fire safety		SBCC, mobilization and enumeration		Transport Safety and Security				
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	Total
Health Professionals from region (National)							32	3													32	3	35
Health Professionals (National)									34	0											34	-	34
Zonal Supervisors	8	0																			8	-	8
District Supervisors	137	10																			137	10	147
District Malaria Focal Persons	32	4																			32	4	36
Team Leaders	59	5																			59	5	64
Data Entry Clerks											35	9									35	9	44
Clinicians					77	23															77	23	100
IEC Mobilizers																	55	1006			55	1,006	1,061
Squad Leaders			246	238																	246	238	484
Spray Operators			1491	20																	1,491	20	1,511
Porters*			268	22																	268	227	495

				7																			
Washers													12	57							12	57	69
Drivers																			102	0	102	-	102
Security Guards													176	15							176	15	191
District Storekeepers															**30**	**5**					30	5	35
District Store Assistants															**27**	**9**					27	9	36
TOTAL M/F	**236**	**19**	**2005**	**485**	**77**	**23**	**32**	**3**	**34**	**0**	**35**	**9**	**188**	**72**	**57**	**14**	**55**	**1006**	**102**	**0**	**2,821**	**1,631**	**4,452**
TOTAL/Training	**255**		**2490**		**100**		**35**		**34**		**44**		**260**		**71**		**1061**		**102**		**4,452**		

* In Ethiopia, porters attend the same training as SOPs and serve as reserve SOPs during the campaign.

2.7 IRS TRAINING

In 2015, AIRS Ethiopia conducted a number of training sessions aimed at building the capacity of the national, regional, and district staff to implement, monitor, and evaluate the quality of spray operations. Environmental compliance training and basic entomology training were conducted for participants drawn from different zones in the country at the national level.

The project conducted IRS TOTs for the zonal and district staff in July over five days. The TOT participants then conducted six-day training for SOPs, reserve SOPs (porters), and SLs in their respective districts. They also conducted orientations for Health Extension Workers (HEWs), washers, store assistants, and guards on spray operations, mobilization, EC, and safety and security. Driver orientation was provided at the central level.

AIRS Ethiopia also conducted training for district storekeepers focusing on stock-card management, storage of insecticides, and other IRS equipment, receipt, and storage of IRS waste from the field, and warehouse security. AIRS Ethiopia also trained nurses and health officers in the IRS target districts on pesticide poison management. Additionally, the project's M&E team trained 44 data entry clerks (DECs) and hired 40 of them, with the remaining four kept in reserve, in case replacements were needed. The breakdown of all trainings, by type of training, sex and number of participants is shown in Table 3 above.

A total of 2,845 spray actors including TOTs, TLs, SLs, SOPs and clinicians were trained to deliver IRS in 2015 (Table 4) with USG funds, a PMI indicator. Women's participation increased from 26.9 percent in 2014 (n= 1,072) to 37.1 percent (n=1,626) in 2015 for the total number of people trained to support IRS. For female SOPs, porters, SLs and washers, screening for pregnancy was done before training.

TABLE 4. NUMBER OF PEOPLE TRAINED WITH USG FUNDS TO DELIVER IRS

Type of Training	Males	Females	Total
IRS delivery TOT	236	19	255
Spray operations	2,005	485	2,490
Clinicians	77	23	100
Total	**2,318**	**527**	**2,845**

2.8 TECHNICAL ASSISTANCE TO 24 GRADUATED DISTRICTS

AIRS Ethiopia organized a two-day IRS planning meeting for district MFPs, district health managers, zonal MFPs, and zonal health office heads in June 2015 with a total of 60 health staff and managers participating (Table 5). The 24 graduated districts are comprised of 749 villages (kebeles) with a total population of approximately 2.9 million, out of which 606 kebeles are malaria endemic with a population of 2.5 million at risk of contracting the disease.

The meeting objectives included:

- Identifying target areas for 2015 spray operation based on morbidity data.
- Estimating the number of unit structures to be sprayed based on resource availability; and
- Identifying any resource gaps that AIRS Ethiopia could support.

The following key factors were identified for action:

- At least 411 villages with 541,502 unit structures with a population of 1,668,235 people were selected for the 2015 spray campaign;

- The total insecticide requirement was calculated to be 69,221 sachets of bendiocarb and 436,343 sachets of propoxur, to be supplied by the government.
- AIRS Ethiopia was to provide PPE and bendiocarb to the ORHB. A total of 31,318 sachets were donated to ORHB for use in five graduated districts to ensure that no bendiocarb with a July 2016 expiry date remained unused and to fill their insecticide need gap. A further 19,920 sachets (AIRS buffer stock) were exchanged with 2,017 expiry stock procured by ORHB. The AIRS ECO conducted a training of MFPs and visited the 5 graduated districts that were earmarked for bendiocarb spraying to ensure use and compliance. Used sachets and other wastes have also been collected from the five districts by AIRS ETH for incineration.

TABLE 5. IRS PLANNING MEETING PARTICIPANTS FOR GRADUATED DISTRICTS

Areas	Total	MFP			Health Office Head/ Deputy			Total		
		M	F	Total	M	F	Total	M	F	Total
Districts	24	21	3	24	21	3	24	42	6	48
Zones	5	6	0	6	5	0	5	11	0	11
ORHB*	1							1	0	1
Total	**30**	**27**	**3**	**30**	**26**	**3**	**29**	**54**	**6**	**60**

*Representative from the Oromia Regional Health Bureau

2.9 GENDER NORMS AND INCOME USE IN ETHIOPIA

Under TO6, the PMI AIRS Project is focusing on creating a more gender equitable project where spray campaigns and spray operational sites are more gender inclusive and accommodating. The project seeks to increase the number of women hired as seasonal employees and increase the roles these women play in spray campaigns. The PMI AIRS Project would like to use this new project focus to measure whether changing the work place and the messages employees hear about gender equality can change the gender norms of their seasonal workers, a secondary effect of a service delivery project. By implementing a quantitative and qualitative study on the gender norms of all seasonal workers, both males and females, and understanding how women use their income, the project seeks to measure how a workplace environment can promote gender equality.

Gender norms and income research was conducted by AIRS Ethiopia in 2015 to better understand whether working on an explicitly gender equitable project changes a seasonal worker's perceptions of gender norms and equality. Baseline data on gender norms before the IRS campaign and at the end of the spray campaign was collected. To understand the use and perception of income earned by women on the project, a survey was done to collect quantitative financial inclusion information. In-depth interviews with a sub-set of women, and their spouses or heads of households were also conducted to better understand the intra-household decision making. Data was collected once during the spray campaign to provide an understanding of how women accessed and used their income and how it varied by age, marriage status, education level, or IRS program specific factors.

AIRS Ethiopia interviewed 22 seasonal workers in four districts; Chewaka, Gida Ayana, Kersa, and Omo Nada. An initial analysis of this data has shown that all seasonal employees have used their income from AIRS Ethiopia for investments of some sort. People have invested their money in things such as cattle and sheep, adding additions to their houses, or using the money to help cover the cost for education.

Because this income is a one-time payment, the money is not used for day-to-day goods, like consumables; the seasonal workers' other work, such as farming or small trade, pays for these goods. Furthermore, seasonal workers make purchasing decisions with their spouses upon receipt of the lump sum project income.

On the other hand, the data from the quantitative analysis has not shown any statistically significant results. Of the 502 surveys given, the team could only match 155 surveys with their pre and post survey codes. When we analyzed the matched data we saw a very small drop in gender norms. It is very hard to draw conclusions from the matched data as the sample size is extremely small. The codes on the 347 surveys did not link up due to a mismatch of actor's codes in the pre and post surveys. Analysis of these unmatched data showed only very slight, but statistically significant, decrease in gender equity in the post spray campaign data.

Regardless, the AIRS Ethiopia team will use these findings to better engage with the NMCP and the local malaria focal points to dispel myths about women being able to work on an IRS campaign, further recruit and retain women, and train supervisors and NMCP staff on gender equality. In the upcoming spray campaign, AIRS Ethiopia will engage with the district health offices at the zonal and district level on the importance of hiring women and share data that shows female SOPs spray just as many structures as men. Furthermore, AIRS Ethiopia will include a gender session during the TOT in 2016.

3. Information, Education and Communication

The primary objective of communication activities is to ensure successful spray rounds by promoting near-universal coverage, communicate information on house preparation for IRS, avoidance of re-plastering of sprayed walls during the peak malaria season, and adherence to safety precautions.

Due to the generally high IRS acceptance levels witnessed over the last several spray rounds, partly as a result of the long history of IRS in Ethiopia and a cost saving strategy, AIRS Ethiopia delegated the mobilization responsibility to the government. The majority of the population is very familiar with the safety requirements and procedures before and after IRS. The MOH staff used community outreach approaches as a communication strategy during the 2015 spray operation and also engaged an IEC focal point in each district to coordinate all mobilization activities through the kebele administration and other channels. The district organized advocacy and communication meetings using kebele meetings, churches/ mosques and also engaged HEWs as mobilizers to conduct the communication campaign. HEWs received orientation on how to conduct community outreach and on specific key IRS messages to be delivered to beneficiaries in their respective kebeles. Door-to-door mobilization was not conducted, and mobilizers were not embedded on IRS teams in the 2015 spray campaign. Even though the campaign witnessed high IRS coverage and acceptance levels, structure readiness for IRS and lack of information on the actual spray day by household owners were challenges experienced during the campaign. As a result, AIRS Ethiopia recommends training and engaging mobilizers (HEWs) as in previous spray rounds to work with the spray teams. During the training, they will emphasize the need to alert beneficiaries that IRS is coming and that they need to remove their belonging from their structures in time for spraying.

4. Implementation of Spray Activities

4.1 Spray Operations and Supervision

IRS implementation was done in close collaboration with the government with all supervisors, including MFPs, IEC, EC, TLs, SLs, data clerks, storekeepers being drawn from among MOH personnel in the districts. The only seasonal spray personnel hired directly by AIRS Ethiopia were the SOPs and porters. The FMOH through the zonal and district offices recruited all spray personnel (SOPs, TLs and SLs, mobilizers, coordinators, supervisors, storekeepers, etc.). The number of spray operation teams was based on the number of structures found during the 2014 IRS campaign. AIRS Ethiopia provided all technical (training, monitoring, entomology, etc.) and logistical (store, soak pit, PPE, equipment supply, insecticide, consumables, transport, etc.) support required for the operation in 36 districts. Five AIRS Ethiopia staff were deployed to the zones during implementation to provide supportive supervision, each in charge of 5–9 districts, working closely with zonal and district MFPs. Overall, IRS supervision was conducted by a team from AIRS Ethiopia staff, FMOH, ORHB, Zonal MFPs, district staff and PMI. AIRS Ethiopia provided the district and zonal health teams with supervisory checklists, either paper-based or electronic, to ensure an objective assessment on spray quality, EC, stock management, etc. As part of the Dimagi mhealth system, all zonal and district MFPs (40) and AIRS supervisors were supplied with android smart phones uploaded with mobile-based EC and supervisory forms. Upon completing a checklist and submitting a report on the mobile platform, a list of specific action points was generated and submitted to all supervisors so as to provide remedial action.

The project used two models to deliver IRS to the 36 project districts: DB IRS and CB IRS. The latter was delivered through the national health extension program. In the DB IRS model, spray teams stayed in camps organized in each district next to the operation sites that included soak pits and a temporary store in some cases. On a daily basis, MFPs and team leaders deployed the spray teams to the target villages. One SL was in charge of four SOPs and one or two porters. TLs were in charge of supervising four squads equivalent to 16 SOPs. Once a gap was identified, it was to be corrected immediately by the supervisors.

Through continuous supervision, the health teams, AIRS Ethiopia, and PMI observed some performance gaps including:

- Spray quality concerns as some SOPs failed to maintain the required distance and speed while spraying.
- Inability of supervisors to provide direct supervision to SOPs while conducting spraying.
- Errors in data recording.
- Mobilization gaps leading to delayed preparation of structures by households.

These performance gaps will be discussed in more detail in the lessons learned and challenges section of the report and Annex F.

4.2 COMMUNITY-BASED IRS

The CB model of IRS was implemented in one district from each of the six zones in the Oromia region supported by PMI, the same as in 2014.

The project held a five-day district-level training to refresh the skills of HEWs in the six selected districts to serve as SLs. The districts had a total of 118 villages targeted for IRS. The trained HEWs, in collaboration with their village leaders, then selected five literate community members (total 639) and trained them for six days on spray operations and communication. Four of the community members worked as SOPs and one served as a porter or SOP replacement in their villages. Table 6 shows the 2015 spray performance for each CB IRS district.

TABLE 6. SPRAY OPERATION PERFORMANCE IN CB IRS AREAS

Zones	District	Insecticide	Structures Found	Structures Sprayed	Spray Coverage	Population Protected	Pregnant Women	Child <5
East Wollega	Sasiga	Bendiocarb	19,027	19,023	100.0	42,926	590	6,273
Ilu Aba Bora	Chewaka	Actellic	34,548	34,548	100.0	81,005	2,018	13,542
Jimma	Kersa	Bendiocarb	29,435	29,401	99.9	77,259	759	10,683
Kellem Wollega	Hawa Galan	Actellic	38,626	38,607	100.0	74,816	1,614	12,706
West Shewa	Bako Tibe	Bendiocarb	19,593	19,471	99.4	45,972	616	5,589
West Wollega	Manasibu	Bendiocarb	37,714	37,692	99.9	87,205	822	9,899
TOTAL			**178,943**	**178,742**	**99.9%**	**409,183**	**6,419**	**58,692**

The length of spray operations in the six CB IRS districts varied based on number of structures per district, with spray duration ranging from 10 – 31 days. Only one vehicle was provided to the district to provide logistical and supervision support. Motorbikes provided by the district health office were used for supervision.

4.3 LOGISTICS AND STOCK MANAGEMENT

AIRS Ethiopia rented a spacious warehouse in Addis Ababa to accommodate the bulky Actellic consignment for 2015 (Figure 2). Each of the district level storage facilities served as distribution centers for IRS materials, equipment, and supplies during the IRS operations. The district storage facilities were managed by a storekeeper and assistant who ensured distribution and close supervision of supplies and materials at the operation sites storage facilities. Insecticide, other materials, and equipment stocks were carefully tracked and managed from the central warehouse to the district storage facility and subsequently to the operation sites storage facilities. All stock records were documented on stock cards.

Empty insecticide sachets/bottles were tracked daily at the sector and district stores. They were accounted for by recording how many insecticide sachets each TL had received and used. Upon receiving the insecticides from the district stores, TLs filled out and signed daily insecticide tracking forms, and then issued sachets to the SLs with a similar insecticide tracking form. The SLs handed the

insecticides to the porters assigned to theirs squads, whose role was to carry and handle the mixing of the insecticides under the supervision of the SLs. This approach ensured that SOPs did not handle insecticides thereby minimizing any chance of insecticide loss. At the end of each spray day, porters or SLs would turn in the used (empty) and unused sachets/bottles to the TL, who returned them to the store. The storekeeper recorded the full sachets/bottles on the stock card and updated the balance. Used sachets/bottles were recorded on the daily utilization record form that tracks each store's empty sachets/ bottles and utilization trend. This reconciliation process enabled the storekeepers to ensure an effective daily inventory and to alert AIRS program staff of discrepancies between the stock and the records. The storekeepers also recorded daily minimum and maximum temperatures readings. A total of 102 vehicles were contracted for the support of the IRS operations in the 36 districts (Figure 3).

FIGURE 2. CENTRAL WAREHOUSE IN ADDIS ABABA WITH ACTELLIC 300 CS

FIGURE 3. SOP TRANSPORT TO IRS SITES IN GUTO GIDA DISTRICT

5. Environmental Compliance

PMI Ethiopia is operating under a Supplemental Environmental Assessment (SEA) amendment developed in 2015, which authorizes the use of three WHO recommended classes of insecticides (pyrethroids, carbamates and organophosphates) as well as chlorfenapyr (when recommended by WHOPES). The SEA authorizes technical assistance and IRS in all zones in the country and is valid for a period of five years, 2015–2020. In addition to bendiocarb, carbamates, which have been used in previous spray campaigns, this year an organophosphate was used in eight project districts.

5.1 Pre-Season Environmental Compliance Assessments

Two pre-season environmental compliance assessments (PSECA) were conducted for all 36 project districts using the checklists installed on smartphones. The first-round PSECA was performed well ahead of the TOT, and informed the district staff of EC gaps they needed to address. Areas that required the contribution of AIRS project office were also identified. Tables 7 and 8 show the gaps identified. In the second round of PSECA, conducted one week before spray operations began, the team verified that all needs had been filled by stakeholders and that the districts were ready for the spray operations.

TABLE 7. KEY GAPS IDENTIFIED DURING FIRST-ROUND PSECA FOR DISTRICT STORES

District Store	Zone						Total
	West Wollega	Kellem Wollega	East Wollega	West Shewa	Ilu Aba Bora	Jimma	
How many fire extinguishers are in need of refilling?	10	7	12	8	8	10	55
How many laminated correct pesticides and safety sheets are required?	7	5	9	5	4	6	36
How many health and safety procedure sheets are needed for stores and vehicles?	20	14	24	14	12	13	97
How many emergency response procedure sheets are required?	20	14	24	14	12	13	97
How many spill response procedure sheets are needed?	11	21	19	24	11	17	103
How many fully stocked first aid kits are needed?	7	5	9	5	4	6	36
How many doses of Atropine and /or charcoal antidotes to pesticides are required?	14	16	24	20	18	15	107
How many pregnancy test kits are needed?	35	28	49	36	30	88	266

TABLE 8. KEY GAPS IDENTIFIED, FIRST-ROUND PSECA, SOAK PITS

Soak Pits	Zones						Total
	West Wollega	Kellem Wollega	East Wollega	West Shewa	Ilu Aba Bora	Jimma	
How many soak pits are in a critically-sensitive area (e.g., flood prone) and/ or overgrown with vegetation?	0	0	0	0	0	0	0
How many soak pits need vegetation cleared?	0	10	17	10	9	12	58
How many soak pits need maintenance of fence, gate, lock?	17	7	17	9	6	12	68
How many washing areas need repair of slope, leak, or cracks?	15	28	26	26	34	30	159
How many soak pits need lines to dry clothes?	1	10	0	7	0	0	18
How many soak pits need the skull and cross-bones danger signs?	0	2	2	1	1	5	11
How many soak pits need a temporary shower built?	17	10	17	6	6	10	66

Apart from the maintenance of previously used soak pits and temporary bathrooms, AIRS Ethiopia did not perform major construction in 2015. In line with the advocacy made to increase the participation of female actors, extra temporary bathrooms were constructed in all operational sites.

AIRS Ethiopia prepared 181 (61 in DB IRS areas and 120 in CB IRS areas) soak pits to ensure safe disposal of effluent waste. Polyethylene plastic sheets were used as ground cover in place of cement for the washing/rinsing areas of the soak pits. The 36 existing district stores were used for storage of IRS materials. AIRS staff and other IRS supervisors inspected the stores for stock management and EC. The project equipped the stores with fire extinguishers, shelves, pallets, first aid kits, dust bins, emergency kits, and thermometers to ensure health and environmental safety during the spray campaign.

Pregnancy tests were undertaken by the 590 women recruited for the IRS operation. The physical condition of SOP and SL was also assessed during the training process by trainers including the MFPs. In addition, the team leaders assessed the physical condition of each SOP each day during the morning mobilization sessions. Apart from testing female actors for pregnancy, there were no medical examinations performed for other spray actors, however this will be implemented prior to the 2016 campaign.

Alongside the IRS TOT training, the project trained 100 clinical practitioners on insecticide exposure management. Districts were notified of the need to have the recommended antidotes (atropine or, diazepam). AIRS ensured that at least one of the antidotes was available in the health facility near the district store. In the 2015 spray round, no site reported insecticide exposure during the spray operations.

After spraying each structure, SOPs provided information to household owners on actions to follow after the spraying as part of EC and safety provisions (Figure 4).

5.2 Mid- and Post-Season Environmental Inspections

All AIRS Ethiopia technical team members were involved in EC inspections and conducted supervision and the pre-spray, mid-spray and post-spray inspections in all target districts. The EC assessment and supervision were based on standard AIRS checklists. District and zonal MFPs were actively involved in supervision as well. Four major checklists (Morning Mobilization and Transport Vehicle Inspection;

Home Owner Preparation and Spray Operator Performance; Storekeeper Performance; and End-of-Day Cleanup) were performed based on supervision plans developed by AIRS Ethiopia and shared with the districts and zones. Supervisors were charged with the task of providing corrections and guiding SOPs on the spot. At the end of each inspection, district health teams held a general discussion on the status, achievements, shortcomings, and constraints found, and forwarded the recommendations for further corrective actions to district health offices and to AIRS supervisors. A summary of inspections and mitigation measures taken are fully described in Table B-1 in Annex B.

FIGURE 4. SOP PROVIDING POST-SEASON KEY MESSAGES IN SASIGA DISTRICT

5.3 Post-Season Demobilization and Waste Disposal

5.3.1 Closure of Storerooms and Soak Pits

The IRS commodities were collected from temporary storerooms and returned to the district stores at the end of spray operations. Soak pits and the stores were closed and secured after cleaning. Additionally, soak pits are covered with plastic sheets and soil to reduce accumulation of decaying debris and vegetation growth.

5.3.2 Solid Waste Disposal

At the end of the spray operations, AIRS Ethiopia collected solid wastes, including empty sachets and used masks, for management at the central level. AIRS Ethiopia is using two incinerators for the incineration of empty sachets and masks and is planning to complete the incineration within two months. Following the signed memorandum of understanding with the recyclers, all empty organophosphate bottles and empty cartons were transferred to the recycling firm. Some empty bottles already delivered to the recycling plant are undergoing processing (Figure 5). Cartons (6,587 Kg) are being recycled by the Ethiopian pulp and Paper Share Company in Wonji to produce printing papers, card boards and cartons. Eney Investment PLC in Addis Ababa is undertaking bottle recycling (80,840 bottles) and will produce shoe soles and electric cable conduits. The project's ECO is following up on the recycling and both firms will issue certificates of completion.

Contaminated IRS wastes including empty bendiocarb sachets (4,061kg) and 1,560kg of used masks are stored in the central warehouse awaiting incineration at the project's incinerator in Addis Ababa. Following complaints from residents at the incineration site, the project is working with the environmental regulatory section in the ORHB, which is expected to provide expert guidance for action by the AIRS Ethiopia project.

5.3.3 Environmental Assessment by GEMS

The Global Environmental Management Support (GEMS) project conducted field evaluations from August 12 – 24, 2015 to support the USAID Mission in ensuring compliance with environmental management plans associated with their malaria IRS programs. Eight districts were visited and a subsequent report indicated that the project complied with the BMP in most circumstances. However, some issues were raised including public complaints with regards to incineration, the need for medical checkups for spray operators and the proximity of offices and residential houses close to IRS stores at district offices. It was also noted that there was need to consider alternative effluent disposal mechanisms in areas with a high water table. The project noted the comments and is committed to address all gaps identified before the next spray round begins.

5.3.4 Incidents Encountered during the IRS Operation

Two incidents were reported during the 2015 IRS operation. Both were vehicle accidents, one involving a hired IRS vehicle and the other was with the AIRS Ethiopia project vehicle. The first accident occurred on June 4, 2015 near Gimbi town. The hired vehicle hit an adult male while crossing the road. The victim was hospitalized and released in good condition. The second accident occurred on July 10, 2015. The AIRS project vehicle hit an eight year old girl while she was crossing the road in Sekoru district. The girl was hospitalized for minor injuries and later discharged in good health. Both incidents were reported to the home office and to PMI within 48 hours of occurrence.

FIGURE 5. OP BOTTLE STORAGE AND PROCESSING

6. POST-SEASON ACTIVITIES

6.1 POST-SEASON REVIEW MEETING

A post-spray meeting was held in Ambo town October 1 – 2, 2015 to review IRS performance and challenges in the 36 IRS targeted districts and make recommendations for the next spray cycle in the following areas:

- IRS implementation processes and spray coverage
- IRS quality
- Environmental Compliance
- SOP recruitment
- Training/ Capacity building for spray operations;
- Advocacy, Communication and Social Mobilization Campaign
- Supervision
- Achievements and challenges

A total of 92 participants including district MFPs, zonal MFPs, district's health office vice heads and zonal heads participated (Annex C). The meeting pointed out key areas that required attention by ORHB, district authorities and AIRS Ethiopia in order to improve spray performance. Key recommendations included:

- Scheduling of regional and district activities should take into consideration the spray calendar so as to reduce movement of supervisors away from IRS.
- Selection of supervisors by the district should take into consideration of staff's availability throughout the IRS period and effort to recruit supervisors from health centers needs to be considered.
- District health office to take an active role and responsibility in the process of SOPs recruitment to ensure that those with experience are considered.
- The need for comprehensive training of supervisors and SOPs was highlighted as a key for improving spray performance.
- There is need for a robust social mobilization for IRS using all available channels and training and deployment of HEWs as mobilizers.

6.2 DE-MOBILIZATION AND LOGISTICS

AIRS Ethiopia ensured that all spray equipment, including spray pumps, PPE, plastic sheets, tents, and mattresses, were properly cleaned and returned to district stores. A comprehensive post-spray inventory of all IRS-related materials in the 36 target districts was conducted in November 2015. The results showed that there was no loss or damage of IRS materials. The IRS materials dispatched to the districts are recorded and documented by the district health offices. The storekeepers are responsible for dispatch and collection of the items after the operation. The security of the IRS stores after the spray campaign is managed by the district health offices.

7. ENTOMOLOGY

Entomological monitoring is essential in any insecticide-based vector control intervention such as IRS. It helps to assess the quality of the vector control intervention as well as its efficacy. The entomological monitoring data is used to justify decisions such as the type of insecticide and selection of target areas. The project implemented the following entomology activities in collaboration with Jimma and Mekelle universities:

- Vector density and species composition in intervention areas.
- Vector behavior
- Wall bioassay to assess quality of insecticide application and insecticide decay rates.
- Insecticide resistance monitoring.

The project supports the ORHB's insectary in Nazareth through procurement of supplies and care of lab animals for mosquito feeding, maintenance of insectary equipment, and payment of temporary staff. The insectary serves as source of susceptible mosquitoes for entomological monitoring activities undertaken by the AIRS team. Jimma University has an established insectary for a susceptible *An. arabiensis* colony supported by the project.

7.1 DETERMINATION OF QUALITY OF SPRAYING AND DECAY RATE

The AIRS Ethiopia team conducted cone bioassay tests for quality check and decay rate in four sites; two DB IRS and two CB IRS districts. One CB IRS district and one DB IRS district were selected for the bioassay tests for Actellic and bendiocarb sprayed structures.

The AIRS Ethiopia team performed the tests in 12 houses per site purposefully selected to represent different wall types and structures sprayed by different SOPs. A total of 48 houses were sampled in the four The tests were carried out using known susceptible mosquito colonies reared in the Adama Malaria Reference Training Center insectary and 2–3-day-old wild mosquitoes reared from larvae or pupae.

Results of the wall bioassay tests conducted three to six days after spraying in organophosphate sprayed structures indicated 100% mortality for both wild and susceptible mosquitoes for all wall surfaces tested (Table 9). There was no difference in mortality between wild and susceptible mosquitoes exposed to sprayed wall surfaces. There was also no difference in mortality of mosquitoes between CB IRS and DB IRS model sites on all wall surfaces sprayed with organophosphates. Mortality was 100% in both sites (CB and DB IRS districts) as well as on all types of wall surface types in both districts.

The cone bioassay test results conducted in carbamate sprayed houses are shown in Table 10. Mortality of wild and susceptible mosquitoes was 100% for all dung plastered and painted houses. Mortality of wild and susceptible *An. gambiae* s.l. ranged from 90% to 96% for mud wall surfaces. There was also no difference between CB IRS and DB IRS model sites for mortality rate of mosquitoes exposed to mud walls sprayed with carbamates in these two districts.

At 4 months post spray, the mortality rate in Chewaka with pirimiphos-methyl was 60.1% and 69.3% with susceptible mosquitoes on mud and dung wall surfaces, respectively. In Tiro Afeta, pirimiphos-methyl performed well on all wall surfaces with the average mortality rate of 84.5% after four months.

The decay rate of bendiocarb was faster on mud wall surfaces compared to other surfaces. In Bako Tibe, mortality rate was 5.9% and 41.7% in Shebe Sombo on mud wall surfaces after three months of IRS.

TABLE 9. WALL BIOASSAY RESULTS FOR PIRIMIPHOS-METHYL

	Tiro Afeta (July-Nov 2015)							Chewaka (July-Nov 2015)				
	% mortality											
	Susceptible			**Wild**				Susceptible				
Time	Mud	Dung	painted	Mud	Dung	painted	Mean	Mud	Dung	painted	Paper	Mean
T0	100	100	100	100	100	100	100	100	100	100	100	100
T1	100	100	100	96.7	98.3	100	99.2	98.4	100	100	100	99.6
T2	100	98.3	98.3	100	100	100	99.4	62.5	73.3	100	100	83.9
T3	81.7	77.3	89.2	ND			82.7	61	63.3	89.7	84.4	74.6
T4	89.3	76.6	87.5	ND			84.5	60.1	69.3	91.9	ND	73.8

ND= Not done due to scarcity of wild mosquitoes

TABLE 10. WALL BIOASSAY RESULTS FOR BENDIOCARB

	Shebe Sombo (Aug-Non 2015)					**Bako Tibe (Aug-Nov 2015)**			
	% mortality								
	Susceptible		**Wild**			**Susceptible**			
Time	Mud	Painted	Mud	Painted	Mean	Mud	Dung	painted	Mean
T0	95	100	100	100	98.8	90	100	100	96.7
T1	82.5	100	61.7	83.3	81.9	53.3	93.3	92.2	79.6
T2	60.6	99.2	ND		79.9	61.7	66.7	99.2	75.9
T3	41.7	94.6	ND		68.1	5.9	83.5	87.6	59

ND= Not done due to scarcity of wild mosquitoes

7.2 MONITORING VECTOR DENSITY AND BEHAVIOR

Three sites were selected for vector density and behavior monitoring with six months pre-spray, and one month post-spray data collection was conducted. The sites were selected from Gobu-Seyo and Seka Chekorsa districts (intervention sites) and from Ilu Gelan district (a control/unsprayed site). An assessment was conducted before the spraying began and repeated one month after spray. Results from the two intervention sites and one control site are presented.

7.2.1 LONGITUDINAL VECTOR MONITORING

Vector monitoring was conducted every month from March 2015 and will continue for 12 months. Summary report on species composition and trend of *Anopheles* were presented in figure 6, 7 and 8. The density of female *An. gambiae* s.l. collected from 20 houses using the pyrethrum spray collection (PSC) method, human landing catches (HLC) and CDC light traps showed a decrease post IRS in the intervention sites (Gobu-Seyo, and Seka Chokorsa). *An. gambiae* s.l densities tended to rise in May and peaked in June and July and remained generally high in August and dipped in September. As IRS is most

effective when implemented just before the peak vector breeding activity or generally just before the rains, it would be appropriate to implement spray operations in May using an insecticide with long residual efficacy, if possible.

FIGURE 6: *ANOPHELES* SPECIES COMPOSITION AND DENSITY IN GOBU SAYO DISTRICT

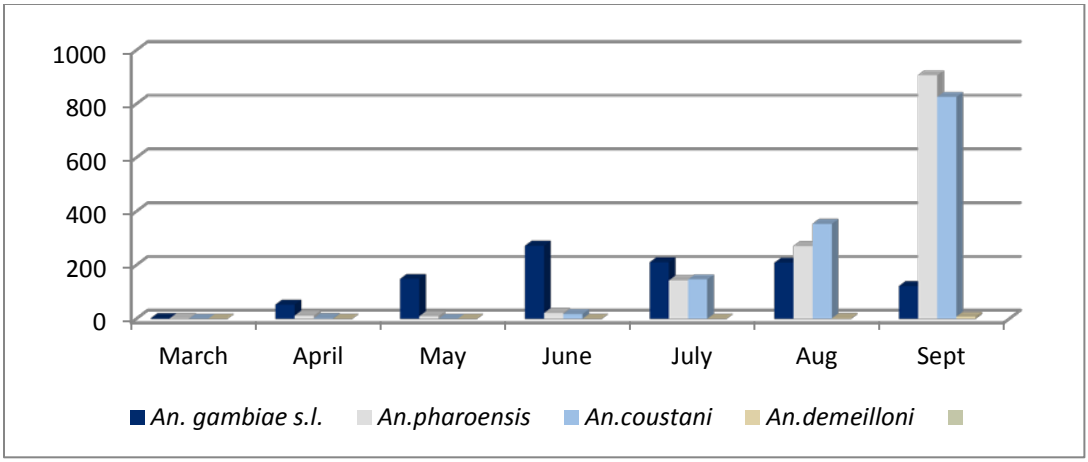


FIGURE 7: *ANOPHELES* SPECIES COMPOSITION AND DENSITY IN ILU GELAN DISTRICT

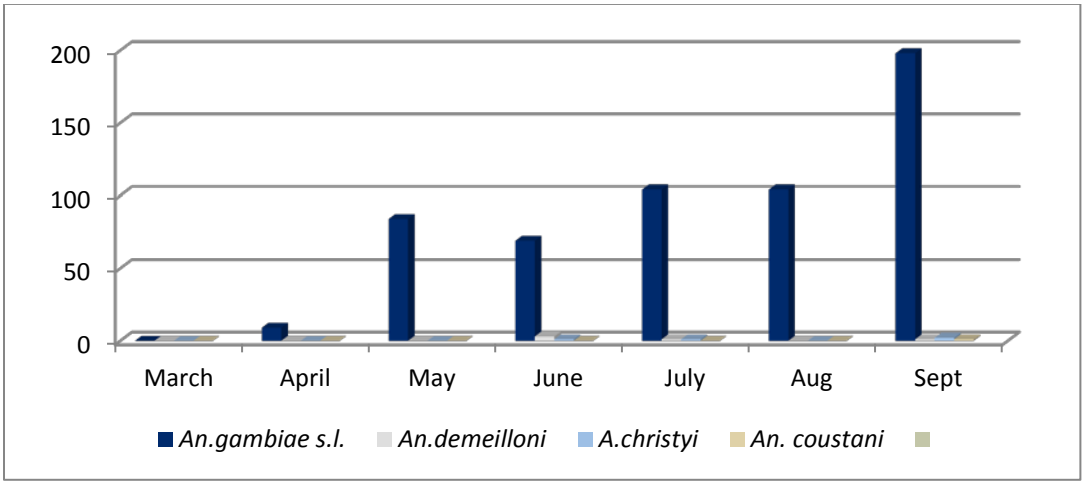
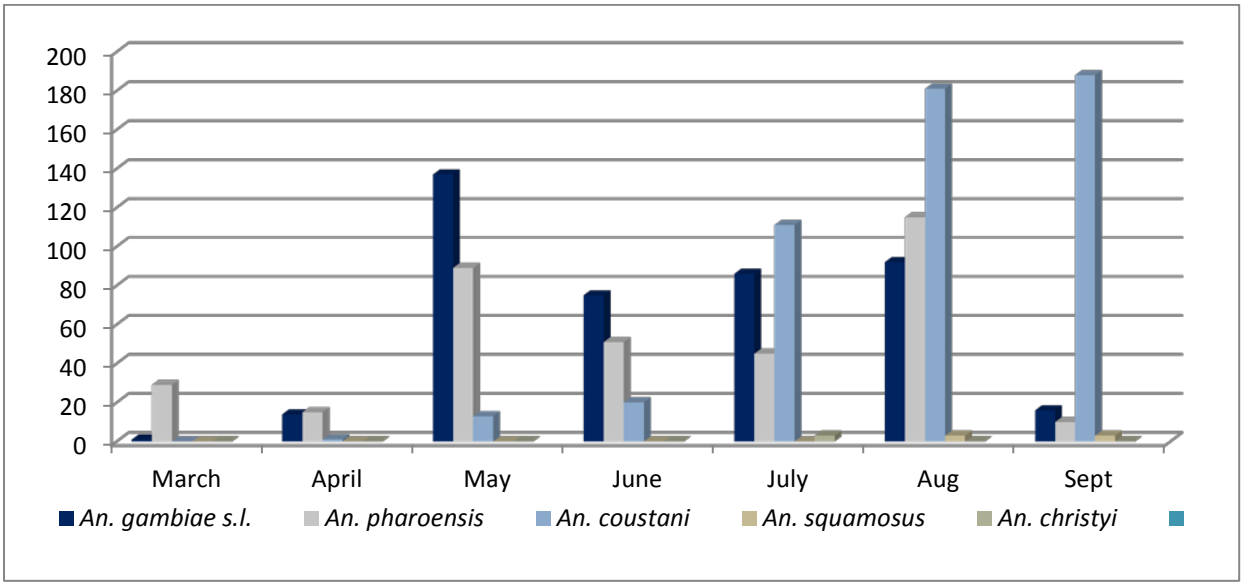


FIGURE 8: *ANOPHELES* SPECIES COMPOSITION AND DENSITY IN SEKA CHOKORSA DISTRICT

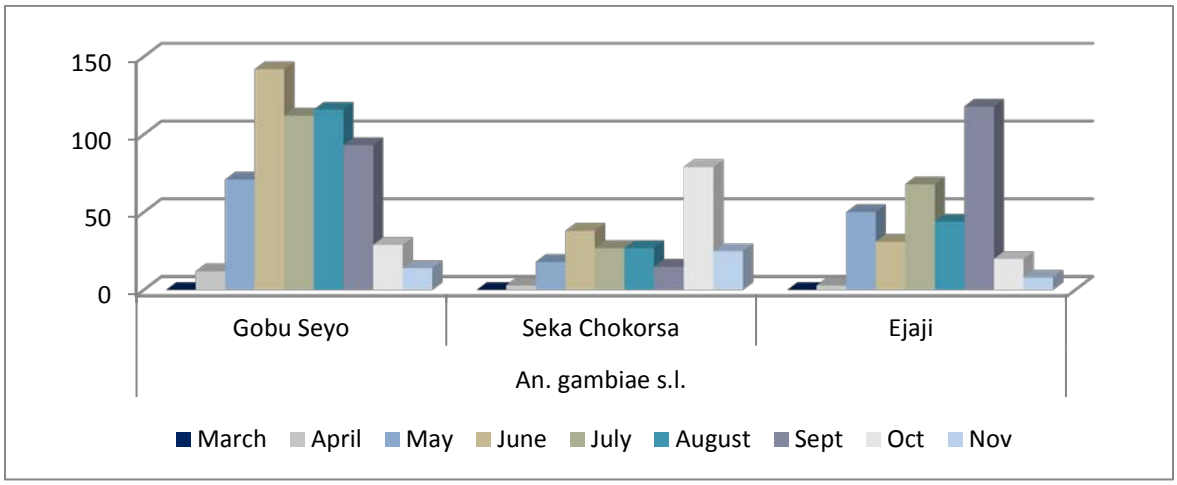


7.2.2 HUMAN LANDING CATCHES

Human Landing Catches (HLC) were undertaken before and one month after the spray. Two collectors (one sitting indoors and the other outdoors) spent the whole night (6 p.m. to 8 a.m.), exchanging places every hour. Two houses from each site were selected for the sampling and two collectors spent two consecutive nights in each. In the intervention site, Gobu Sayo, the team collected 116 and 93 *An. gambiae* s.l. respectively before and one month after the spray. In another intervention site, Seka Chokorsa, the team collected 27 and 15 *An. gambiae* s.l. respectively before and one month after the spray. In Ejaji town, the control site, the number of *An. gambiae* s.l. collected was 44 before and 118 after intervention time, an increase of more than double. Vector population is expected to peak in September. The decrease in *An. gambiae* s.l. in Gobu Sayo and Seka Chokorsa may indicate that spraying had an impact on vector densities (Figure 9).

Furthermore, the data collected does not show any specific preference, though more mosquitoes were collected during the first half of the night (6–12 pm) in the intervention sites, but more mosquitoes were colected during the second half of the night in cotrol site, Ilu Gelan.

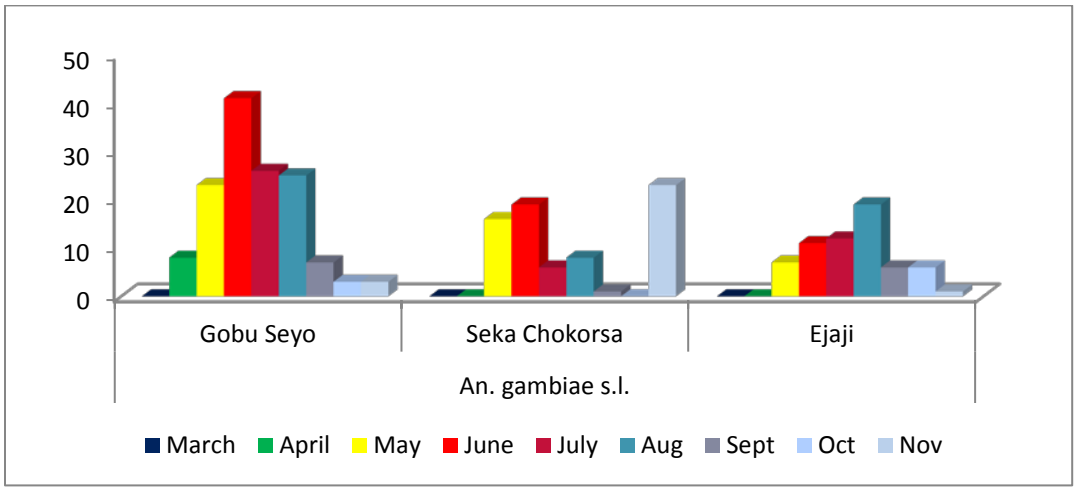
FIGURE 9: TOTAL NUMBER OF *ANOPHELES GAMBIAE* S.L. COLLECTED BY HUMAN LANDING COLLECTION



7.2.3 CDC LIGHT TRAPS

CDC light trap collection was undertaken in two houses for two nights in each site. Few *An. gambiae* s.l. were collected to make meaningful comparisons between pre- and post-spray densities. In all sites, there was a decrease in the numbers of *An. gambiae* s.l. in post-spray collections (Figure 10). In Gobu-Seyo site, an increase of *An. pharoensis* and *An. coustani* were observed post spray.

FIGURE 10: CDC LIGHT TRAP COLLECTION IN THE THREE SITES



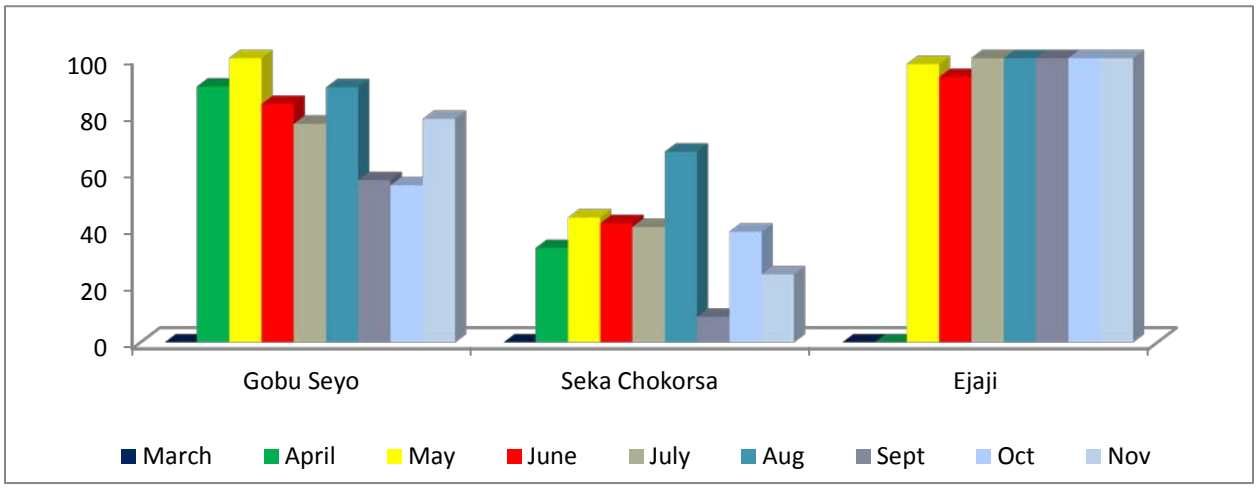
7.2.4 PARITY RATE

Ovary dissection was performed on all unfed female mosquitoes captured during the pre- and post-spray HLC collections to determine parity rates. In Gobu-Seyo and Seka Chokorsa intervention sites, the parity rate ranged from 10% - 57% after spray (Table 11). In Ilu Gelan control site, the parous rate remained the same at 100% before and post spray (Figure 11).

TABLE 11. MOSQUITOES DISSSECTED FOR PARITY RATES IN THREE STUDY SITES

Time	Gobu Sayo				Seka Chekorsa				Ilugelan			
	An. gambiae s.l. Collected	# Dissected	Parous	% Parous	*An. gambiae* s.l. *Collected*	# Dissected	Parous	% Parous	*An. gambiae* s.l. Collected	# Dissected	Parous	% Parous
Aug	116	114	104	89.7	27	27	18	67	44	44	44	100.0
Sept	93	88	53	57.0	15	10	1	9	118	115	115	100.0

FIGURE 11: PARITY RATES OF *AN. GAMBIAE* S.L. IN THREE STUDY SITES



7.3 INSECTICIDE SUSCEPTIBILITY

In 2015, AIRS Ethiopia tested the main malaria vector, *An. gambiae* s.l., for susceptibility to 11 insecticides in eight fixed sites using WHO tube assays. According to the WHO classification, the results showed that the vector was fully susceptible to pirimiphos-methyl, fenitrothion, and propoxur in all study sites. It was also fully susceptible to bendiocarb in six of the eight sites and resistant in two sites. The vector was highly resistant to DDT and all pyrethroids including etofenprox (Table 12).

Of the eight sites where insecticide resistance testing was performed, three were in Oromia, one each in SNNPR, Tigray, Afar, Gambela and Amhra regions. Two of sites in Oromia sites are in PMI AIRS project districts.

TABLE 12. INSECTICIDE RESISTANCE RESULTS FROM EIGHT SITES IN 2015

No.	Insecticide	% mortality							
		Region: SNNPR	Region: Oromia	Region: Oromia	Region: Amhara	Region: Tigray	Region : Afar	Region: Gambella	Region: Oromia
		District: Halaba	Dsitrict: Omonada/ Asendabo	District: Zwai Dugda	District: Bahrdar	Dsitrict: Alamata	District: Amibara	District: Lare	District: Chewaka
		Site: Habiba	Site: Osso Billi	Site: Shenen/Burka	Site: Zenzlima-Robit	Site: Hadish Kigni	Site: Were/Sedi	Site: Kurgeng	Site: Mender 1,2 and 3
1	DDT	25(25/100) (R)	4 (4/100) (R)	ND	10.8(10/93) (R)	40 (30/75) (R)	48.0 (48/100) (R)	24 (24/100) (R)	12.4(15/104)(R)
2	Lambda-cyhalothrin	21.4(22/103) (R)	9 (9/100) (R	ND	10.7(8/75) (R)	34.7 (26/75) (R)	34.9 (39/101) (R)	24 (24/100) (R)	55.4(51/95)(R)
3	Deltamethrin	43(46/107) (R)	32 (32/100) (R)	31.5(32/101)(R)	25.3(19/75) (R)	57.3 (43/75) (R)	49.2 (50/102) (R)	11 (11/100) (R)	48.2(48/99)(R)
4	Fenitrothion	100(104/104) (S)	100 (100/100) (S)	100 (98/98) (S)	100(75/75) (S)	100 (100/100) (S)	100 (99/99) (S)	100 (100/100) (S)	100(99/99) (S)
5	Malathion	96.2(101/105)(POR)	83 (83/100) (R)	ND	43(43/100) (R)	100 (100/100) (S)	100 (102/102) (S)	88 (88/100) (R)	95.9(88/92) (POR)
6	Pirimiphos-methyl	100(103/103) (S)	98 (98/100) (S)	100 (100/100) (S)	100(75/75)(S)	100 (100/100) (S)	100 (101/101) (S)	100 (100/100) (S)	100(83/83)(S)
7	Propoxur	100(102/102) (S)	100 (100/100) (S)	100 (100/100) (S)	99(99/100)(S)	100 (100/100) (S)	100 (102/102) (S)	100 (100/100) (S)	100(100/100) (S)
8	Bendiocarb	100(103/103) (S)	95 (95/100) (R)	100 (100/100) (S)	87(87/100) (R)	100 (100/100)(S)	100 (100/100) (S)	100 (100/100) (S)	100(100/100)(S)

9	Permethrin	24.8(26/105) (R)	22(22/100) (R)	12.8(13/102)(R)	9(9/100) (R)	89 (89/100) (R)	60.9 (65/97) (R)	28(28/100) (R)	20.1(16/80) (R)
10	Etofenprox	42.7(44/103) (R)	50 (50/100) (R)	ND	9.3(7/75) (R)	53.2 (42/75) (R)	78.9(75/94) (R)	86 (86/100) (R)	10.5(9/91)(R)
11	Alpha-cypermethrin	16.3(17/105) (R)	4 (4/100) (R)	ND	17.3(13/75) (R)	80 (80/100) (R)	70.3(73/101) (R)	ND	18.6(16/92)(R)

7.4 Determination of Decay Rate of Insecticides used for IRS in Ethiopia

As part of the planned activities in 2015, the project in collaboration with Jimma and Addis Ababa universities is conducting studies to determine the decay rate of different insecticides in experimental huts in two sites. The objectives of the study are to:

- Determine the decay rates of bendiocarb, propoxur, and pirimiphos methyl;
- Determine the effect of different wall surfaces on the persistence of insecticides;
- Determine whether or not insecticide decay rates vary by site.

The results of this study will be critical in making decisions on insecticide choice for IRS in future spray rounds. Two sites were selected, Ziway in East Showa zone and Sekoru in Jimma zone. Ten experimental huts have been constructed at each of the study sites with wall surfaces representative of the situation within the communities: painted, smooth mud, rough mud and dung surfaces. Two huts will serve as controls (sprayed with water) while the remaining eight will be treated with bendiocarb (400mg/m^2), propoxur (1000mg/m^2), propoxur (2000mg/m^2) and pirimiphos-methyl (1000mg/m^2) in replicates. Four filter papers (Whatman # 1) will be placed on each of the wall surfaces and the concentration of the insecticide will be tested by High Performance Liquid Chromatography (HPLC) at Jimma University. To determine the decay rate, wall bioassays will be conducted using 2 – 5 day old susceptible *An. arabiensis* exposed to the different wall surfaces based each month after spraying for at least six months.

8. MONITORING AND EVALUATION

8.1 APPROACH AND KEY OBJECTIVES

The key objectives of AIRS Ethiopia M&E activities were:

- Emphasize accuracy of both data collection and data entry through comprehensive trainings and supervision at all levels;
- Facilitate data use in both field and office settings through participatory project design and implementation;
- Streamline and standardize the data information flow to minimize errors and facilitate timely reporting; and
- Ensure IRS data security and storage for future reference through establishment and enforcement of proper protocols.

8.2 DATA COLLECTION AND DATA QUALITY ASSURANCE PROTOCOLS

Data was collected using standardized data collections forms designed to capture all core PMI indicators. AIRS Ethiopia has five main forms to capture all AIRS process indicators at different levels:

- Training Participant Registration Form
- Daily Spray Operator Form
- Squad Leaders Daily Summary Form
- Team Leaders Daily Summary Form
- District Malaria Focal Person Daily Summary Form.

AIRS Ethiopia uses only the Daily Spray Operator Form, as it is the primary data source. The three data summary forms are used by district operations supervisors to manage team and squad performance on a daily basis. Table D-1 in Annex D presents the use of each form.

The PMI AIRS Project used three paper-based data quality assurance tools (the Error Eliminator (EE) Form, Data Collection Verification (DCV) Form, and Data Entry Center Supervision Checklist) to ensure proper supervision of data collection and data entry. These tools are fully described in Table D-2 in Annex D.

Additionally, AIRS Ethiopia used the AIRS Access Database Cleaning/Reporting Tool. The tool is a database that links to the AIRS database backend (i.e., the spray data) and has two functions: generating district-level reports and data cleaning. The district-level reports provide spray progress to date, per day, per week, per squad, per administrative level (district, village), per spray operator, etc. These various reports required no computer knowledge or individual analysis. Hence, they were used by AIRS operations team members or government supervisors to get updates and respond to spray coverage issues in real time. The data-cleaning function was used by DECs for data verification and daily data cleaning. The M&E team and spray supervisors also used the cleaning function to perform data verification (e.g., looking up the spray data for a specific day, SOP, or structure).

During regional and zonal TOTs, the M&E team emphasized definitions of key IRS terms and reporting indicators, compliance with M&E protocols, and proper data collection. They also trained field staff and supervisors on supervisory roles and responsibilities and data security. The M&E team was fully engaged in supervising field work during spray operations. While observing data collection and entry in the field, the team identified issues and was able to correct errors on the spot.

One of the key tools for providing corrections in the field was the DCV form, used by AIRS staff and government supervisors to capture issues and guide feedback during spray operations. The most common issues found through the use of the DCV form are summarized in Table 13.

TABLE 13. USE OF DCV FORM: COMMON ISSUES AND CORRECTIVE ACTIONS

Errors/Issues Observed	Corrective Actions Taken
Unmarked structures SLs did not consistently mark structures with chalk.	The M&E team and supervisors advised SLs, TLs, and field supervisors and provided on-the-spot correction and training.
Missing IRS card numbers Some households did not have their IRS cards from previous years campaigns.	The team provided reserve IRS cards during spray operations to be distributed to households needing replacement IRS cards. Additionally, the SOPs were told to emphasize to households the importance of keeping their IRS cards in a safe place.
IRS cards not updated SLs were not updating the 2015 section of the IRS cards with 2015 spray information: date of spray, name and code of SOP, total # of eligible structures found and sprayed/ unsprayed.	Orientation was provided to SLs to remind them to update IRS cards correctly.
Old IRS cards with no space to write for 2015 IRS information A few IRS cards were missing the 2015 lable to write the information.	The IRS cards were distributed in 2012 and the cards had limited space to write the information. The AIRS M&E team informed SLs and TLs to replace the old IRS cards with the new IRS cards, which include space for 2015 information.

See Table D-3 in Annex D for a summary of AIRS Ethiopia's tools for addressing core areas of data quality.

8.3 DATA ENTRY

AIRS employed 40 DECs, one per district for 32 districts and two per district for four districts which had large numbers of structures. The 2015 AIRS Ethiopia database along with the reporting/cleaning tool was installed on every DEC's laptop together with a separate program to synchronize the data and use cloud technology for storage.

AIRS expanded a client server data entry system in East Wollega Zone. In addition to the three DECs last year, one more was added to the system. At the zonal health office, four DEC computers were networked to a single SQL server. As we have used in other AIRS countries, a single laptop was set-up as an SQL server that was loaded with the necessary applications, database and system configurations to support multiple users. The server functioned as a central data bank for the client machines connected to it. In this way the DECs entered data on their server-connected laptops that was then stored in a single backend on the server and all data back-ups and transfer procedures were performed from the

server. This system facilitated data aggregations and transfers and more centralized supervision of Data Entry Clerks.

Data entry was carried out at two levels, first by "totals" (for quick reporting and feedback) then by "details," i.e., by each structure captured on the Daily Spray Operator Form, for more accurate data entry and verification purposes.

8.4 Data Storage

The Daily Spray Operator forms are stored in binders at the district level. The forms were filed by date and team to provide a uniform organizational system and facilitate easy reference.

At the end of every day, all data were backed up electronically in three stages, first in a back-up folder on the data entry laptop; second, to a cloud back-up system (Sugar Sync); and third, on an external memory drive that was provided to each DEC.

8.5 Data Cleaning

The M&E Manager, M&E coordinator, and IT Specialist facilitated data cleaning at the district level, which involved the following:

- Ensuring that all Daily Spray Operator forms were entered correctly by the double entry method (by totals and then by details);
- Ensuring that all necessary corrections were made so that the totals and aggregate details per form are in agreement;
- Checking and where necessary removing duplicate records;
- Checking that all backups are made on the secondary media and hard copy as per the protocol; and
- Identifying and entering missing records.

Data cleaning was done using a Microsoft Access-based IRS Cleaning/ Reporting tool. The DECs cleaned spray data daily throughout the spray campaign, with final data cleaning completed 20 days after the end of the spray campaign.

8.6 Reporting of Spray Data

Spray data was collected and entered into the database on a daily basis, though with some delays in some districts due to long distance between spray sites and data entry centers. SLs collected the data while TLs checked and verified data. Further checks were completed by MFPs and district IEC Officers. District DECs checked the completeness and accuracy of daily spray data variables before entering the data into the database. Weekly IRS Progress Reports were shared with the AIRS home office and PMI. At the end of each spray day, MFPs used the mobile system to submit daily performance reports to a central server managed by Dimagi LLC. The server subsequently submitted these reports to all AIRS Ethiopia supervisors, the AIRS Operations Director and the Technical Project Manager.

During the spray campaign, Dhedessa district reported structures as sprayed on September 13 and 14 while no spraying activities happened on the stated dates. This occurrence was reported to the M&E Manager by the DEC assigned to this district. An investigation was conducted from Oct 6 -12, 2015 to assess the status of spraying in the affected kebeles by the M&E team and they performed a data quality assessment based on the reported information from the database. A total of 1,024 structures from seven identified kebeles were visited. It was observed that most of the households visited had IRS identification cards.

Out of the 1,576 structures which were reported by the district as spayed on September 13 and 14, 2015, the teams were able to verify a total of 726 structures from the database by using the IRS identification number from the affected kebeles. The 298 structures that did not have IRS cards were confirmed as sprayed based on information from household owners and had "IRS/ 2015"marking on the door. Based on the data assessment, it was concluded that spraying was conducted in acceptable coverage in the affected kebeles, However, spraying was conducted on September 2-9 as indicated on the data forms presented for data entry so the AIRS Ethiopia project did not to pay the remaining days per diem (15-17 days) for the 10 supervisors involved (1 MFP, 2 TLs and 7 SQLs) and recommended to the Ilubabor zone management team to take administrative actions as per the government procedures.

All AIRS Ethiopia performance indicators are presented in an M&E Plan matrix in Annex E. Details of some key IRS indicators, such as number of structures sprayed, people protected, and insecticide-treated net availability and use, are provided in the following sections of the report.

8.6.1 Number of Structures Found, Sprayed, and Spray Coverage

A total of 708,258 structures were found by SOPs during the 2015 spray campaign across all the 36 districts. Of the structures found, 704,945 structures were sprayed, and an overall spray coverage of 99.5 percent was achieved. District-level data is presented in Table 14. In total, SOPs found 318,845 living/sleeping structures and sprayed 316,417 (99.2%) of them. Of the total structures sprayed, living/ sleeping structures represented 45% (n= 316,417) while the rest of the structures including kitchens, cowsheds and toilets constituted 55.5% (n= 388,358). Entomological data has confirmed high densities of resting *Anopheles* mosquitoes in cowsheds and toilets. Among the local communities, kitchens are occasionally used as sleeping quarters. Table 15 presents the spray data disaggregated by structure type.

8.6.2 Population Protected

A total of 1,655,997 people were protected through the project in 2015. This population includes 23,084 pregnant women and 230,366 children under five years of age. The vulnerable groups accounted for 15.3% of the total population protected through IRS.

TABLE 14. SUMMARY OF 2015 SPRAY RESULTS

Zone	District	Structures Found	Sprayed					Total Population	% Population Protected
			Structures Sprayed	Spray Coverage	Population Protected	Pregnant Women	Children <5		
East Wollega	**East Wollega**	**141,827**	**141,487**	**99.8**	**314,903**	**4,226**	**41,477**	**315,797**	**99.7**
	Boneya Boshe	12,190	12,141	99.6	20,800	253	2,850	20,937	99.3
	Dega	14,758	14,704	99.6	37,054	567	5,480	37,198	99.6
	Gida Ayana**	22,259	22,223	99.8	44,612	485	5,018	44,670	99.9
	Gobu Sayo	12,458	12,453	100.0	23,074	179	2,710	23,082	100.0
	Guto Gida	17,006	16,890	99.3	46,905	791	5,418	47,312	99.1
	Limmu	11,329	11,254	99.3	23,867	371	2,724	23,996	99.5
	Sasiga	19,027	19,023	100.0	42,926	590	6,273	42,935	100.0
	Wama Hagalo	16,840	16,840	100.0	41,070	629	6,673	41,070	100.0
	Wayu Tuka	15,960	15,959	100.0	34,595	361	4,331	34,597	100.0
Ilu Aba Bora	**ILU Aba Bora**	**81,882**	**81,729**	**99.8**	**173,316**	**4,490**	**29,013**	**173,860**	**99.7**
	Bedele	10,464	10,341	98.8	26,816	628	4,656	27,279	98.3
	Borecha	22,283	22,283	100.0	35,609	1,322	6,107	35,609	100.0
	Chewaka**	34,548	34,548	100.0	81,005	2,018	13,542	81,005	100.0
	Dedesa	14,587	14,557	99.8	29,886	522	4,708	29,967	99.7
Jimma	**Jimma**	**155,256**	**155,032**	**99.9**	**402,621**	**4,291**	**55,178**	**403,197**	**99.9**
	Kersa	29,435	29,401	99.9	77,259	759	10,683	77,328	99.9
	Omonada**	36,167	36,069	99.7	100,879	1,260	14,450	101,130	99.8
	Seka Chekorsa	24,312	24,312	100.0	55,083	744	7,693	55,083	100.0
	Sekoru	21,732	21,732	100.0	65,444	618	9,163	65,444	100.0
	Shabe Sombo	17,413	17,399	99.9	38,351	353	4,867	38,367	100.0
	Tiro Afeta**	26,197	26,119	99.7	65,605	557	8,322	65,845	99.6

Zone	District	Structures Found	Sprayed					Total Population Found	% Population Protected
			Structures	Spray Coverage (%)	Population Protected	Pregnant Women	Children <5		
Kellem Wollega	**Kellem Wollega**	**106,629**	**106,498**	**99.9**	**200,011**	**3,213**	**28,268**	**200,351**	**99.8**
	Dale Sadi	17,728	17,728	100.0	30,466	510	4,281	30,466	100.0
	Dale Wabara	21,665	21,665	100.0	36,938	636	5,008	36,938	100.0
	Hawa Galan**	38,626	38,607	100.0	74,816	1,614	12,706	74,854	99.9
	Lalo Kile	12,757	12,645	99.1	23,217	184	2,609	23,519	98.7
	Seyo	15,853	15,853	100.0	34,574	269	3,664	34,574	100.0
West Shewa	**West Shewa**	**86,478**	**84,958**	**98.2**	**213,130**	**2,357**	**27,948**	**217,669**	**97.9**
	Bako Tibe	19,593	19,471	99.4	45,972	616	5,589	46,419	99.0
	Danno	18,870	18,541	98.3	51,319	462	7,234	52,526	97.7
	Dendi	12,984	12,320	94.9	33,955	365	4,202	35,814	94.8
	Ilu Galan**	19,399	19,179	98.9	44,323	460	6,070	44,864	98.8
	Nonno	15,632	15,447	98.8	37,561	454	4,853	38,046	98.7
West Wollega	**West Wollega**	**136,186**	**135,241**	**99.3**	**352,016**	**4,507**	**48,482**	**354,941**	**99.2**
	Babo Gamebel**	18,343	18,270	99.6	47,643	354	6,406	47,806	99.7
	Begi	17,692	17,692	100.0	51,556	959	9,374	51,556	100.0
	Guliso	12,639	12,330	97.6	30,403	174	3,063	31,518	96.5
	Kiltu Kara	12,250	12,126	99.0	30,687	187	2,385	30,820	99.6
	Kondola**	19,233	19,233	100.0	63,462	1,754	13,706	63,462	100.0
	Manasibu	37,714	37,692	99.9	87,205	822	9,899	87,282	99.9
	Nejo Rural	18,315	17,898	97.7	41,060	257	3,649	42,497	96.6
Grand Total		**708,258**	**704,945**	**99.5**	**1,655,997**	**23,084**	**230,366**	**1,665,815**	**99.4**

** OP districts

TABLE 15. SUMMARY OF STRUCTURES FOUND AND SPRAYED BY TYPE AND COVERAGE

Zone	District	Sleeping/Living Structure			Kitchen		Animal Shed		Latrine		Other Structure			
		Found	Sprayed	% of Sleeping/ Living Structures Sprayed	Found	Sprayed	Found	Sprayed	Found	Sprayed	Found	Sprayed	Total found	Total sprayed
East Wollega	**East Wollega**	**61,968**	**61,705**	**99.6%**	**43,078**	**42,956**	**20,802**	**20,774**	**11,686**	**11,670**	**4,387**	**4,382**	**141,921**	**141,487**
	Boneya boshe	4,289	4,253	99.2%	2,084	2,078	5,318	5,309	276	276	225	225	12,192	12,141
	Dega	7,370	7,334	99.5%	6,023	6,003	924	923	216	216	230	228	14,763	14,704
	Gida Ayana	10,431	10,414	99.8%	7,791	7,776	1,633	1,624	2,284	2,280	130	129	22,269	22,223
	Gobu Sayo	4,355	4,352	99.9%	3,622	3,620	3,029	3,027	842	842	612	612	12,460	12,453
	Guto Gida	7,361	7,236	98.3%	5,729	5,685	1,098	1,096	2,836	2,825	48	48	17,072	16,890
	Limmu	5,557	5,514	99.2%	4,285	4,250	1,075	1,070	345	345	76	75	11,338	11,254
	Sasiga	9,038	9,035	100.0%	4,307	4,307	1,012	1,012	4,443	4,442	227	227	19,027	19,023
	Wama Hagalo	7,048	7,048	100.0%	4,818	4,818	3,335	3,335	163	163	1,476	1,476	16,840	16,840
	Wayu Tuka	6,519	6,519	100.0%	4,419	4,419	3,378	3,378	281	281	1,363	1,362	15,960	15,959
Ilu Aba Bora	**Ilu Aba Bora**	**33,847**	**33,720**	**99.6%**	**17,591**	**17,575**	**23,078**	**23,066**	**4,415**	**4,415**	**2,961**	**2,953**	**81,892**	**81,729**
	Bedele	6,017	5,907	98.2%	1,888	1,884	2,185	2,177	283	283	98	90	10,471	10,341
	Borecha	5,925	5,925	100.0%	5,352	5,352	5,926	5,926	3,253	3,253	1,827	1,827	22,283	22,283
	Chewaka	16,521	16,521	100.0%	7,339	7,339	9,640	9,640	845	845	203	203	34,548	34,548
	Dedesa	5,384	5,367	99.7%	3,012	3,000	5,327	5,323	34	34	833	833	14,590	14,557
Jimma	**Jimma**	**79,661**	**79,514**	**99.8%**	**34,656**	**34,595**	**30,266**	**30,245**	**1,026**	**1,026**	**9,671**	**9,652**	**155,280**	**155,032**
	Kersa	13,744	13,725	99.9%	8,262	8,245	6,610	6,610	285	285	536	536	29,437	29,401
	Omonada	18,047	17,990	99.7%	6,687	6,663	6,788	6,776	88	88	4,566	4,552	36,176	36,069
	Seka chekorsa	11,717	11,717	100.0%	6,501	6,501	4,232	4,232	259	259	1,603	1,603	24,312	24,312
	Sekoru	13,081	13,081	100.0%	3,997	3,997	3,803	3,803	20	20	831	831	21,732	21,732
	Shabe Sombo	8,969	8,964	99.9%	4,309	4,305	3,567	3,566	79	79	489	485	17,413	17,399
	Tiro Afeta	14,103	14,037	99.5%	4,900	4,884	5,266	5,258	295	295	1,646	1,645	26,210	26,119
Kellem Wollega	**Kellem Wollega**	**37,980**	**37,913**	**99.8%**	**28,343**	**28,302**	**23,424**	**23,399**	**14,591**	**14,589**	**2,296**	**2,295**	**106,634**	**106,498**
	Dale sadi	5,186	5,186	100.0%	3,920	3,920	4,275	4,275	4,038	4,038	309	309	17,728	17,728
	Dale wabara	7,385	7,385	100.0%	5,968	5,968	4,097	4,097	3,670	3,670	545	545	21,665	21,665
	Hawa Galan	14,607	14,597	99.9%	11,011	11,004	8,795	8,791	3,915	3,914	301	301	38,629	38,607
	Lalo Kile	4,560	4,503	98.8%	2,661	2,627	3,806	3,785	1,274	1,273	458	457	12,759	12,645

Zone	District	Sleeping/Living Structure			Kitchen		Animal Shed		Latrine		Other Structure			
		Found	Sprayed	% of Sleeping/ Living Structures Sprayed	Found	Sprayed	Found	Sprayed	Found	Sprayed	Found	Sprayed	Total found	Total sprayed
	Seyo	6,242	6,242	100.0%	4,783	4,783	2,451	2,451	1,694	1,694	683	683	15,853	15,853
West Shewa	**West Shewa**	**42,743**	**41,587**	**97.3%**	**22,208**	**21,966**	**16,627**	**16,446**	**2,037**	**2,022**	**2,961**	**2,937**	**86,576**	**84,958**
	Bako Tibe	9,220	9,114	98.9%	4,962	4,953	4,575	4,570	387	385	450	449	19,594	19,471
	Danno	10,210	9,895	96.9%	4,856	4,834	2,825	2,816	198	198	800	798	18,889	18,541
	Dendi	7,007	6,512	92.9%	2,994	2,892	2,740	2,630	51	50	241	236	13,033	12,320
	Ilu Galan	9,107	8,975	98.6%	4,693	4,639	4,373	4,336	189	189	1,053	1,040	19,415	19,179
	Nonno	7,199	7,091	98.5%	4,703	4,648	2,114	2,094	1,212	1,200	417	414	15,645	15,447
West Wollega	**West Wollega**	**62,646**	**61,978**	**98.9%**	**44,215**	**43,932**	**21,188**	**21,165**	**1,282**	**1,270**	**6,910**	**6,896**	**136,241**	**135,241**
	Babo Gamebel	8,208	8,158	99.4%	5,154	5,140	2,432	2,430	762	757	1,792	1,785	18,348	18,270
	Begi	8,602	8,602	100.0%	6,367	6,367	2,131	2,131	47	47	545	545	17,692	17,692
	Guliso	6,259	5,976	95.5%	3,968	3,927	2,031	2,025	37	37	367	365	12,662	12,330
	Kiltu Kara	5,796	5,761	99.4%	4,175	4,088	2,271	2,267	3	3	7	7	12,252	12,126
	Kondola	10,887	10,887	100.0%	3,934	3,934	3,149	3,149	32	32	1,231	1,231	19,233	19,233
	Manasibu	15,120	15,102	99.9%	14,681	14,673	6,292	6,291	17	17	1,609	1,609	37,719	37,692
	Nejo Rural	7,774	7,492	96.4%	5,936	5,803	2,882	2,872	384	377	1,359	1,354	18,335	17,898
Grand Total		**318,845**	**316,417**	**99.2%**	**190,091**	**189,326**	**135,385**	**135,095**	**35,037**	**34,992**	**29,186**	**29,115**	**708,544**	**704,945**

8.6.3 Availability and Use of Mosquito Nets

Across the 36 districts, households reported having a total of 485,648 mosquito nets at the time the SOP visited during the 2015 spray campaign. In total, 17,186 pregnant women were reported as having slept under a mosquito net the night prior to the SOP's visit. Additionally, 173,095 children under five years of age were reported as having slept under a mosquito net the previous night (Table 16).

TABLE 16. NUMBER AND USE OF MOSQUITO NETS

	District	Total # of Mosquito Nets Found	# of Pregnant Women Sleeping Under Mosquito Nets	# of Children <5 Sleeping Under Mosquito Nets
East Wollega	East Wollega	**30,973**	**1,458**	**14,781**
	Boneya Boshe	2,989	88	1,248
	Dega	55	17	84
	Gida Ayana	1,066	74	732
	Gobu Sayo	600	20	286
	Guto Gida	1,876	237	1,537
	Limmu	19	0	3
	Sasiga	9,641	438	4,567
	Wama Hagalo	14,501	583	6,322
	Wayu Tuka	226	1	2
IluAba Bora	Ilu Aba Bora	**55,219**	**3,926**	**25,270**
	Bedele	9,762	609	4,605
	Borecha	15,780	1,317	6,087
	Chewaka	22,275	1,658	11,486
	Dedesa	7,402	342	3,092
Jimma	Jimma	**145,525**	**3,583**	**48,551**
	Kersa	22,203	559	8,444
	Omonada	35,274	1,015	12,584
	Seka Chekorsa	22,868	710	7,520
	Sekoru	28,712	579	8,580
	Shabe Sombo	14,754	281	4,346
	Tiro Afeta	21,714	439	7,077
Kellem Wollega	Kellem Wollega	**78,807**	**2,822**	**24,970**
	Dale Sadi	13,637	510	4,274
	Dale Wabara	13,596	537	4,267
	Hawa Galan	33,742	1,423	11,520
	Lalo Kile	8,910	157	2,235
	Seyo	8,922	195	2,674
West Shewa	West Shewa	**45,262**	**1,531**	**18,030**
	Bako Tibe	8,005	374	2,733

Zone	District	Total # of Mosquito Nets Found	# of Pregnant Women Sleeping Under Mosquito Nets	# of Children <5 Sleeping Under Mosquito Nets
	Danno	4,762	211	3,366
	Dendi	14,679	344	4,076
	Ilu Galan	14,172	370	5,225
	Nonno	3,644	232	2,630
West Wollega	West Wollega	**129,862**	**3,866**	**41,493**
	Babo Gamebel	8,844	117	2,541
	Begi	23,810	959	9,373
	Guliso	13,280	113	2,079
	Kiltu Kara	12,263	182	2,259
	Kondola	16,060	1,548	12,569
	Manasibu	37,970	721	9,309
	Nejo Rural	17,635	226	3,363
Grand Total		**485,648**	**17,186**	**173,095**

8.6.4 Insecticide Consumption and SOP Performance Indicators

During the 2015 spray campaign the project used Bendiocarb 80 WP (carbamate) in 28 districts and Actellic 300 CS (pirimiphos methyl, an organophosphate) in eight districts. A total of 240,161 sachets of bendiocarb and 80,836 bottles of Actellic were consumed. SOPs sprayed 2.1 and 2.7 unit structures with one unit of insecticide (sachet/bottle), respectively. No missing insecticides were reported and all empty sachets/bottles were transported from the districts to Addis Ababa for incineration and recycling. Table 17 provides detailed insecticide usage and SOP performance per district.

TABLE 17. INSECTICIDE USE AND SPRAY OPERATOR PERFORMANCE

Zone	District	SOP Performance	Insecticide used		Sachet Use and Distribution	
		Average # of Unit Structures per SOP per Day	Bendiocarb in Sachets	Actellic in Bottles	Average # of Sachets/Bottles per SOP per Day	Average # of Structures Sprayed per Sachet/Bottle
East Wollega	**East Wollega**	**17.7**	**55,834**	**8,173**	**8.0**	**2.2**
	Boneya boshe	17.4	6,062		8.7	2.0
	Dega	19.6	6,706		8.9	2.2
	Gida Ayana	17.1		8,173	6.3	2.7
	Gobu Sayo	16.9	5,852		8.0	2.1
	Guto Gida	21.8	7,092		9.2	2.4
	Limmu	16.2	5,286		7.6	2.1
	Sasiga	19.7	8,032		8.3	2.4
	Wama Hagalo	15.6	9,103		8.4	1.8
	Wayu Tuka	15.9	7,701		7.7	2.1

Zone	District	SOP Performance	Insecticide used		Sachet Use and Distribution	
		Average # of Unit Structures per SOP per Day	Bendiocarb in Sachets	Actellic in Bottles	Average # of Sachets/Bottles per SOP per Day	Average # of Structures Sprayed per Sachet/Bottle
Ilu Aba Bora	**Ilu Aba Bora**	**18.0**	**23,641**	**12,900**	**8.1**	**2.2**
	Bedele	18.0	5,400		9.4	1.9
	Borecha	19.3	11,280		9.8	2.0
	Chewaka	17.5		12,900	6.5	2.7
	Dedesa	17.4	6,961		8.3	2.1
Jimma	**Jimma**	**17.7**	**49,379**	**24,470**	**8.4**	**2.1**
	Kersa	16.5	16,417		9.2	1.8
	Omonada	18.5		14,353	7.4	2.5
	Seka Chekorsa	19.1	12,600		9.9	1.9
	Sekoru	18.0	11,353		9.4	1.9
	Shabe Sombo	18.2	9,009		9.4	1.9
	Tiro Afeta	16.4		10,117	6.4	2.6
Kellem Wollega	**Kellem Wollega**	**18.3**	**31,350**	**13,801**	**7.8**	**2.4**
	Dale Sadi	19.1	7,925		8.5	2.2
	Dale Wabara	20.6	10,641		10.1	2.0
	Hawa Galan	18.6		13,801	6.7	2.8
	Lalo Kile	15.7	5,368		6.7	2.4
	Seyo	16.7	7,416		7.8	2.1
West Shewa	**West Shewa**	**15.6**	**33,777**	**7,995**	**7.7**	**2.0**
	Bako Tibe	16.5	9,153		7.7	2.1
	Danno	15.5	10,452		8.8	1.8
	Dendi	14.7	6,289		7.5	2.0
	Ilu Galan	14.6		7,995	6.1	2.4
	Nonno	16.7	7,883		8.5	2.0
West Wollega	**West Wollega**	**17.0**	**46,180**	**13,497**	**7.5**	**2.3**
	Babo Gamebel	17.2		6,471	6.1	2.8
	Begi	16.4	8,189		7.6	2.2
	Guliso	15.1	5,850		7.2	2.1
	Kiltu Kara	18.1	6,089		9.1	2.0
	Kondola	16.9		7,026	6.2	2.7
	Manasibu	18.2	18,084		8.7	2.1
	Nejo Rural	15.9	7,968		7.1	2.2
Grand Total		**17.4**	**240,161**	**80,836**	**8.4/6.5**	**2.1/2.7**

9. CAPACITY BUILDING AND SUPPORT TO FMOH

9.1 FMOH CAPACITY BUILDING

Based on the Capacity-Building Action Plan developed by AIRS Ethiopia jointly with the National Malaria Control Program (NMCP) and PMI, and subsequent to activities accomplished in 2014, training was conducted in environmental compliance and basic entomology and vector control.

The capacity building initiative was aimed at enhancing competency of MOH staff in safe implementation of IRS in the country and adherence to environmental compliance procedures and entomological techniques. A total of 34 and 35 staff attended the training on entomology and EC, respectively.

AIRS Ethiopia was scheduled to establish a resource center and provide the NMCP with a computer to store all PMI AIRS tools and materials electronically. This activity did not occur as planned because AIRS could not identify someone at NMCP to facilitate the creation of the resource center.

Entomological Monitoring

The entomology training was held in Adama (March 23 – 26) with participants coming from 10 regions and covered the following topics:

- Malaria entomology and malaria transmission
- Identification of malaria vectors
- Malaria vector sampling methods
- Vector incrimination and malaria control
- WHO tube bioassay
- Bottle bioassay
- Cone wall bioassay
- Integrated Vector Management (IVM)

An AIRS project wide entomological training was held in Adama (July 6 – 10, 2015) for AIRS entomology staff and MOH staff from 8 PMI AIRS countries including Ethiopia. One staff member from the NMCP attended the training.

Support to Jimma and Mekelle Universities,

AIRS Ethiopia provided support to Jimma University and Mekelle University in the form of consumables and equipment to enhance their capacity for conducting entomological monitoring and laboratory assays. In addition, entomologists from each of the universities were used to conduct insecticide monitoring and susceptibility studies for the project.

Environmental Compliance

The national environmental compliance training conducted from April 1–3 in Adama had 35 participants drawn from 10 regions of the country. The training focused on the following key areas:

- Introduction to IRS and environmental compliance
- Worker and resident health and safety and use of PPE
- Pesticides transport and storage
- Spraying techniques
- IRS waste disposal
- Spill response
- Warehouse management and insecticide tracking
- Supervision and monitoring in IRS
- Design and construction of soak pits
- Insecticide resistance management

Spray operations training conducted by AIRS Ethiopia as part of TOT in 2015 enhanced the capacity of 255 MOH staff in IRS planning and implementation. The trained TOTs in turn facilitated the training spray operators and other actors at the district level.

IRS implementation was also conducted in close collaboration with the ORHB, zonal and district health offices to promote sustainability. The districts MFPs staff managed the entire IRS program with the support of AIRS Ethiopia supervisors deployed to the districts/zones. Supervision of IRS operations was conducted in collaboration with ORHB and zonal and district MFPs using standard tools/checklists developed by AIRS.

9.2 Disposal of Obsolete DDT

In 2015, AIRS Ethiopia was tasked with providing support to the FMOH with the disposal of some 85,000 kg of obsolete DDT and contaminated waste present in 47 stores within zones and districts in PMI supported districts. In order to accomplish these activities the following have been accomplished:

- Veolia ES Field Services has been contracted to support the repacking, export and disposal of the DDT.
- Mabbett & Associates Inc. has been contracted to support training for DDT and DDT waste removal.
- Persons to serve as focal points for Ethiopia at the Ministry of Health and Ministry of Environment & Forests have been appointed.
- Documents submitted to Polish competent authorities for approval for DDT disposal.
- Training of 40 technicians, 47 supervisors, 5 AIRS staff and representatives from the Ministry of Agriculture (1), Ministry of Environment and Forests (2) and FMOH (1) conducted in Adama from October 5 – 9. The training on safety protocols for removal of hazardous material was conducted by 4 staff from Mabbett, 1 staff from Veolia and the AIRS Director of Environmental Compliance and Safety.

Subsequent to the training, repacking of DDT and waste at the various stores was completed and the wastes are currently housed in the AIRS warehouse located in Addis Ababa awaiting transport to Poland for incineration.

10. Challenges, Lessons Learned and Recommendations

10.1 Challenges

The main challenges experienced during the IRS campaigns included:

- Storage space at the district and health posts was limited especially for Actellic sprayed districts. .
- Since there was an increase in the number of female SOPs, there were not enough right size gumboots for them. AIRS will make sure there is adequate number next spray campaign.
- Network connectivity was intermittent in several districts leading to delays in data reporting.
- The lack of door to door mobilization led to unpreparedness of households for spraying on spray days.
- Loss of IRS cards by households was reported and this led to printing new cards hence increasing cost.
- Competing priorities took government staff away from IRS hence impacting training, supervision and spray quality. It was observed that there was a wide variation in the competence of district and zonal government staff.
- Some SOPs did not pay critical attention to spray protocol thus leading to poor spray quality. This is a cause for concern and will be the main focus during the next spray campaign.

10.2 Lessons Learned and Recommendations

- Recruitment of MOH staff that serve as supervisors on IRS by the District Health Office should consider their availability and commitment to the activity.
- Careful planning of activities by ORHB, zonal and districts should be done by incorporating IRS in annual work plans for proper coordination so as to reduce interference with IRS training and supervision.
- Recruit supervisors from lower levels of the district's MOH structure (e.g. health centers) to minimize supervisor absenteeism.
- Zonal and district MFPs should share and discuss IRS progress and challenges on a regular basis with zonal/district heads to enhance their participation and support for IRS.
- Enhance mobilization by embedding HEWs as mobilizers on IRS teams to ensure better community readiness and participation in IRS.
- Recruit a part-time IEC coordinator to manage IEC activities and coordinate with the districts.
- Recruitment of SOPs to focus mainly on IRS experience so as to reduce the number of new SOPs to a minimum.
- Conduct comprehensive training for MOH staff and AIRS staff (all supervisors) involved in IRS implementation and SOPs on IRS techniques to enhance their skills with sufficient time allocated for

practical sessions.

- Train a cadre of master trainers (10 – 15) including AIRS staff to run IRS training at TOT sessions.
- Recruit one pump technician per district to take charge of major pump maintenance and support weekly pump calibration.
- Recruit 5 part time Spray Operations Coordinators to cover at least 5 districts to support district MFPs on training and supervision coordination.

Annex F provides a detailed description of actions to be undertaken in 2016 aimed at improving IRS training; spray quality, supervision and mobilization.

ANNEX A:
2015 IRS PROCUREMENT

TABLE A-1. PPE AND OTHER SUPPLIES PROCURED

Items	36 Districts (28 DB IRS & 8 CB IRS)	24 Graduated Districts	Non-PMI Districts
International Procurement			
Actellic 300CS (833ml Bottles)	87,372		
Cermaic Nozzle Tips	2,200		
Washers for CFV	550		
Control Flow valves (CFV)	550		
Gumboots / Pair	804		
Rubber Gloves / Pair	10,600	6,376	
Mouth /nose masks (box of 120)	30,400	44,600	
Local Procurement			
Water tanker 2000 Lit capaciy	13		
Apron / waterpruf / Pcs	40		
Coveralls / Pcs	500	500	1,000
Toolkit Bag / Pcs	20		
Padlock / Pcs	60		
Canvas Tent 8 Main Size	100		
Warning Sign / Store	7		
Warning Sign/Soak	20		
Chalk (Box of 50)	149		
Female size boots / Pair	118		
Soap toilet /Pcs	65,600		
Soap laundry	5,885		
Drycell Battery / Pair/	2,837		
Flashlight / Tourch / Pcs	1,518		
Candle / box of 8	1,130		
Washer for CFV / Pcs	200		
IRS card / PCS	175,620		

ANNEX B: INSPECTION REPORTS AND SUPERVISION RESULTS

2015 MID- AND POST-SPRAY INSPECTION REPORTS

INTRODUCTION

The Africa Indoor Residual Spraying (AIRS) Ethiopia project conducted 2015 spray operations from July 21to August 25 for OP districts (8 districts) and from August 11 to September 16, 2015 for (28 districts) PMI-supported districts. The project used two models of IRS to deliver the service to the 36 project districts: district-based IRS (DB IRS) and community-based IRS (CB IRS) delivered through the national health extension program.

The entire AIRS Ethiopia technical team, including Spray Operations Coordinator, Operations Manager, M&E Manager, and M&E coordinator, was involved in environmental compliance inspections. The team members divided five zones and 36 project districts among themselves to conduct supervision and pre-, mid-, and post-spray inspection of the spray campaign to all districts.

During the supervision and environmental inspection visits, the team used AIRS project-wide checklists to observe soak pits, bathrooms, insecticide storage conditions, community involvement, house preparation, IEC, and performance of SOPs. District Malaria Focal Persons and Zonal Malaria Focal Persons were actively involved as supervisors on behalf of district health offices using checklists installed on smart phones. The regional level experts have also been able to do supervision and came up with valuable recommendations that can help improve the quality of IRS operation for the future. At the end of each inspection, district health teams supervising IRS held a general discussion on the status, achievements, shortcomings, and constraints and then forwarded the recommendations to district offices for corrective actions to be taken.

OBJECTIVES OF INSPECTIONS

The objective of conducting mid- and post-spray environmental compliance activities during the 2015 IRS operation in Ethiopia was to:

- Ascertain the level to which the Ethiopian IRS operation is compliant with USAID's Pesticide Procedures specified in Federal Regulations 22CFR216, the Ethiopia IRS PERSUAP/SEA, and the IRS guidelines;
- Work with the district, zonal, and regional health offices and Federal Ministry of Health to observe progress of IRS activities, and determine and document whether the recommendations and procedures established during the previous inspections are being followed;
- Assess the logistics systems to ensure that adequate supplies exist and that processes to prevent pilferage ("leakage")/misuse of insecticides outside of the AIRS spray campaign are in place;
- Ensure that the safe use of the insecticide, including handling of the chemicals, safe distribution, and

other safety procedures are maintained;

- Evaluate stock and inventory management system in the district stores; and
- Observe SOPs' compliance with best IRS management practices in project spray sites.

GENERAL OBSERVATION

Overall in DB IRS, the 61 soak pit sites with cement wash areas and standard fences, most of which are enclosed by chicken-wire fencing, were refurbished before the spray. In six CB IRS districts, the team prepared 107 small, community-sized soak pits and replenished 13 larger soak pits that the project used before in each sprayed village. All project-supported districts have proper stores in which to keep insecticides and other IRS materials. Insecticide-contaminated wastes such as empty sachets, used masks, torn gloves, and contaminated boxes have been collected and are being stored in the same stores. All empty sachets and used masks have been collected and placed in the central store near Addis Ababa, and incineration has started. Facilitation of items intended for recycling like OP bottles and Cartons is progressing well.

MID-INSPECTION OBSERVATIONS

Most districts properly followed procedures established for tracking the insecticide usage. The storekeepers have numbered all sachets and distributed them to each spray team by serial number.

- All districts had good and working soak pits in all the sites.
- All district stores had appropriate shelves and racks on which the stock is neatly stored and easy to manage.
- The insecticide and other IRS materials were properly kept in separate rooms to prevent insecticide contamination.
- The majority of home owners removed their belongings, including food items from the houses before spraying.
- The AIRS team provided all districts with plastic sheets to cover household items that were kept inside during spraying.

AREAS FOR IMPROVEMENT

INSECTICIDE TRACKING

The follow up of insecticide consumption especially bendiocarb was a serious point of attention in the 2015 IRS operation. The reason for this major follow up emanated from the fact that the stock dispatched from the central warehouse had an expiration date of July 2016. Therefore, it was important for the project to ensure that there was no leftover bendiocarb of the 2016 batch.

The project has attempted different mechanisms beginning from the central level up to the district stores. An anticipated excess stock (about 50,000 sachets) at the central warehouse was sent to West Arsi Zone, which comprises some of the graduated districts. Some 19,920 sachets were exchanged for with a 2017 batch by ORHB. To ensure the consumption of the stock that our project sent to West Arsi Zone, the project is following the spraying progress in the zone and assisting the reallocation to sites experiencing deficit.

AIRS Ethiopia supervisors coordinated reallocation of the stock from one district to another in PMI-supported districts leading to use of the entire 2016 batch.

POST-SPRAY ACTIVITIES AND INSPECTIONS

All contaminated IRS wastes (empty sachets, empty bottles, cartons and used masks) from districts were collected and returned to the central warehouse.

- All PPE including coveralls were properly washed and stored in the district stores.
- Spray pumps were cleaned and stored.
- AIRS team completed stock preliminary inventory in all districts.
- All unused insecticide is stored safely in the district stores.
- Soak pits are cleaned, covered by a plastic sheet and locked.
- Polyethylene sheets used as ground cover on soak pit sites were washed and stored in district stores.
- Plastic sheets were properly collected from SOPs, washed and stored properly.

Recommendations

- District stores should be regularly cleaned and maintained in the off season.
- Temperature recording in insecticide stores by district storekeepers should be continued during the off season.

TABLE B-1. SUMMARY OF INSPECTIONS AND MITIGATION MEASURES IN THE 2015 SPRAY CAMPAIGN

Mitigation Measure	Status of Mitigation Measures	Remarks
1a. Pre-contract inspection and certification of vehicles used for pesticide or spray team transport.	Pre-contract inspection and certification of vehicles was conducted between June 1 and August 9. All vehicles that were contracted met all criteria before they were engaged. A total of 111 vehicles were inspected: when inspected, one driver had an expired license; two drivers hadn't attended training; five vehicles did not have fully stocked first aid kits.	Vehicles and drivers that did not meet inspection standards were not contracted and replacements were found. Driver orientation was provided for cases where the driver was not trained. First aid kits were replenished.
1b. Driver training	All 105 project and rented vehicle drivers were trained in Addis Ababa before dispatched to field. Topics included safety measures for transporting insecticides and safe driving techniques. During the spray campaign, 161 transportation vehicle inspections were conducted and on 2 occasions, the driver provided had not been trained.	The 2 drivers were given orientation by the MFP at the district level.
1c. Cell phone, personal protective equipment (PPE) and spill kits on board during pesticide transportation	All drivers had cell phones as a pre-requisite before their vehicles were rented. Also, drivers were given a set of PPE to use when transporting insecticides and/ or spray team members. Each vehicle used for the transport of pesticides was equipped with a spill kit. A total of 161 morning mobilization vehicle inspections were conducted throughout the 2015 spray campaign. On 156 occasions, the vehicle had all required PPE and spill kits. On 6 occasions, the vehicle did not have all required PPE and spill kits.	Corrective action was taken before the vehicles left for the field to ensure they had required PPE and spill kits.
1d. Initial and 30-day pregnancy testing for female candidates for jobs with potential pesticide contact	Before recruitment, initial pregnancy tests were conducted on all female candidates applying for positions as SOPs, Porters, Squad Leaders, Washers, Team Leaders/Supervisors, Storekeepers and Store Assistants.	In future spray rounds, medical tests will be conducted for all spray operators, including males.
1e. Health fitness testing for all operators	A pre-spray general physical/ medical examination required for spray personnel was not conducted as this is not the practice in IRS in Ethiopia. Only female spray actors took a pregnancy test and all were declared fit to participate in IRS.	A fitness test will be conducted for males before the start of the 2016 campaign since it is standard AIRS policy.
1f. Procurement of, distribution to, and training on the use of PPE for all workers with potential pesticide contact.	Both international and local procurements for PPE were done on time. The PPE were received and distributed to all operational sites on time before the start of the spray campaign. Also, all candidates with potential pesticides contact were fully trained on correct PPE use.	

1g. Training on mixing pesticides and the proper use and maintenance of spray pumps.	At both TOT and district-level SOP trainings, the trainers demonstrated the proper mixing of pesticides, including triple rinse of the Actellic 300 CS bottles. The trainings also demonstrated the proper use and maintenance of spray pumps. A total of 255 health personnel from the 36 IRS target districts and zones were trained.	
1h. Provision of adequate facilities and supplies for end-of-day cleanup,	Each operational site had an adequate storage facility. All facilities were compliant, and had the materials required for clean-up. A total of 173 End of Day inspections were conducted. 4 of the 173 inspections indicated inadequate wash facility and supplies.	Immediate corrective actions were taken to ensure that the wash facility & supplies met the standards.
1i. Enforce clean-up procedures.	All clean-up procedures were inspected as scheduled. Pump clean-up procedures were done in the soak pits as required and supervised by the AIRS, Zonal and District supervisors every day throughout the spray campaign. Washing or bathing were supervised by Team Leaders and Malaria Focal Persons. The ECO and AIRS Technical Personnel supervised clean-up procedures when present at any operational site. 173 end-of-day inspections were conducted. 107 of them reported compliant procedures and 66 reported non-compliant procedures.	All non-compliant procedures were minor and they were immediately corrected on the spot.
2a. IEC campaigns to inform homeowners of responsibilities and precautions.	Homeowners were informed about their roles, responsibilities, and precautions mainly through community outreach approaches. An IEC focal point in each district was engaged to coordinate all mobilization activities through the kebele administration and other channels. The district organized advocacy and communication meetings using kebele meetings, churches and also engaged HEWs as mobilizers to conduct the communication campaign. In some villages, the HEWs were not actively involved in the mobilization activity.	Due to some gaps in mobilization, AIRS Ethiopia will include mobilizers on IRS teams in the next spray round.
2b. Prohibition of spraying houses that are not properly prepared	All homeowners, SOPs, and Squad Leaders were trained on how to prepare structures before spraying is done. Out of 367 homeowners preparation inspections carried out, 259 indicated that homeowners and SOPs were compliant. However,108 of the inspections showed some form of non-compliant issues.	In all non-compliant cases, actions were taken to address the situation including covering immovable materials such as huge sacks of grain with plastic sheets.
2c. Two-hour exclusion from house after spraying	SOPs reminded households to wait two hours after spraying before they open the rooms to allow circulation of air for at least 30 minutes before cleaning. Of the 367 homeowner preparation inspections carried out, in only one instance did the homeowner indicate not being informed of the 2-hour exclusion requirement.	This will be addressed through future mobilization and SOP training for action on key messages.
2d. Instruct homeowners to wash itchy skin and go to health clinic if symptoms do	Homeowners were instructed to wash with plenty of water and soap if any household member experienced itching skin, and to visit the nearest clinic if itching persisted. In 11 instances out of the 367 homeowner preparation	This will be stressed during training next year.

not subside	inspections carried out, the homeowner indicated not being informed of this exposure protocol.	
3a. Indoor spraying only	SOPs sprayed indoor walls of living structures. This included inner walls, ceiling, and eaves of all sleeping rooms. During the 367 homeowner preparation inspections, there were 3 instances where an SOP was found not to be in compliance with this stipulation by spraying large areas around eaves, doors and windows.	In these 3 instances, the SOP was immediately corrected and instructed to only spray windows, doors and eaves as per the protocol.
3b. Training on proper spray technique	All SOPs, Squad Leaders and Team Leaders were trained on standard spray techniques. This included emphasizing 1meter distance away from the "sprayable" surface, keeping the nozzle tip 45cm from the "sprayable" surface, and spraying at the correct speed. There was constant supervision in the field to ensure that SOPs adhere to all BMPs. In 13 of the 367 homeowner preparation inspections, SOPs were found to be using the wrong spray technique.	In each of these instances, the appropriate corrective action (SOP redirected on correct spray technique) was immediately taken. This area has been flagged and will be seriously monitored next spray campaign.
3c. Maintenance of pumps	SOPs, Supervisors, and Team Leaders were trained in pump maintenance. Pumps were checked daily before use. Parts of pumps that were found to be faulty were replaced. On 53 occasions, pumps were found to be leaking.	Repairs were immediately undertaken to fix the pumps and training of pump technicians will be done in future spray rounds.
4a. Choose sites for disposal of liquid wastes according to PMI BMPs	181 district- and community-based soak pits were inspected twice before spray operations started. All operational sites were inspected to ensure that they meet BMP standards before they were certified for use.	
4b. Construct soak pits with charcoal to adsorb pesticide from rinse water.	All soak pits were constructed with five layers of sawdust, charcoal, bigger stones, smaller stones, and gravel as the top layer. They were slopped toward the bio bed.	
4c. Maintain soak pits as necessary during season	Two soak pits were reported to require maintanance out of the 173 soak pit inspections carried out.	The maintenance was performed as soon as possible.
4d. Inspection and certification of solid waste disposal sites before spray campaign	All solid waste generated, including empty sachets and used masks, has been collected for management at the central level. The waste will be disposed of using two incinerators for the incineration of empty sachets and masks within two months. Recycling of the empty Actellic bottles and empty cartons is ongoing at the selected recycling facility.	

4e. Monitoring waste storage and management during campaign.	Wastes were stored and managed according to PMI BMPs during the spray campaign. There were clearly labeled sacks/ boxes for keeping used nose masks, hand gloves, and all other waste that was generated.	
4f. Monitoring disposal procedures post-campaign	The AIRS Ethiopia ECO will monitor the post-spray campaign solid waste disposal including used masks, empty sachets and bottles at the selected facilities.	
5a. Maintain records of all pesticide receipts, issuance, and return of empty sachets/bottles	Records of all pesticide receipts, issuance, and returned empties were kept on stock cards with a backup in a ledger.	
5b. Reconciliation of number of houses sprayed vs. number of sachets/bottles used	District Malaria Focal Persons, Zonal Supervisors and AIRS team closely moitored the insecticide used per structure by using performance tracking sheet and insecticide tracking tools.	
5c. Visual examination of houses sprayed to confirm pesticide application	Regional delegates, PMI, Team leaders, District Malaria Focal persons, Zonal Supervisors and AIRS team inspected sprayed structures to ensure that they met BMP standards during and after spray.	
5d. Perform physical inventory counts during the spray season.	ECO, Store Assistants, Operations Manager, and COP performed regular inventory counts throughout the spray campaign. 140 store checks were conducted during the spray campaign.	

ANNEX C: REPORT ON 2015 POST IRS EVALUATION MEETING

The project organized a post-spray meeting to evaluate the implementation of the 2015 IRS campaign and document lessons learned from the process. The meeting was held in Ambo (West Showa Zone) on October 1 - 2, 2015. The participants were malaria focal persons (MFPs) and district health office heads from the 36 project districts, zonal MFPs, zonal health office heads from the six project zonal health offices, representatives from the Oromia Regional Health Bureau (ORHB) and NMCP, Senior Malaria Advisor - PMI Ethiopia, and AIRS Ethiopia office staff. A total of 92 participants attended the review meeting.

TABLE C-1: 2015 POST IRS EVALUATION MEETING PARTICIPANTS

	Areas	Professional category	Sex			Remarks
			M	F	Total	
1	Project districts	MFP	33	3	36	
		Health office head/deputy	32	2	34	2 absents
2	Project zones	MFP	5	0	5	1 absent
		Health office head/Deputy	5	0	5	1 absent
3	ORHB	Malaria expert & Gender expert	1	1	2	
4	FMOH	NMCP Senior expert	1	0	1	
5	PMI/USAID	PMI Senior Malaria Advisor	1	0	1	
6	AIRS staff	Technical staff	7	1	8	
	Total		85	7	92	

Main agenda items were as follows:

- Opening Remarks by AIRS COP, PMI, NMCP, and ORHB representatives;
- Presentations on project implementation and current malaria situation by five zonal MFPs, one zonal health vice head and one OP district health office;
- Presentation on technical components of IRS (Spray Operations, EC, Entomology, Logistics, M&E, Finance and Administration) by AIRS staff; and discussion of each item.
- Group works & presentations on IRS Training, Recruitment of SOPs, IRS Spray quality, IRS supervision, Environmental compliance/Store management, Advocacy/Community Mobilization and experiences with use of Actellic.

The presentation and discussions indicate that:

- The operation was successful with high coverage achieved.
- The regional, zonal, and district health offices greatly appreciated PMI/USAID support for the

program.

- Supervision was not fully effective due to competing activities and lack of commitment by some supervisors.
- The project helped strengthen the capacity of the health offices to undertake high-quality spray operations and environmental compliance activities.
- Payment system through the Commercial Bank of Ethiopia ran smoothly and the meeting appreciated this approach.

Challenges and lessons learned:

- Spray quality issues with regard to maintaining correct nozzle distance from wall surface, speed and rhythm was observed during the supportive supervision and raised as a challenge and needs attention during group work and discussion.
- Pump maintenance and use of checking that only recommended nozzle type (8002E) was used for IRS was discussed.
- Daily reporting and submission of daily spray data timely as per data flow protocol has to be adhered to and the meeting called on MFPs and supervisors to keep clear of dishonesty in data reporting as witnessed in Dedessa District.
- Poor network connectivity leading to travelling of DECs to distant locations was noted as a challenge to smooth data entry.
- Despite the project collecting boot sizes from SOPs and supplying sufficient numbers, some spray actors could not get their size. In such cases spray actors were asked to buy their own boots and this practice is expected to continue.
- The project may have to introduce a permanent numbering mechanism or print more IRS cards every year to avoid the shortage due to the poor IRS card retention rate by households.

ANNEX D: DATA COLLECTION AND QUALITY ASSURANCE TOOLS

TABLE D-1. ETHIOPA IRS 2015 DATA COLLECTION TOOLS

Data Collection Tool	Usage
Training Participants Registration Form	Used by lead trainer at training workshops to capture category and number of people trained disaggregated by male and female.
Daily Spray Operator Form	Used by squad leaders (SLs) during spray operations to capture structures found, structures sprayed and unsprayed, population protected and unprotected, mosquito net and insectcide information. This tool also captures geography, spray actors' names and codes, household names, IRS numbers, structures type, etc.
Daily Squad Leader Summary Form	Used by SLs to summarize the daily data from each Daily Spray Operator Form for which they are responsible.
Daily Team Leader Summary Form	Used by team leaders (TLs) to summarize the daily data from each SL for which they are responsible. This tool is used to manage squad performance on a daily basis.
Dailiy District Malaria Focal Person Summary Form	Used by district MFP during spray operations to summarize the daily data from each TL whom they supervise. This tool is mainly used to manage team performance on a daily basis.

TABLE D-2. DATA QUALITY ASSURANCE TOOLS

Data Quality Assurance Tool	Purpose and Usage
Error Eliminator (EE) Form	Purpose: • To check the completeness and correctness of data collected in the field. • To highlight common data collection errors so they can be quickly identified with corrections being made and retraining provided by the supervisor. Used in the field post-data collection by: • TLs on daily basis to check 50% of the forms filled by the spray operators (SOPs) under their supervision. • Information, education and communication (IEC) supervisor each day to check 37.5% of the forms filled by SOPs under his/her supervision. • District MFP each day checks 12.5% of the forms filled by SOPs under his/her supervision.

Data Quality Assurance Tool	Purpose and Usage
Data Collection Verification (DCV) Form	Purpose: • To check the accuracy of data collected in the field, i.e., ensure that the data written on the Daily Spray Operator Forms match the information reported by households and/or the data recorded on the IRS Cards disseminated to households. Used during field audits by: • AIRS M&E and Database Managers • AIRS Operations Manager • AIRS Spray Operations Coordinator • Zonal District MFPs • District Heads and Deputies • District Environmental Compliance Experts
Data Entry Site Supervision Checklist	Purpose: • To check the application of data entry and documentation protocols and provide on-the-spot support to data entry clerks (DECs) Used during visits to data entry centers by: • M&E Manager • Database Manager • IT Specialist

TABLE D-3. DATA QUALITY ASSURANCE AND CONTROL

Quality Assurance/ Quality Control Issue	Method/Tools for Quality Assurance
Spray data integrity	• Used standardized data collection forms • Comprehensive training for spray data capture and protocols • Multiple levels of supervision • SOPs are supervised directly by their SL and TL. ▪ Supervisors monitor TLs and verify Daily Spray Operator Forms. ▪ TLs, and IEC and EC experts monitor and verify data capture by SLs. ▪ District MFL verifies and run random spot checks on data collection. • Use of EE and DCV forms to ensure complete and accurate data collection
Spray data entry and management	• Data entry training for all DECs and spray supervisors • Prompt field data entry and transfer; data collection forms arrive at data entry sites daily and data entry is done on a daily basis • Data verification via double-data entry system ▪ Initial data entry of totals per data collection form ▪ Follow-up entry of detailed data, i.e., per individual household • Use of Microsoft Access-based IRS Cleaning/Reporting tool to clean data on a daily basis • Database designed with locks and validation checks
Data security	• Paper data collection forms stored systematically in binders and filed at district level for permanent reference • Database designed with passwords to restrict unauthorized entry • Databases backed up daily on the data entry server laptop, on Sugar Sync, and on external pen drives every day

TABLE D-4. HUMAN RESOURCES HIRED BY DISTRICT AND TYPE FOR THE 2015 SPRAY ROUND

District	Team leaders			Squad leaders			Spray operators			Porters			Washers			Security guards			Water fetchers			Store assistants			Data entry clerks			Drivers		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
Diga	1	0	1	5	1	6	22	3	25	0	6	6	0	2	2	1	0	1	1	0	1	1	0	1	1	0	1	2	0	2
Sasiga	CB IRS			0	16	16	36	0	36	0	9	9	0	0	0	10	0	10	0	0	0	1	0	1	0	1	1	1	0	1
Gida Ayana	2	0	2	4	6	10	32	10	42	11	9	20	0	3	3	2	0	2	2	0	2	1	0	1	1	0	1	4	0	4
Boneya Boshe	1	1	2	6	0	6	24	0	24	0	6	6	0	2	2	2	0	2	2	0	2	1	0	1	1	0	1	2	0	2
Wama Hagalo	2	0	2	9	0	9	36	0	36	0	9	9	0	2	2	2	0	2	2	0	2	0	1	1	1	0	1	3	0	3
Guto Gida	2	0	2	6	1	7	28	0	28	0	7	7	0	2	2	2	0	2	2	0	2	1	0	1	1	0	1	3	0	3
Gobu Sayo	2	0	2	6	0	6	24	0	24	1	5	6	1	1	2	2	0	2	2	0	2	1	0	1	1	0	1	2	0	2
Limu	2	0	2	6	0	6	20	4	24	0	6	6	0	2	2	2	0	2	2	0	2	1	0	1	1	0	1	3	0	3
Wayu Tuka	1	1	2	7	2	9	33	3	36	0	9	9	0	2	2	2	0	2	2	0	2	1	0	1	0	1	1	3	0	3
Manasibu	CB IRS			10	40	50	99	0	99	23	2	25	0	0	0	25	1	26	3	0	3	1	0	1	2	0	2	1	0	1
Kondala	2	0	2	9	0	9	38	0	38	12	6	18	0	3	3	3	0	3	3	0	3	1	0	1	1	0	1	4	0	4
Begi	2	0	2	9	0	9	36	0	36	9	0	9	3	0	3	3	0	3	2	1	3	1	0	1	0	1	1	4	0	4
Guliso	2	0	2	6	1	7	28	0	28	7	0	7	0	2	2	2	0	2	1	1	2	0	1	1	1	0	1	3	0	3
Kiltu Kara	1	1	2	5	1	6	24	0	24	5	1	6	0	2	2	2	0	2	2	0	2	1	0	1	1	0	1	2	0	2
Nejo Rural	2	0	2	9	1	10	40	0	40	0	10	10	0	3	3	3	0	3	3	0	3	0	1	1	1	0	1	3	0	3
Babo Gambel	2	0	2	8	1	9	36	0	36	7	11	18	2	1	3	3	0	3	0	2	2	1	0	1	1	0	1	4	0	4
Dendy	2	0	2	0	7	7	28	0	28	6	1	7	0	2	2	2	0	2	1	1	2	1	0	1	1	0	1	3	0	3
Danno	2	0	2	6	4	10	40	0	40	0	10	10	0	2	2	2	0	2	2	0	2	0	1	1	1	0	1	3	0	3
Nonno	2	0	2	4	4	8	32	0	32	5	3	8	0	2	2	2	0	2	1	1	2	0	1	1	1	0	1	4	0	4
Ilu Galan	3	0	3	10	1	11	44	0	44	3	19	22	0	3	3	3	0	3	3	0	3	1	0	1	1	0	1	4	0	4

Bako Tibe	CB IRS			3	19	22	56	0	56	7	7	14	0	0	0	13	2	15	0	0	0	1	0	1	1	0	1	1	0	1
Sekoru	2	0	2	10	0	10	40	0	40	10	0	10	0	2	2	2	0	2	1	0	1	0	1	1	1	0	1	3	0	3
Omo Nada	3	1	4	16	0	16	64	0	64	29	3	32	4	0	4	3	1	4	4	0	4	1	0	1	2	0	2	6	0	6
Tiro Afeta	3	0	3	13	0	13	53	0	53	14	12	26	0	3	3	3	0	3	2	0	2	1	0	1	1	0	1	5	0	5
Kersa	CB IRS			2	39	41	80	0	80	20	0	20	0	0	0	11	10	21	0	0	0	0	1	1	0	1	1	1	0	1
Seka Chekorsa	3	0	3	11	0	11	44	0	44	8	3	11	1	0	1	3	0	3	1	0	1	1	0	1	0	1	1	3	0	3
Shebe Sombo	2	0	2	8	0	8	32	0	32	7	1	8	1	1	2	2	0	2	2	0	2	1	0	1	0	1	1	3	0	3
Lalo Kile	2	0	2	0	8	8	30	0	30	6	2	8	0	2	2	2	0	2	1	1	2	1	0	1	1	0	1	3	0	3
Dale Sadi	1	1	2	0	8	8	32	0	32	1	7	8	0	2	2	2	0	2	0	2	2	1	0	1	1	0	1	3	0	3
Dale Wabara	3	0	3	6	4	10	40	0	40	1	9	10	0	3	3	3	0	3	1	2	3	0	1	1	1	0	1	3	0	3
Hawa Galan	CB IRS			12	31	43	88	0	88	37	7	44	0	0	0	21	1	22	0	0	0	1	0	1	2	0	2	1	0	1
Seyo	2	0	2	8	0	8	32	0	32	0	8	8	0	2	2	2	0	2	2	0	2	0	1	1	1	0	1	3	0	3
Chewaka	CB IRS			13	40	53	112	0	112	24	32	56	0	0	0	28	0	28	0	0	0	1	0	1	2	0	2	1	0	1
Borecha	2	0	2	7	3	10	40	0	40	5	5	10	0	3	3	3	0	3	3	0	3	1	0	1	1	0	1	3	0	3
Dhedessa	2	0	2	7	0	7	28	0	28	5	2	7	0	2	2	2	0	2	2	0	2	1	0	1	1	0	1	3	0	3
Bedele	1	0	1	5	0	5	20	0	20	5	0	5	0	1	1	1	0	1	0	1	1	1	0	1	0	1	1	2	0	2
Total	**59**	**5**	**64**	**246**	**238**	**484**	**1491**	**20**	**1511**	**268**	**227**	**495**	**12**	**57**	**69**	**176**	**15**	**191**	**55**	**12**	**67**	**27**	**9**	**36**	**33**	**7**	**40**	**102**	**0**	**102**

Note: CB IRS=community-based IRS

ANNEX E: ETHIOPIA MONITORING AND EVALUATION PLAN INDICATOR MATRIX

THE PMI AIRS PROJECT

TABLE E. ETHIOPIA MONITORING AND EVALUATION PLAN INDICATOR MATRIX

Last Updated: 21 October 2015

	Data Source(s) and Reporting Frequency	Disaggregate	Annual Targets and Results					
			Year 1		Year 2		Year 3	
			Target	Results	Target	Results	Target	Results
1.1.1 Number and percentage of insecticide procurements that had a pre-shipment QA/QC test at least 60 days prior to spray campaign	Data source: Project records – insecticide procurements Reporting frequency: Each spray campaign	By Spray Campaign	1; 100%	1 order[2]; 100%	TBD; 100%		TBD; 100%	
1.1.2 Number and percentage of international insecticide procurements delivered in country, at port of entry, at least 30 days prior to the start of spray operations	Data source: Project records – international procurements Reporting frequency: Each spray campaign	By Spray Campaign	1; 100%	1 order; 100%	TBD; 100%		TBD; 100%	

[2] Actellic 300CS (87,372 bottles)

Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregate	Annual Targets and Results					
			Year 1		Year 2		Year 3	
			Target	Results	Target	Results	Target	Results
1.1.3 Number and percentage of international equipment procurements, including PPE, delivered in country, at port of entry, at least 30 days prior to start of spray operations	Data source: Project records Reporting frequency: Each spray campaign	By Spray Campaign	1; 100%	1 order[3]; 100%	TBD; 100%		TBD; 100%	
1.1.4 Number and percentage of local procurements for PPE delivered 14 days before the start of spray operations	Data source: Project records Reporting frequency: Each spray campaign	By Spray Campaign	1; 100%	1 order[4]; 100%	TBD; 100%		TBD; 100%	
1.1.5 Successfully completed spray operations without an insecticide stock-out	Data source: Project records Reporting frequency: Each spray campaign	By Spray Campaign	Completed	Completed	Completed		Completed	
1.2 In-Country Exemption and Custom Clearance Process								
1.2.1 Complete exemption and clearance process within the minimum 2 weeks	Data source: Project records Reporting frequency: Each spray campaign	By Spray Campaign	Completed	Completed	Completed		Completed	
1.3 In-Country Logistics, Warehousing, and Training								
1.3.1 Number and percentage of logistics and warehouse managers trained in IRS supply chain management	Data source: Training records Reporting frequency: Each spray campaign	By Spray Campaign By Gender	36; 100%	35; 97.2% Male=30, Female=5	TBD; 100%		TBD; 100%	

[3] Ceramic Nozzle Tip, Washer for CFV, Control Flow Valve (CFV), Gumboots, Rubber Gloves, Mouth/nose masks

[4] Water tanker 2000 Lit capacity, Apron / waterproof, Overalls, Toolkit Bag, Padlock, Canvas Tent 8 Main Size, Warning Sign, Chalk, Female size boots, Soap toilet, Soap laundry, Drycell Battery, Flashlight / Torch, Candle, Washer for CFV, IRS cards

Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregate	Annual Targets and Results					
			Year 1		Year 2		Year 3	
			Target	Results	Target	Results	Target	Results
1.3.2 Number and percentage of base stores where physical inventories are verified by up-to-date stock records	Data source: Project records Reporting frequency: Each spray campaign	By Spray Campaign	39 (36 district stores and 3 central warehouses); 100%	38[5]; 36 district stores, 2 central warehouses	TBD; 100%		TBD; 100%	
1.3.3 Submit up-to-date inventory records 30 days after the end of each spray campaign	Data source: Project records Reporting frequency: Each spray campaign	By Spray Campaign	Completed	Completed	TBD; 100%		TBD; 100%	
Component 2: Implement safe and high-quality IRS programs and provide operational management support								
2.1 Planning and Design of IRS Programs								
2.1.1 Annual PMI AIRS country work plan developed and submitted on time	Data source: Project records Reporting frequency: Annually	By Spray Campaign	Completed	Completed	Completed		Completed	
2.1.2 Percentage reduction in project operational expenses per structure from the previous year, excluding insecticide costs	Data source: Project financial records Reporting frequency: Annually	By Spray Campaign	5%	7.5%[6]	5%		5%	
2.2 Support of Safety and Health Best Practices and Compliance with USAID and Host Country Environmental Regulations								
2.2.1 SEA/letter reports submitted on time based on schedule agreed upon with the-	Data source: Project records – submitted SEAs/ letter reports	By Spray Campaign	Completed	Completed	Completed		Completed	

[5] In 2015 AIRS used 2 central warehouses
[6] Plan=$4.94, Actual=$4.57; save $0.37

Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregate	Annual Targets and Results					
			Year 1		Year 2		Year 3	
			Target	Results	Target	Results	Target	Results
PMI COR team	Reporting frequency: Each spray campaign							
2.2.2 Number of spray personnel trained in environmental compliance and personal safety standards in IRS implementation	Data source: Project records – Training reports Reporting frequency: Each spray season	By Spray Campaign By Gender	2,584	3,178[7]; Male=2,588, Female=590	TBD		TBD	
2.2.3 Number of health workers receiving insecticide poisoning case management training	Data source: Project records – Training reports Reporting frequency: Each spray season	By Spray Campaign By Gender	108	100; Male=77, Female=23	TBD		TBD	
2.2.4 Number of adverse reactions to pesticide exposure documented	Data source: Incident report forms Reporting frequency: Each spray campaign	By Spray Campaign By Residential/ occupational exposure	0	0	0		0	
2.2.5 Number and percentage of soak pits and storehouses inspected and approved prior to spraying	Data source: Project records – Reports submitted by district environmental officers Reporting frequency: Each spray season	By Spray Campaign By Soak Pit By Storehouse	DB IRS: 65 soak pits; 100% 2 central warehouses and 30 store rooms; 100% CB IRS districts:	DB IRS: 61Soakpits; 93.8% 2 Central werhouses; and 30 Store rooms; 100% CB IRS: 120 Soakpits;	TBD; 100%		TBD; 100%	

[7] ToT Participants 255, SQL=484, SOP=1511, Porter=495, Washer=69, Driver 102,Guard=191, Storekeeper=35 and Storekeeper assistant=36

Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregate	Annual Targets and Results					
			Year 1		Year 2		Year 3	
			Target	Results	Target	Results	Target	Results
			120 soak pits; 100%; 6 stores 100%	100% and 6 Store rooms; 100%				
2.3 Conduct Communications Activities and Community Mobilization								
2.3.1 Number of radio spots and talk shows aired	Data source: Project records Reporting frequency: Per spray campaign	By Spray Campaign	N/A[8]	N/A	TBD		TBD	
2.3.2 Number of IRS print materials disseminated	Data source: Project records Reporting frequency: Semi-annually	By Spray Campaign By Type of printed material and message(s)	N/A[9]	N/A	TBD		TBD	
2.3.3. Number of people reached with IRS messages via door-to-door mobilization	Data source: Mobilization Data Collection Forms Reporting frequency: Daily per mobilization conducted	By Spray Campaign By Gender	N/A[10]	N/A	TBD		TBD	
2.4 Spray Targeted Structures According to Technical Specifications								
2.4.1 Number of structures targeted for spraying	Data source: Previous spray campaign data, enumeration data (targets); Daily Spray Operator	By Spray Campaign	670,303[11]	708,258	TBD		TBD	

[8] Radio spots are not used in Ethiopia.
[9] Ethiopia carries out mass mobilization and does not go house-to-house distributing printed materials. Mass mobilization is conducted by the government.
[10] Ethiopia carries out mass mobilization and does not mobilize house-to-house. Mass mobilization is conducted by the government.
[11] Number of structures targeted based on the number of structures found in 2014.

	Forms (results) Reporting frequency: Daily per spray campaign							
2.4.2 Number of structures sprayed with IRS	Data source: Daily Spray Operator Forms Reporting frequency: Daily per spray campaign	By Spray Campaign	569,758[12]	704,945	TBD		TBD	
2.4.3 Percentage of total structures targeted for spraying that were sprayed with a residual insecticide (Spray Coverage)	Data source: Daily Spray Operator Forms Reporting frequency: Daily per spray campaign	By Spray Campaign	85%	99.5%	85%		85%	
2.4.4 Number of people residing in structures sprayed (Number of people protected by IRS)	Data source: Daily Spray Operator Forms Reporting frequency: Daily per spray campaign	By Spray Campaign By Gender By pregnant women By children <5 years old	1,647,099[13]	1,655,997[14] Pregnant women= 23,084 Children <5= 230,366 Male: 831,310 Female: 824,687	TBD		TBD	TBD
Component 3: Ongoing Monitoring and Evaluation and Quality Control Measures								
3.1 Submit AIRS Ethiopia M&E Plan to PMI for approval	Data source: Project records Reporting frequency: Semi-annual	By Spray Campaign	Completed	Completed	Completed		Completed	
3.2 Conduct a post-spray data quality audit within 60 days of	Data source: Spray operations reports	By Spray Campaign	N/A	N/A	Completed		Completed	

[12] 85% of target (85% * 670,303).
[13] Based on number of people protected in 2014.
[14] This value includes males and females; the gender segregation is done as per the National Mini DHS 2014 where males comprise 50.2% of the population and females, 49.8%.

completion of spray operations	Reporting frequency: Per spray campaign							
Component 4: Contribute to Global and Country-Level IRS Policy Setting and Develop and Disseminate Experiences and Best Practices								
4.1 Number of guidelines/checklists/tools related to IRS operations developed or refined with project support	Data source: Project records – Activity reports Reporting frequency: Semi-annually	By Spray Campaign By Guideline/checklist/tool	TBD	6[15]	TBD		TBD	
4.2 Number of articles/best practices documents published	Data source: Project records – Activity reports Reporting frequency: Semi-annually	By Spray Campaign By IRS Technical Area	TBD	-	TBD		TBD	
4.3 Number of best practice presentations given at national/ regional/international workshops and conferences	Data source: Project records – Activity reports Reporting frequency: Semi-annually	By Spray Campaign By IRS Technical Area	TBD	-	TBD		TBD	
4.4 Number of enterprises engaged through public-private partnerships	Data source: Project records – Activity reports Reporting frequency: Semi-annually	By Spray Campaign	2[16]	2	TBD		TBD	

[15] 1: mHealth system/ smart phone application for Environmental and operational activities with 7 supervisory checklists, 2: Error Eliminator, 3: Data Collection Verification Form, 4: Data Entry Center Supervision Checklist, 5: AIRS Access Database and Cleaning/Reporting Tool, and 6: Training attendance sheet.
[16] Two private companies will be targeted for recycling AIRS waste: one for plastic OP bottles and the other for cardboard boxes.

Component 5: Contribute to the collection and analysis of routine entomological and epidemiological data								
5.1 Support entomological monitoring activities and insecticide resistance strategies								
5.1.1 Number of entomological sentinel sites supported by the PMI AIRS Project established to monitor vector bionomics and behavior (vector species, distribution, seasonality, feeding time, and location)	Data source: Entomological reports Reporting frequency: Annually	By Spray Campaign	3[17]	3	TBD		TBD	
5.1.2 Number and percentage of entomological monitoring sentinel sites measuring all the five primary PMI entomological monitoring indicators	Data source: Entomological reports Reporting frequency: Annually	By Spray Campaign	3;100%	3;100%	TBD		TBD	
5.1.3 Number and percentage of entomological monitoring sites measuring at least one secondary PMI indicator	Data source: Entomological reports Reporting frequency: Annually	By Spray Campaign	3;100%	3;100%	TBD		TBD	
5.1.4 Number and percentage of insecticide resistance testing sites that tested at least one insecticide from each of the four classes of insecticides recommended for malaria vector control	Data source: Entomological reports Reporting frequency: Annually	By Spray Campaign	8[18];100%	5[19]; 62.5%	TBD		TBD	

[17] Three selected kebeles from three different districts (Ilugelan, Gubusayo and Seka Chekorsa) will host entomological sentinel sites.
[18] The sites are Omo Nada, Chewaka, Zeway Dugda, Halaba, Bahirdar, Alamata, Amibara and Gambela.
[19] This activity is ongoing up to December 2015, this report is shown up to October

5.1.5 Number of wall bioassays conducted within 2 weeks of spraying to evaluate the quality of IRS	Data source: Entomological reports Reporting frequency: Per spray campaign	By Spray Campaign	48[20]	48	TBD		TBD	
5.1.6 Number of wall bioassays conducted after the completion of spraying at monthly intervals to evaluate insecticide decay*	Data source: Entomological reports Reporting frequency: Per spray campaign	By Spray Campaign	240[21]	96[22]	TBD		TBD	
5.1.7 Number of vector susceptibility tests for different insecticides conducted in selected sentinel sites*	Data source: Entomological reports Reporting frequency: Per spray campaign	By Spray Campaign By Type of Insecticide	88[23]	49 Tests[24];	TBD		TBD	
5.2 Support Epidemiological Malaria Data Collection and Analysis								
5.2.1 Collect routine epidemiological data	Data source: Project Reports Reporting Frequency: Annually	By Spray Campaign	N/A[25]	N/A	TBD		TBD	

[20] 12 houses from 4 kelebes (2 DB kebeles and 2 CB kebeles) will be used for wall bioassays conducted within 2 weeks of spraying to evaluate the quality of IRS.
[21] 48 bioassays per month for 5 months will be conducted in 4 kelebes (2 DB kebeles and 2 CB kebeles).
[22] This activity is ongoing up to December 2015, this report is shown up to October
[23] AIRS Ethiopia plans to test 11 insecticides in eight different sites (number of sites noted in indicator 5.1.4).
[24]49 Tests: Permethrin=5, Propoxur=5, Malathion=4, Lambdacyhalothrin=4, Fenitrothion=5, Etofenprox=4, DDT=4, Bendiocarb=5, Deltamethrin=5, Alpha-cypermethrin=3, Pirimphos-methyl=5
[25] This activity is not being carried out in Ethiopia.

5.2.2 Number of targeted health facilities with routine epidemiological malaria data collection supported by the PMI AIRS Project	Data source: Epidemiological reports Reporting frequency: Annually	By Spray Campaign	N/A	N/A	TBD		TBD	
Component 6 (Cross-cutting): Capacity Building, Knowledge Transfer, Gender Inclusion								
6.1 Increasing the Role of Women and Addressing Gender Barriers								
6.1.1 Number of people trained to deliver IRS in target districts *	Data source: Project records – Training reports Reporting frequency: Semi-annually	By Spray Campaign By Gender Percentage of Women Trained	2,885[26]	2,845 Male=2,318 Female=527; 18.5%	TBD		TBD	
6.1.2 Total number of people trained to support IRS in target districts[27]	Data source: Project records – Training reports Reporting frequency: Semi-annually	By Spray Campaign By Gender Percentage of women trained	4,398	4,383[28] Male=2,755 Female=1,624; 37.1%	TBD		TBD	
6.1.3 Number of women recruited (i.e. number of women on the selection list) for IRS employment	Data source: Project records – Recruitment reports reports Reporting frequency: Semi-annually	By Country By Percentage of women recruited	TBD	1,626	TBD		TBD	

[26] This is the planned number of people to be trained as Spray Operators, Squad Leaders, Porters, supervisors (i.e. via TOT), and those trained in poison management.
[27] This indicator covers all of the cadre who support IRS operations.
[28] TOT=255; Data Entry Clerks=44; Pesticide poison management=100; HEW=1061; SQI=484; SOP=1511; Porter=495; Washers=69; Drivers=102; Guards=191; Storekeepers=35 and Storekeeper Assistant=36. 69 additional participants were trained at national trainings that were not affiliated with direct IRS support in target districts. These individuals were not included in the above figure.

6.1.4 Number of people trained as IRS Training of Trainers	Data source: Project records – Training reports Reporting frequency: Semi-annually	By Spray Campaign By Gender Percentage of women trained	267	255 Male=236 Female=19; 7.5%	TBD		TBD	
6.1.5 Total number of people hired to support IRS in target districts	Data source: Project records – Contracts signed Reporting frequency: Semi-annually	By Spray Campaign Gender Percentage of women hired	4,398; 1,759 women/40% female	4,379[29] Male=2,753 Female=1,626; 37.1%	TBD		TBD	
6.1.6 Number and percentaage of women hired in supervisory roles in target districts (this number includes site supervisors, squad leaders, team leaders, M&E assistants and others who supervise seasonal staff)	Data source: Project records – Contracts signed Reporting frequency: Semi-annually	By Spray Campaign Percentage of women hired	279; 36%	262[30]; 33.9%	TBD		TBD	
6.1.7 Number of staff (permanent and seasonal) who have completed gender awareness training	Data source: Project records – Training reports Reporting frequency: Semi-annually	By Spray Campaign Gender Percentage of women hired	288	310[31]; Male=282 Female=28; 9.0%	TBD		TBD	

[29] TOT=255; Data Entry Clerks=40; Pesticide poison management=100; HEW=1061; SQI=484; SOP=1511; Porter=495; Washers=69; Drivers=102; Guards=191; Storekeepers=35 and Storekeeper Assistant=36

[30] Supervisors(TLs)=19, SQLs=238 and Storekeepers=5

[31] 255 TOT attendees; 35 Storekeepers and 20 AIRS permanent staffs.

6.2 Capacity Building								
6.2.1 Number of government officials trained in IRS oversight	Data source: Project records – Training reports Reporting frequency: Semi-annually	By Spray Campaign By Gender Percentage of Women Trained	302[32]	290[33]; Male=266 Female=24, 8.3%	TBD		TBD	
6.2.2 Implement all activities outlined in their yearly Capacity Building Action Plan	Data source: Project records – Capacity assessment reports Reporting frequency: Semi-annually	By Spray Campaign	Completed	Completed	Ongoing		Completed	
6.2.3 Ethiopia government implements at least one aspect of the IRS program independently.	Data source: Project records – MOUs Reporting frequency: Semi-annually	By Spray Campaign	Completed	Completed[34]	TBD		TBD	

[32] 267 from TOT; 35 from National training.
[33] 255 from TOT; 35 from store keepers training
[34] In 2015, the government of Ethiopia was responsible for mass mobilization prior to the implementation of the IRS campaign.

ANNEX F: PROPOSED ACTIONS FOR IMPROVING SPRAY QUALITY

1. Spray Quality: Lack of consistency in correctly applying the swaths by SOPs

Proposed Action 1: Improve the quality of TOT and SOP training

- Thoroughly train all Abt staff on spray techniques so they can conduct high quality supervision when they are in the field, regardless of their main role on the project. Train a cadre of master trainers (10 – 15) to run IRS training alongside AIRS staff at TOT sessions.
- Conduct a comprehensive training of MOH staff involved in IRS implementation on IRS techniques and supervision through a boot camp to enhance their skills with sufficient time allocated for practical sessions as a standard and post-tests to be administered.
- Conduct TOT in smaller manageable groups of no more than 50 participants.
- Conduct training of SOPs in CB based IRS districts centrally so as to manage quality of training and training supervisory oversight by AIRS staff.
- Selection of training sites to consider sufficiency of wall surfaces for training, and where this is not available AIRS Ethiopia to consider other forms of surfaces. Ensure that SOP training includes practical training, as well as theoretical.
- Recruitment of SOPs to focus mainly of those with IRS experience so as to reduce the number of new SOPs to a minimum. The District Health Office and Local Administration office to make sure that only SOPs with previous IRS experience are recruited. Establish a 15% threshold for the number of new SOPs so that we can conduct proper training and oversight.
- Recruit one pump technician per operation site to take charge of pump maintenance and support weekly pump calibration.
- Recruit 5 part time Spray Operations Coordinators to cover at least 5 districts to support district MFPs on training and supervision coordination.

Proposed Action 2: Improve IRS supervision

- Train MOH staff (as above) with emphasis on supervision (clarifying roles) and conduct a special session for team leaders during TOT sessions. Emphasize the need for supervisors to watch SOPs spray inside structures so they can observe their technique.
- Clarify supervision roles/reporting lines and bring Zonal Heads on board so as to follow up on commitment of district staff and replacement of weak/errant staff. A weekly meeting between AIRS staff and district MFP with the Zonal Heads is proposed.
- Recruitment of MOH staff to serve as supervisors on IRS by the District Health Office should consider their availability and dedication.
- The AIRS staff and district MFP to review all supervision checklists and make a follow up on any supervision deficiencies.
- End-of-day meeting of supervisors and AIRS staff to be mandatory to follow up on any observed deficiencies.
- The 5 part time Spray Operations Coordinators (proposed above) to work with the district MFP on supervision with a clear role of tracking supervisor's performance.

2. **Community mobilization**: Lack of prior knowledge of the actual spray day by households leading to delays in house preparation.

Proposed Actions:

- Train and engage mobilizers (HEWs) as in previous spray rounds to work with the spray teams. Emphasize the need to alert beneficiaries that IRS is coming and that they need to remove their belongings from their structures in time for spraying.

3. **House preparation**: Spray operators and squads fail to ensure removal of all food and related materials out of the houses.

Proposed Actions:

- Through the enhanced training for TOTs/supervisors and SOPs the importance of house preparation will be addressed.
- Checklists filled by supervisors will be reviewed daily to assess number of households visited.

4. **Flashlights:** Spray operators carry out the spraying in dark rooms (non-functioning flashlights)

Proposed Actions:

- We shall ensure that all spray operators, team leaders, and supervisors are availed higher quality flashlights. Team leaders will regularly check that spray operators' flashlights are in good working condition, and are actually being used and replacements are made if not working.
- As part of morning mobilization, MFP and supervisors will ensure that each SOP has a functioning flashlight before departing to the field.
- PMI to provide guidance on spraying with partially open windows or doors in view of BMP.

5. **Nozzle Tips: Nozzle tip 153-400E found in use by a few SOPs**

Proposed Actions:

- Conduct an inventory of all nozzle tips in each district and central store and retrieve all non-standard tips available and replace with the correct nozzles when needed.
- Undertake a thorough assessment of how the nozzles found their way into IRS stores.

6. **Verandahs:** Verandahs not sprayed yet people spent some time there in the evenings.

Proposed Action:

- Collect relevant entomological data to see whether this a common place for vectors to rest.

7. **Selection of districts and spray villages**: Districts/ villages above 2000 meters sprayed against national guidelines.

Proposed Action:

- A review of all districts to be selected for the 2016 spray round to be conducted by Oromia Regional Health Bureau, AIRS Ethiopia and PMI in line with national guidelines.